

MH-60S Multi-Mission Combat Support Helicopter

Executive Summary

- DOT&E concluded in a November 2015 memorandum to the USD(AT&L) and the Navy, based on the testing conducted to date, that a Littoral Combat Ship (LCS) employing the current Mine Countermeasures (MCM) mission package would not be operationally effective or operationally suitable if the Navy called upon it to conduct MCM missions in combat. Three of the seven primary shortcomings supporting this conclusion are attributed, at least in part, to the MH-60S with Airborne Mine Countermeasures (AMCM) systems:
 - Critical MCM systems are not reliable.
 - Minehunting capabilities are limited in other-than-benign environmental conditions.
 - The Airborne Mine Neutralization System (AMNS), by design, cannot neutralize most of the mines in the Navy's threat scenarios; an Explosive Ordinance Disposal Team provided by another unit must be used.
- From April through August 2015, the Navy conducted Technical Evaluation (TECHEVAL) of the *Independence* variant LCS and Increment 1 MCM mission package, including the MH-60S and its AMCM systems, aboard LCS 2. During TECHEVAL, the MH-60S and its associated AMCM mission kit and mission systems experienced nine problems that interrupted or delayed LCS MCM activities. These problems included MH-60S rotor blade delamination, an MH-60S power distribution unit failure, a broken relief valve on an MH-60S hydraulic reservoir, multiple AMCM mission kit failures that required the MH-60S to return to port for repairs, and an AMNS neutralizer that failed to launch when commanded. The launch failure would have required the aircrew to jettison the launch and handling system if live rounds (operational assets) been employed. As a result, LCS 2 demonstrated sustained MH-60S operations lasting more than one week just once during TECHEVAL.
- The Airborne Mine Detection System (ALMDS) does not meet Navy detection/classification requirements. In particular, the system does not meet the Navy's requirements for minimum probability of detection and classification in all depth bins or for the average probability of detection and classification in all conditions over a region of the water column that extends from the surface to a reduced maximum depth requirement. When the system and operator detect and classify a smaller percentage of mines than predicted by fleet planning tools, the MCM commander will likely underestimate the residual risk to transiting ships following clearance operations. In some conditions, the system also generates a large number of false classifications (erroneous indications of mine-like objects) that can delay near-surface minehunting operations until conditions improve or slow



- mine clearance efforts because of the need for additional search passes to reduce the number of false classifications. In favorable conditions, such as those observed during TECHEVAL, detection performance meets the Navy's requirements and tactics, techniques, and procedures have been successful in reducing false classifications to the Navy's acceptable limits.
- The current increment of the AMNS cannot neutralize moored mines above a prescribed operating ceiling, which will preclude neutralizing most of the mines expected in some likely threat scenarios; an Explosive Ordinance Disposal Team provided by another unit must be used. Within its operating range, AMNS performance is frequently degraded by the loss of fiber-optic communications between the aircraft and the neutralizer. The system has experienced loss of fiber-optic communications in a wide range of operationally relevant operating conditions, including those that are relatively benign. Although the Program Office has stated that it intends to develop an improved AMNS to extend its depth range and potentially improve performance in coarse bottom conditions and higher currents, none of these efforts are funded and the Navy is considering other alternatives.

System

- The MH-60S is a medium lift ship-based helicopter manufactured in three variants (blocks) that are derived from the Army UH-60L Blackhawk.
- All three blocks share a common cockpit, avionics, flight instrumentation, and power train with the MH-60R.
- Installed systems differ by block based on mission:
 - Block 1, Fleet Logistics – precision navigation and communications, maximum cargo or passenger capacity.

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- Block 2A/B, AMCM System – AMCM system operator workstation; a tether/towing system and the two MCM systems currently under development; ALMDS for detection and classification of near-surface mines; and the AMNS for neutralization of in volume and bottom mines. Any Block 2 or subsequent aircraft (e.g., Block 3 A/B aircraft) can be an AMCM aircraft.
- Block 3A, Armed Helicopter – 20 mm Gun System, forward-looking infrared with laser designator, crew served side machine guns, dual-sided HELLFIRE air-to-ground missiles, the 2.75-inch family of rockets, and defensive electronic countermeasures.
- Block 3B, Armed Helicopter – adds a tactical datalink (Link 16) to Block 3A capabilities.
- Block 1 – Vertical replenishment, internal cargo and personnel transport, medical evacuation, Search and Rescue, and Aircraft Carrier Plane Guard
- Block 2 – Detection, classification, identification, and/or neutralization of sea mines, depending on the specific AMCM systems employed on the aircraft
- Block 3 – Combat Search and Rescue, Surface Warfare, Aircraft Carrier Plane Guard, Maritime Interdiction Operations, and Special Warfare Support

Major Contractors

- Sikorsky Aircraft Corporation – Stratford, Connecticut
- Lockheed Martin Mission System and Sensors – Owego, New York

Mission

The Maritime Component Commander can employ variants of MH-60S to accomplish the following missions:

