

## Littoral Combat Ship (LCS)

### Executive Summary

- The Navy plans to acquire a total of 55 Littoral Combat Ships (LCSs). In early FY11, the USD(AT&L) authorized the purchase of hulls 3 through 22 (10 of each ship design; LCS 1 class is a monohull constructed of steel and aluminum and LCS 2 class is an all aluminum trimaran design) versus the original intent of procuring just the down-selected design.
- LCS 1 completed a 3 to 4 week shipyard maintenance period to repair an underwater hull crack that had curtailed seakeeping and human factors trials.
- LCS 2 experienced major disruptions and delays caused by problems with core systems and Mine Countermeasures (MCM) mission modules, principally the Twin Boom Extendible Crane, the lift platform, and the Remote Multi-Mission Vehicle (RMMV). LCS 2 also experienced underwater hull damage in the area of the waterjet propulsors caused by bimetallic corrosion.
- The Navy announced that Raytheon's Griffin missile system will provide an interim replacement for the canceled Army Non-Line-of-Sight Launching System and Precision Attack Missile for later increments of Surface Warfare (SUW) mission packages.
- OSD approved the Navy's request to split the program into two separate acquisition programs – one for seaframes and the other for mission modules. The Navy also established a new Program Executive Officer for LCS Programs to oversee the seaframe and mission modules program offices and related mission system program offices.



LCS 1



LCS 2

### System

- The LCS is designed to operate in the shallow waters of the littorals where larger ships cannot maneuver as well. It is intended to accommodate a variety of individual warfare systems (mission modules) assembled and integrated into interchangeable mission packages.
- The Navy currently plans to field MCM, SUW, and Anti-Submarine Warfare (ASW) mission packages.
- The Navy is buying two ship (seaframe) designs:
  - USS *Freedom* (LCS 1) class is a semi-planing monohull constructed of steel and aluminum.
  - USS *Independence* (LCS 2) class is an aluminum trimaran design.
- Common design characteristics:
  - Combined two diesel and gas turbine propulsion with four waterjet propulsors
  - Sprint speed in excess of 40 knots, draft of less than 20 feet, and range in excess of 3,500 nautical miles at 14 knots
  - Accommodations for up to 76 personnel (air detachment, mission module personnel, and core crew of no more than 40)
- A Common Mission Package Computing Environment for mission package command and control
- Hangars sized to embark MH-60R/S and Vertical Take-Off Unmanned Aerial Vehicles (VTUAVs)
- 57 mm BOFORS Mk 3 gun
- The designs have different core combat systems to provide command and control, situational awareness, and self-defense against anti-ship cruise missiles and surface craft.
  - LCS 1: COMBATSS-21, an Aegis-based integrated combat weapons system with a TRS-3D (German) air/surface search radar, Ship Self-Defense System Rolling Airframe Missile (RAM) system (one 21-cell launcher), and a DORNA (Spanish) Electro-Optical/Infrared for 57 mm gun fire control.
  - LCS 2: Integrated combat management system (derived from Dutch TACTICOS system) with a Swedish 3D air/surface search radar (Sea Giraffe), one RAM (11-cell) launcher integrated with the Close-In Weapons System (Mk 15) search and fire control radars (called SeaRAM), and Sea Star SAFIRE Electro-Optical/Infrared for 57 mm gun fire control.

# NAVY PROGRAMS

- More than a dozen individual programs of record involving sensor and weapon systems and other off-board vehicles make up the individual mission modules.
- The Navy plans to acquire a total of 55 LCSs. In early FY11, the USD(AT&L) authorized the purchase of hulls 3 through 22 (10 of each ship design) vice the original intent of procuring just the down-selected design.

## Mission

- The Maritime Component Commander will employ LCS to conduct MCM, ASW, or SUW based on the mission package fitted into the seaframe. With the Maritime Security Module installed as part of the SUW mission package, the ship can conduct visit board search and seizure maritime interception operations. Commanders can employ LCS in a maritime presence role regardless of the installed mission package based on capabilities inherent to the seaframe.

## Activity

- In early FY11, the USD(AT&L) authorized the Navy to implement a dual award acquisition strategy to award each prime contractor a 10-ship block buy contract for the period FY10-15; the Navy subsequently contracted to buy two ships from each contractor with funds appropriated for FY10 and FY11 (LCS 5-8).
- DOT&E approved changes to the LCS LFT&E Management Plan in February 2011. The changes reflect the Navy's decision to continue the procurement of both seaframe variants of the LCS Class and identify additional live fire testing and resources needed to adequately assess the survivability of both ship designs.
  - Management Plan designates LCS 3 and LCS 4 as the ships that will undergo shock trials in 2014.
  - The Navy is developing 57 mm and 30 mm ammunition LFT&E Management Plans to submit for approval in FY12.
- OSD approved the Navy's request to split the program into two separate acquisition programs – one for seaframes and the other for mission modules. The Navy also established a Program Executive Officer for LCS Programs to oversee the seaframe and mission modules program offices and related mission system program offices.
- The Navy announced that Raytheon's Griffin missile system will replace the cancelled Army Non-Line-of-Sight Launching System and Precision Attack Missile as an interim capability in a later increment of SUW mission packages. The Navy plans to conduct a new competition to select a missile system as a permanent solution to be incorporated into a post-FY16 increment.
- The Navy also announced that the ASW mission package (Increment II) will comprise a Variable Depth Sonar (VDS), the Fire Scout VTUAV, a Multi-Function Towed Array, Light Weight Tow (a torpedo decoy system), and the MH-60R helicopter and associated sensors and weapons.

