Remote Minehunting System (RMS)

Executive Summary

- Contractor testing completed in FY13 suggests that vehicle reliability has grown since the Remote Minehunting System (RMS) program emerged from the Nunn-McCurdy review in FY10; however, these tests were not conducted in an operationally realistic manner. Data from the recent developmental testing suggest that reliability may not have improved sufficiently to enable a Littoral Combat Ship (LCS) with two Remote Multi-Mission Vehicles (RMMVs) onboard to complete the desired area search without having to return to port more often than currently planned and desired to obtain replacements. An accurate assessment of achieved RMMV reliability cannot be made until the RMS is tested under operationally realistic end-to-end minehunting missions.
- As observed during operational assessment and developmental testing of the MH-60S Organic Airborne Mine Countermeasures, the AN/AQS-20A does not meet all Navy requirements in all operating modes.
- The analysis of test data collected during developmental testing of RMS communications and launch, handling, and recovery improvements, and the AN/AQS-20A sonar is still in progress. The Navy expects to issue formal developmental test reports in 2QFY14.

System

- The RMS is designed to provide an organic, off-board mine reconnaissance capability to detect, classify, and localize non-buried bottom and moored mines, as well as to identify shallow-water bottom mines only.
- The RMS will be launched, operated, and recovered from the LCS as part of the Mine Countermeasures (MCM) mission package (when embarked).
- The RMS is comprised of four components:
  - RMMV
    - The RMMV is an unmanned, semi-submersible, un-tethered vehicle designed to conduct autonomous or semi-autonomous mine reconnaissance missions.
    - The RMMV physically transports AN/AQS-20A sensors, processors, and datalink equipment to the operations area where mine reconnaissance data are collected, recorded, and transmitted to the host LCS platform.
  - AN/AQS-20A sensor
    - The AN/AQS-20A is a variable depth forward-looking and side-scanning sonar that is deployed and retrieved by the RMMV.
    - The sensor tow body automatically controls depth based on specific mission planning parameters, providing a stable platform for integral mine reconnaissance sensors.
    - The AN/AQS-20A provides detection, classification, and localization of non-buried bottom (on the ocean floor)

and volume (in the water column) mine-like-contacts. The sensor utilizes a port and starboard Side-Looking Sonar and a Gap Filler Sonar for detection of bottom and tethered volume mines. A Volume Search Sonar (VSS) and a Forward-Looking Sonar are utilized for all mine type detection. An Electro-Optic Identification Device can replace the VSS for missions requiring (mine versus non-mine) identification of shallow-water bottom mine-like-contacts via high-resolution imaging.
  - Remote Minehunting Functional Segment (RMFS)
    - RMFS is the software that will be hosted in the mission package computing environment on the LCS.
    - RMFS is a two-operator system that enables the Remote Vehicle Operator and Remote Sensor Operator to command and monitor RMS operations.
    - Specific RMFS functionality enables the operator to (1) command and monitor the RMMV; (2) receive, process, and display real-time mission data; (3) conduct performance monitoring/fault detection/fault localization; and (4) perform network communication to the Data Link System (DLS).
    - RMFS also exchanges data with the Global Command and Control System – Maritime/Mine Warfare Environmental Decision Aids Library for mission planning and interface to the Global Information Grid.
  - DLS
    - The DLS enables the RMMV to communicate with the LCS MCM mission package via one of two radio frequency datalink subsystems.
    - The Multi-Vehicle Communications System (MVCS) consists of two radios – an Ultra High Frequency line-of-sight datalink that is used for vehicle launch and recovery and near-ship operations and a low-band Very

High Frequency datalink that is used for over-the-horizon mission operations. Both datalinks provide encrypted continuous communications between the LCS MCM mission package and the RMMV for real-time command and control and mission data capture.

Mission

MCM Commanders will employ the RMS from an MCM mission package-equipped LCS, to detect, classify, and localize non-buried bottom and moored mines, as well as to identify shallow-water bottom mines only in support of theater minehunting operations in shallow-water and deep-water minefields.

Major Contractors

- RMMV: Lockheed Martin – West Palm Beach, Florida
- AN/AQS-20A: Raytheon Corporation – Portsmouth, Rhode Island

Activity

- The RMMV contractor completed the second and final phase of system reliability growth improvements and completed 438 hours of in-water validation testing in 2QFY13.
  - An FY10 Acquisition Decision Memorandum, at the conclusion of the program's Nunn-McCurdy review, directed the implementation of a reliability growth program for the vehicle and this testing to assess vehicle reliability improvements against a reduced reliability requirement.
  - An earlier phase of contractor testing was completed in 1QFY11.
  - Vehicles with the full complement of reliability improvements have not been tested on an LCS. Testing was conducted in benign conditions from shore, which did not subject the RMMV to the handling stresses imposed by the LCS handling system.
- The Navy funded development of pre-planned product improvements for the AN/AQS-20A and is investigating improved tactics, techniques, and procedures for employment of the sensor. Both efforts are intended to correct effectiveness deficiencies observed during operational assessment and developmental testing of the AN/AQS-20A conducted in FY11.
- The Navy requested approval to deviate from the operational assessment strategy prescribed in the approved RMS Test and Evaluation Master Plan (TEMP).
  - The approved RMS TEMP directs the conduct of ship-based developmental testing and operational assessment of RMS in FY14 from an LCS at sea. Due to the unavailability of an RMS-compatible LCS seaframe to facilitate conduct of ship-based RMS testing, the planned FY14 testing will be conducted from a shore base.
  - Dedicated end-to-end mission testing of the RMS from an LCS ship-base may not occur until the programs' Technical Evaluation starting in 4QFY14. DOT&E expects to approve the requested deviation in 2QFY14.
- The Navy completed a scheduled phase of developmental testing of some structural improvements for the RMMV and the RMMV launch, handling, and recovery system and MVCS upgrades in dockside and at-sea testing in 4QFY13.
- The Navy completed a supplemental phase of developmental testing of the AN/AQS-20A in 4QFY13. The testing of the sensor, towed behind the Athena Research Vessel System, was intended to characterize detection/classification performance against moored mines located near the surface.
- In December 2013, the Navy proposed a new RMS acquisition strategy to support a Milestone C decision. DOT&E did not concur with the proposal because the selected measure for the RMMV reliability was not appropriate to ensure the new units would be operationally suitable and the quantity of units being procured prior to the completion of IOT&E was excessive.
- DOT&E recommends strongly that the planned operational assessment previously expected to be conducted 2QFY14 be postponed until 3/4QFY14. DOT&E will not approve the Navy's plan to conduct an operational assessment until the intended test article is representative of the system that will be tested during the LCS MCM mission package IOT&E and ultimately provided to the fleet at Initial Operational Capability. Upgrades to both the RMMV as well as the AN/AQS-20A are planned and the upgraded RMS is expected to start developmental testing in June 2014.