Activity

- Having completed the land-based phase of an operational assessment of the AMNS in 3QFY14 with the MH-60S helicopter operating from Naval Air Station, Oceana, Virginia, the Navy conducted the ship-based phase aboard USS *Independence* (LCS 2) in 1QFY15 during Increment 1 MCM mission package developmental testing. The ship-based phase of the assessment focused on shipboard integration and the system's operational suitability, but was also able to collect limited effectiveness data.
- The Navy also completed the ship-based phase of an ALMDS operational assessment in 1QFY15 aboard LCS 2 during Increment 1 MCM mission package developmental testing in accordance with the DOT&E-approved test plan. The test collected limited data to examine system effectiveness and the shipboard suitability of the MH-60S helicopter equipped with the ALMDS.
- From April through August 2015, the Navy conducted TECHEVAL of the *Independence* variant LCS and Increment 1 MCM mission package, including the MH-60S and AMCM systems, aboard LCS 2. Although the Navy originally planned to complete the test in June 2015 and then complete operational testing in FY15, problems with failures of seaframe and MCM systems caused the testing to be extended. The Navy has delayed the operational testing until the spring of 2016, at the earliest.
- In May 2015, the Navy conducted AMNS medium current developmental testing from a surrogate platform in the Atlantic Ocean near the South Florida Test Facility. The Navy explored alternative tactics and collected data to inform possible system improvements.
- In June 2015, the Navy commenced ALMDS and AMNS cybersecurity operational testing concurrently with LCS 2 cybersecurity testing in accordance with the DOT&E-approved test plan. The initial phase of the cybersecurity operational test, a Cooperative Vulnerability and Penetration Assessment was completed in July 2015, but did not include the MH-60S. The final phase of the test, an Adversarial Assessment, is on hold pending a Navy decision on the readiness of the Increment 1 MCM mission package and *Independence* variant LCS for operational testing.
- In November 2015, DOT&E provided the USD(AT&L), the Assistant Secretary of the Navy for Research Development and Acquisition, and the Program Executive Officer for Littoral Combat Ships a classified assessment of the performance of the *Independence* variant LCS and Increment 1 MCM mission package. DOT&E based the assessment on the data collected during the TECHEVAL and earlier periods of developmental and operational testing.

Assessment

- DOT&E concluded in a November 2015 memorandum to USD(AT&L) and the Navy, based on the testing conducted to date, that an LCS employing the current MCM mission package would not be operationally effective or operationally suitable if the Navy called upon it to conduct MCM missions in combat. Three of the seven primary shortcomings supporting this conclusion are attributed, at least in part, to the MH-60S with AMCM systems:
 - Critical MCM systems are not reliable.
 - Minehunting capabilities are limited in other-than-benign environmental conditions.
 - The AMNS, by design, cannot neutralize most of the mines in the Navy's threat scenarios; an Explosive Ordinance Disposal Team provided by another unit must be used.
- During TECHEVAL, the MH-60S and its associated AMCM mission kit and mission systems experienced nine problems

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that interrupted or delayed LCS MCM activities. These problems included MH-60S rotor blade delamination, an MH-60S power distribution unit failure, a broken relief valve on an MH-60S hydraulic reservoir, multiple AMCM mission kit failures that required the MH-60S to return to port for repairs, and an AMNS neutralizer that failed to launch when commanded. The launch failure would have required the aircrew to jettison the launch and handling system if live rounds (operational assets) been employed. As a result, LCS 2 demonstrated sustained MH-60S operations lasting more than one week just once during TECHEVAL.