- The Navy can deploy LCS alone or in conjunction with other ships.

## Major Contractors

- LCS 1
  - Prime: Lockheed Martin Maritime Systems and Sensors – Washington, District of Columbia
  - Shipbuilder: Marinette Marine – Marinette, Wisconsin
- LCS 2
  - Prime: General Dynamics Corporation Marine Systems, Bath Iron Works – Bath, Maine
  - Shipbuilder: Austal USA – Mobile, Alabama
- Mission Packages
  - Future Mission Package Integration contract awarded to Northrop Grumman – Los Angeles, California

- LCS 1:
  - Developmental T&E of core seaframe systems resumed in the first half of FY11 after pausing to allow the ship to participate in counter-narcotics operations and a major naval exercise in FY10. Events completed included air defense tracking, gun accuracy verification, signature measurements, and surface target tracking and engagement. Events that were only partially completed because of equipment/integration problems included seakeeping trials, evaluation of the effects of ship motion on crew performance and fatigue, evaluation of the WBR-2000 Electronics Support Measures systems performance, and VTUAV dynamic interface testing.
  - The ship completed a short industrial availability to repair an underwater hull crack that had curtailed seakeeping and human factors trials.
  - LCS 1 commenced a post shakedown availability in June and remained in the shipyard through the end of the fiscal year.
- LCS 2:
  - Developmental T&E of core seaframe systems commenced at the end of FY10 and continued throughout FY11. Events completed included combat systems alignment and characterization; basic surface and air target tracking; datalink performance checks; launch, handling, and recovery of rigid hull inflatable boats in moderate sea conditions; initial integration/performance testing of MCM mission modules; shipboard noise measurements; and radar cross section measurements. Events that were only partially completed because of equipment deficiencies included evaluation of the Identification Friend-or-Foe systems; seakeeping trials; evaluation of the effects of ship motion on crew performance and fatigue; and launch, handling, and recovery of the Remote Multi-Mission Vehicle (RMMV).

# NAVY PROGRAMS

- LCS 2 completed a 3- to 4-week shipyard maintenance period to make interim repairs to underwater hull damage in the area of the waterjet propulsors caused by bimetallic corrosion.

## Assessment

- This assessment is based on limited information from developmental test progress reports. The program offices have not released any formal developmental T&E reports.
- LCS 1:
  - While LCS 1 was not able to complete all planned developmental T&E in FY11, major portions of most events were completed, and the ship did not experience any major disruptions other than those caused by discovery and repair of the hull crack.
- LCS 2:
  - LCS 2 testing experienced major disruptions and delays caused by problems with the Twin Boom Extendible Crane used to launch, handle, and recover watercraft and the RMMV, which is still under development. Additional disruptions were caused by failure of the lift platform used to move mission systems and other equipment between the mission bay and hangar; the Multi-Vehicle Communications system; the Identification Friend-or-Foe systems; satellite communications systems; hull corrosion; and propulsion systems.
- Both developmental and operational testing of the AN/AQS-20A Sonar Mine Detecting Set, an Airborne Mine-countermeasures mission module system within the LCS MCM mission package, revealed the system is deficient in meeting required thresholds for False Classification Density (FCD) and Vertical Localization. These deficiencies may preclude the LCS MCM mission package from meeting its required threshold for Area Coverage Rate Sustained (ACRS). If the FCD and Vertical Localization deficiencies are not corrected prior to IOT&E, they may adversely affect the operational effectiveness of the LCS MCM Mission Package.
- Developmental testing of the Airborne Laser Mine Detection System (ALMDS), an Airborne Mine-countermeasures mission module system within the LCS MCM mission package, revealed the system is deficient in meeting the required threshold for FCD. This deficiency will likely preclude the LCS MCM mission package from meeting its required threshold for ACRS. If the ALMDS FCD deficiency

is not corrected prior to IOT&E, it will adversely affect the operational effectiveness of the LCS MCM Mission Package.

- LCS is not expected to be survivable in a hostile combat environment. This assessment is based primarily on a review of LCS design requirements, which do not require the inclusion of the survivability features necessary to conduct sustained operations in its expected combat environment. Even though two ships are already operational and two more are under construction, DOT&E cannot provide additional insight into the survivability of the class, or better assess the extent of their vulnerability to expected threats because the Navy has significantly delayed the release of their Detail Design Integrated Survivability Assessment Reports for both designs.

## Recommendations

- Status of Previous Recommendations. Two recommendations from FY05 and FY06 remain that involve a risk assessment on the adequacy of Level I survivability and detailed manning analyses to include mission package support. The Navy has partially addressed one FY09 recommendation to develop an LFT&E program with the approval of the LFT&E Management Plan; however, the recommendation will not be fully addressed until the details of the surrogate testing and the lethality testing are developed. Both of the FY10 recommendations remain valid. The Navy should implement all recommendations from DOT&E's Combined Operational and Live Fire Early Fielding Report and address all deficiencies noted in the Navy's Board of Inspection and Survey Acceptance Trials report.
- FY11 Recommendations.
  1. The Navy should investigate solutions and correct AN/AQS-20A FCD and Vertical Localization deficiencies prior to the LCS MCM Mission Package IOT&E.
  2. The Navy should investigate solutions and correct the ALMDS FCD deficiency prior to the LCS MCM Mission Package IOT&E.
  3. While the final survivability assessment of LCS cannot be made until the full ship shock trials and total ship survivability trials are completed, the Navy should continue to report vulnerabilities discovered during live fire tests and analyses. Doing so will inform acquisition decisions as soon as possible in the procurement of the LCS class.

# NAVY PROGRAMS