

Littoral Combat Ship (LCS)

Preliminary assessments indicate that the *Independence* variant of the Littoral Combat Ship (LCS) with the Surface Warfare (SUW) Increment 3 mission package (MP) is operationally effective, demonstrating the capability to defeat small boats in a simultaneous attack. Both LCS seaframe variants remain operationally unsuitable due to previously observed low reliability and availability caused by propulsion failures. The LCS survivability is challenged in a contested environment against selected kinetic threat types, and the survivability of the LCS variants in a cyber-contested environment is currently unknown.



System Description

The LCS is a small surface vessel designed for operation in littoral, shallow waters while also capable of open-ocean operations. The LCS comprises two seaframe variants: the *Freedom* variant and the *Independence* variant. The *Freedom* variant is a monohull design constructed of steel (hull) and aluminum (deckhouse) with two steerable and two fixed-boost waterjets driven by a combined diesel and gas turbine main propulsion system. The *Independence* variant is an aluminum trimaran with two steerable waterjets driven by diesel engines and two steerable waterjets driven by gas turbine engines. LCS seaframes host and derive mission capability from the SUW, Mine Counter Measure (MCM), and Anti-Submarine Warfare (ASW) MPs.

The SUW MP derives capability from the following components:

- Two Mk 46 30mm guns
- MH-60R or MH-60S helicopter
- MQ-8 Fire Scout unmanned air vehicle
- Two 11-meter rigid-hull inflatable boats
- 24 Longbow Hellfire missiles or Surface-to-Surface Missile Module (SSMM)

The MCM MP derives capability from the following components:

- AN/ASQ-235 Airborne Laser Mine Detection System
- AN/AQS-20C mine hunting sonar
- Knifefish Block I unmanned undersea vehicle (post MCM MP IOT&E capability)
- AN/DVS-1 Coastal Battlefield Reconnaissance and Analysis (COBRA) Block 1
- Airborne Mine Neutralization System
- Barracuda Mine Neutralization System (post MCM MP IOT&E capability)

- Unmanned Influence Sweep System

The ASW MP derives capability from a combined variable depth sonar and multi-function towed array to detect, classify, and localize a threat submarine, and from Mk 54 torpedoes deployed from an MH-60R helicopter to destroy threat submarines. The LCS platform baselines also intend to include a newly developed Light Weight Tow to improve LCS survivability against an incoming threat torpedo, but the Navy has yet to fund its development or installation.

Program

The LCS seaframes and its separate mission packages are Acquisition Category IC programs. Components of the mission packages are individual programs of record. DOT&E approved an update to Revision B of the LCS Test and Evaluation Master Plan (TEMP) in 2018 that accounted for testing of the three mission packages and the two seaframe variants. This led to SUW MP Increment 3 testing that supported initial operation capability of the SSMM in March 2019 and a subsequent purchase authorization of the SUW MP Increment 3 in August 2019. The Navy intends to update the TEMP to incorporate changes to previously identified testing required for the MCM and ASW MP IOT&E in support of their beyond low rate production. The schedule for the TEMP update, IOT&E, and production decision continues to fluctuate. The Navy is under contract for all remaining builds of the two LCS seaframes.

Major Contractors

- Lockheed Martin and Fincantieri Marinette Marine – Marinette, Wisconsin.
- Austal USA – Mobile, Alabama.
- Northrup Grumman – Falls Church, Virginia.

Test Adequacy

The FY20 integrated tests were sufficient to determine the performance of the SUW Increment 3 MP on the *Independence* variant. Test results showed significantly less variability in performance than anticipated, enabling DOT&E to approve the removal of two events and saving approximately \$11 million in test resources.

In FY21, the Navy tested the Unmanned Influence Sweep System from the *Independence* variant of the LCS in accordance with the DOT&E-approved test plan. Details are in the Unmanned Influence Sweep System section of this report.

In FY21, the Navy continued hydrodynamic testing of the variable depth sonar and multi-function towed array following modifications intended to improve dynamic stability at higher speeds and affect operational effectiveness of the LCS with the ASW MP. Consequently, the Navy has not yet started the operational testing on an LCS platform with the ASW MP.

In FY21, the Navy started evaluating the survivability of the full set of LCS variants and MP combinations in a cyber-contested environment. The Navy intends to conduct a Coordinated Vulnerability and Penetration Assessment and an Adversarial Assessment for the following three combinations: 1) the LCS *Freedom* variant with SUW MP in 1QFY22, 2) the LCS *Independence* variant with ASW MP, not yet scheduled, and 3) the first available variant with MCM MP, not yet scheduled. If post-test analysis determines that there are interface differences that remained untested, the Navy will need to schedule up to three additional evaluations identified in the Revision B TEMP to assess the survivability of the remaining combinations of the LCS variants and MPs.

The LCS LFT&E assessment of the survivability of both LCS variants against air-delivered and underwater threats, and the lethality of the SSMM weapons, concluded in late 2019.

Performance

Effectiveness

Preliminary assessment indicates that the *Independence* variant with the SUW Increment 3 MP is operationally effective, demonstrating the capability to defeat small boats in a simultaneous attack represented with the Navy's expendable high-speed maneuvering surface target. The capability against more stressing operationally representative small boats could not be evaluated due to the limitations of existing surface targets. Testing highlighted problems that required operators to shift to an alternate defense mode.

The modeling and simulation results of the SSMM, the Army-developed Longbow Hellfire Missile will be provided in the SUW Increment 3 MP on the *Independence* variant report expected to be published in 2QFY22.

Not enough data are currently available to assess the operational effectiveness of either the ASW MP or MCM MP and their components. Preliminary assessments indicate that the Navy must overcome several challenges to reduce the risk to meeting operational effectiveness requirements.

Suitability

Both LCS seaframe variants remain operationally unsuitable due to low reliability and availability caused by propulsion failures, detailed in the LCS *Independence* variant with SUW Increment 2 report in FY16 and the LCS *Freedom* variant with SUW Increment 3 report in 3QFY20. The Navy will continue to measure platform reliability and availability during all remaining test events to determine if the most significant reliability concerns have been resolved.

Preliminary assessments indicate that the SUW Increment 3 MP is suitable, pending the resolution of seaframe reliability and availability. The SSMM, part of the SUW MP Increment 3, experienced no reliability or availability failures during testing. The Mk

50 30mm guns, consistent with prior evaluations, are sufficiently reliable and available.

Not enough data are yet available to assess the suitability of either the ASW MP or the MCM MP and their components. However, the reliability and availability of the Unmanned Influence Sweep System and the launch and recovery systems on the LCS introduce risk to the operational suitability of the MCM MP.

Survivability

LFT&E analysis highlighted several LCS design features that drive survivability performance of each Variant against selected kinetic threat categories. Not enough data are yet available to assess the survivability of the LCS variants with any of the MPs in a cyber-contested environment.

Recommendation

1. The Navy should develop expendable and credible small boat target surrogates capable of achieving higher speeds to determine the operational effectiveness of the LCS with the SUW MP in a more stressing operational environment.