- On eight occasions, LCS 2 conducted MH-60S operations for two days or less before needing repairs that in many cases required the ship or helicopter to return to port for spare parts or repairs. In one case, after returning to port, the Navy elected to replace a helicopter embarked aboard LCS and in need of repairs rather than repair it.
- In total, during 132 days of TECHEVAL, the LCS 2 Aviation Detachment employed 2 MH-60S helicopters for 141 flight hours.
- Considering only the 58 days underway, LCS 2 was ALMDS-mission capable for 16 days, AMNS-mission capable for 26 days, and not capable of conducting the planned AMCM mission for 16 days due to helicopter, tow cable, and computer problems. Nearly all the lost AMCM mission days occurred in the AMNS configuration. This is not surprising given that the AMNS mission is more stressing on the MH-60S and its AMCM mission kit because of the need to lower the loaded AMNS launch and handling system into the water and retrieve it at least once per sortie.
- The MH-60S aircrew employed 2 ALMDS pods to search for mines for 33 hours and 3 AMNS launch and handling systems to launch 107 inert neutralizers against 66 targets.
- The ALMDS does not meet Navy detection/classification requirements in all depth bins or for the average probability of detection and classification in all conditions over a region of the water column that extends from the surface to a reduced maximum depth requirement. When the system and operator detect and classify a smaller percentage of mines than predicted by fleet planning tools, the MCM commander will likely underestimate the residual risk to transiting ships following clearance operations. To account for this uncertainty, the Navy might find it necessary to conduct minesweeping operations. However, the Navy does not plan to include the mechanical minesweeping capability that would be required in the MCM mission package. In some conditions, the ALMDS also generates a large number of false classifications (erroneous indications of mine-like objects) that can delay near-surface minehunting operations until conditions improve or slow mine clearance efforts because of the need for additional search passes to reduce the number of false classifications. In favorable environmental conditions, such as those observed during TECHEVAL, detection performance meets the Navy's requirements and the new multi-pass tactic has been successful in reducing false classifications to the Navy's acceptable limits at the cost of requiring more search and identification time.
- The current increment of the AMNS cannot neutralize moored mines above a prescribed operating ceiling, which will preclude neutralizing most of the mines expected in some likely threat scenarios; an Explosive Ordinance Disposal Team provided by another unit must be used. Within its operating range, AMNS performance is frequently degraded by the loss of fiber-optic communications between the aircraft and the neutralizer. The system has experienced loss of fiber-optic communications in a wide range of operationally relevant operating conditions, including those that are relatively benign. Although the Program Office has stated that it intends to develop an improved AMNS to extend its depth range and potentially improve performance in coarse bottom conditions and higher currents, none of these efforts are funded and the Navy is considering other alternatives.
 - AMNS Increment 1 cannot neutralize near surface mines because of safety interlocks designed to protect the helicopter and crew from exposure to fragments, surge, and blast that might result from mine detonation.
 - During the shore-based phase of an operational assessment completed in 2014, the system and its operators were unable to achieve the Navy's requirement for mine neutralization success in realistic conditions. Frequent loss of fiber-optic communications between the aircraft and the neutralizer was the primary cause of unsuccessful attack runs. The Navy attributed the failures to the bottom composition even though the bottom conditions experienced in the test area were not significantly different from those expected in some potential operating areas.
 - During TECHEVAL, which was conducted in favorable environmental conditions against a narrower segment of mine threats, the Navy observed higher probabilities of AMNS neutralization success than observed during the 2014 operational assessment. However, preliminary results indicate performance is consistent with previous results in the same environment.
 - Following developmental testing in high-current environments in 2013, Navy Air Test and Evaluation Squadron Twenty One concluded that the AMNS neutralizer, as currently designed, is ineffective in swift water currents. Although the Navy completed additional developmental testing in 2015, the Navy's testing has not characterized system performance under operationally realistic conditions in even moderate currents that might be encountered in potential operating areas.
- Consistent with the concept of operations, the LCS is reliant on shore-based support for assistance with diagnosis and repair of MCM mission systems including ALMDS and AMNS. The mission package detachment lacks the wherewithal to handle anything beyond relatively uncomplicated preventive maintenance and minor repairs. Thus, when ALMDS and AMNS failures occur, the Navy assumes that in most cases these systems will be replaced by embarked or shore-based spares.

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- Although TECHEVAL is intended to be developmental testing in nature, the test was designed to integrate the test objectives of both developmental and operational test communities. DOT&E personnel observed the testing aboard LCS 2. If the Navy elects to continue with the same system hardware and software configurations, DOT&E and the Navy will use the resulting data to supplement data collected during the operational test. If the Navy decides to go forward to operational testing with a new system, integrated test data collected in FY15 may not be representative of the system the Navy intends to field, and the Navy might need to repeat some portions of TECHEVAL to provide the requisite data.

Recommendations

- Status of Previous Recommendations. The Navy has partially addressed the FY11 recommendation to investigate solutions and correct the ALMDS False Classification Density and reliability deficiencies prior to IOT&E. The Navy has partially addressed the FY12 recommendation to assess corrections made to resolve previously identified Multi-spectral Targeting System (MTS) deficiencies by conducting FOT&E. The Navy has not acted or has yet to complete action on FY13 and FY14 recommendations to:
 1. Complete comprehensive survivability studies for MH-60S employing the 20 mm Gun System and the 2.75" Unguided Rocket Launcher.
 2. Conduct comprehensive live fire lethality testing of the HELLFIRE missile against a complete set of threat-representative small boat targets.
 3. Correct the tracking deficiencies in the MTS and conduct appropriate FOT&E in order to satisfactorily resolve the Surface Warfare Critical Operational Issue.
 4. Complete comprehensive IOT&E on the 2.75" Unguided Rocket and Advanced Precision Kill Weapon System II (APKWS II) to resolve the Surface Warfare Critical Operational Issue not resolved in limited assessments of system performance provided in Quick Reaction Assessments against small boat threats.
 5. Test the Surface Warfare mission capability of MH-60S helicopter equipped with MTS and the HELLFIRE missile throughout the operational mission environment in FOT&E and LFT&E.
 6. Complete vulnerability studies for MH-60S employing the LAU-61G/A Digital Rocket Launcher armed with APKWS II rockets.
 7. Conduct comprehensive lethality testing of the LAU-61G/A Digital Rocket Launcher armed with APKWS II rockets against a complete set of threat-representative small boat targets.
 8. Correct AMCM mission kit reliability issues that limit AMNS mission availability identified during the operational assessment.
 9. Develop corrective actions to eliminate early termination fiber-optic communications losses observed in the AMNS operational assessment.
 10. Conduct AMNS current testing from MH-60S.
- FY15 Recommendation.
 1. The Navy should provide LCS with a mine neutralization capability in water depths above the current AMNS operating ceiling.