Assessment

- Contractor testing completed in FY13 suggests that vehicle reliability has grown since the RMS program emerged from the Nunn-McCurdy review in FY10. However, these tests were not conducted in an operationally realistic manner. The defined reliability measurement for the Nunn-McCurdy reliability growth program is not operationally relevant in that it includes post-mission analysis time when the RMMV is not operating, doesn't require the RMMV to be operating under a realistic load, permits additional maintenance if completed within two hours, and does not count several critical failures that would be termed operational mission failures in operational testing because they affect the performance of the mission. Hence, the reliability derived from the contractor testing is artificially inflated by at least a factor of two.
  - Data from the recent developmental testing, also conducted from shore but in a more operationally realistic manner, suggest that reliability may not have improved sufficiently to enable an LCS with two RMMVs onboard

to complete the desired area search without having to return to port more often than currently planned and desired to obtain replacements.

- An accurate quantitative assessment of operational availability of the RMS (a Key Performance Parameter) will not be obtainable until the reliability, maintainability, and logistics supportability of the RMS can be assessed during ship-based testing from an LCS as part of the MCM mission package.

• As observed during operational assessment and developmental testing of the MH-60S Organic Airborne Mine Countermeasures, the AN/AQS-20A still does not meet all Navy requirements in all operating modes.

- Contact depth (vertical localization) errors exceeded Navy limits in all AQS-20A operating modes. False classification density (number of non-mine like objects erroneously classified as mine-like per unit area searched) also exceeded Navy limits in two of three search modes. If left uncorrected, a large number of false targets and vertical localization errors generated by the AN/AQS-20A will reduce the minehunting capability of the LCS with an embarked MCM mission package.

- In 2008, developmental testing of the RMS revealed that the system has problems meeting the probability of reacquisition requirement when attempting to identify bottom objects in deeper waters. The Navy expects to implement fixes in the next version of the vehicle to correct this deficiency.

• The analysis of test data collected during developmental testing of structural improvements for the RMMV and the RMMV recovery system, and for MVCS upgrades is still in progress. However, sailors reported that communications between an RMMV equipped with MVCS upgrades and LCS 2 were unreliable throughout the test. The Navy expects to issue a formal test report in 2QFY14 and to complete additional MVCS and launch and recovery testing in 2QFY14 and 4QFY14.

• The Navy has not yet demonstrated the system can meet its single pass detection and classification requirements against moored and bottom mines spanning the portion of the shallow water regime not covered by the Airborne Laser Mine Detection System (ALMDS).

- The Navy is weighing the need for multiple search passes with the sensor towed at different depths under some conditions. Use of multi-pass search tactics would require more time to cover the same area and would negatively affect the LCS area coverage rate.

- Recent testing suggests that the AN/AQS-20A search envelope might be able to be extended upward to restore the desired overlap with the demonstrated ALMDS envelope. The analysis of test data collected during recent developmental testing of the AN/AQS-20A sensor is still in progress. The Navy expects to issue a formal developmental test report in 2QFY14. The Navy still must complete tactics development and operational testing to verify whether the use of the AN/AQS-20A will mitigate ALMDS shortfalls in expected threat environments.

Recommendations

• Status of Previous Recommendations. This is the first annual report for this program since 2008. The program was restructured in 2010 as a result of a Nunn-McCurdy breach.

• FY13 Recommendations. The Navy should:
1. Conduct reliability testing of the RMS under operationally realistic end-to-end minehunting missions as soon as possible to accurately assess achieved RMS, RMMV, and AN/AQS-20A reliability.
2. Conduct ship-based testing of the RMS that includes end-to-end minehunting missions from an LCS as part of the MCM mission package as soon as possible to:
    - Assess operational availability of the RMS.
    - Assess the RMMV launch, handling, and recovery system performance under operational conditions.
    - Assess fixes to resolve communications problems observed in FY13 testing.
    - Verify the RMS and LCS with MCM mission package are ready for IOT&E.
3. Investigate solutions and correct AN/AQS-20A False Classification Density and Vertical Localization deficiencies prior to IOT&E.
4. Update the RMS and AN/AQS-20A TEMPs and test plans to develop adequate testing to verify corrected deficiencies and assess operational capability of the systems the Navy expects to employ to meet LCS's mission requirements.