

Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion for Sonar AN/BQQ-10 (V) (A-RCI)

Executive Summary

- The Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) Sonar is an improvement over the legacy sonar systems; however, insufficient test data exists to conclude that annual A-RCI Advanced Processor Build (APB) upgrades improve mission capability.
- The Navy completed operational testing of the A-RCI APB-06 system and found it to be not effective and not suitable.
- DOT&E issued a classified consolidated A-RCI report on all operational test results of A-RCI for the APB-06 and prior systems in October 2009.

System

- A-RCI is an open architecture sonar system intended to maintain the acoustic advantage over threat submarines.
- A-RCI utilizes legacy sensors and replaces central processors with COTS computer technology and software. It includes the following:
 - A sonar system for the *Virginia* class submarine
 - A replacement sonar system backfit into *Los Angeles*, *Ohio*, and *Seawolf* class submarines
 - Schedule-driven annual software upgrades (APBs) and biannual hardware upgrades called Technology Insertions (TI)
- The Navy intends the A-RCI upgrades to provide expanded capabilities for anti-submarine warfare, high-density contact management, and mine warfare, particularly in littoral waters and against diesel submarines.
- Although technically separate acquisition programs the TB-16 series tactical towed array, the TB-29 series long-range search towed array, and the new acquisition programs TB-34 tactical towed array (TB-16 replacement) and the TB-33 long-range search towed array (TB-29 replacement) are primary passive sensors for A-RCI. These arrays along with the spherical



array, hull array, wide aperture array, and high frequency array, which are installed during submarine construction, are the sensors required by A-RCI.

Mission

Submarine crews equipped with the A-RCI sonar should be able to complete the following submarine force missions:

- Search, detect, and track submarine and surface vessels in open-ocean or littoral sea environments without being counter-detected
- Search, detect, and avoid mines or other submerged objects
- Covertly conduct Intelligence, Surveillance, and Reconnaissance
- Covertly conduct Special Forces Operations missions
- Conduct under-ice operations

Prime Contractor

- Lockheed Martin Maritime Systems and Sensors, Washington, District of Columbia

Activity

- The Navy completed operational testing of the A-RCI TI-06/APB-06 system following an Arctic Ocean under-ice event to test the High Frequency sonar in March 2009. Previous APB-06 testing of the passive sonar capability included Anti-Submarine Warfare (ASW) search testing against an Italian diesel-electric submarine (SSK) in September 2008 and High-Density Surface Contact Management in April 2008 and in October 2008. Testing was conducted in accordance with a DOT&E-approved test plan. The Navy's Commander,

Operational Test and Evaluation Force (COTF) issued their report in August 2009.

- DOT&E approved the A-RCI TI-06/APB-07 Test and Evaluation Master Plan (TEMP) on June 18, 2009. The TEMP allows for combined testing with the AN/BYG-1 Combat Control System and the new towed array acquisition programs for the TB-33 and the TB-34 arrays. A-RCI APB-07 testing is planned to begin in October 2009 and is scheduled to complete

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before the first APB-07 submarine deploys with the upgrade in 2010.

- The Navy finished the development of A-RCI APB-09 and began installing the system on operational submarines (initial installation on USS *North Carolina* – a *Virginia* class submarine). The Navy has not completed a TEMP for A-RCI APB-09. The new draft Capabilities Development Document deleted previously required operational metrics for assessing the ASW performance of submarine sonar.
- DOT&E issued a classified consolidated A-RCI report on all operational test results of A-RCI for the APB-06 and prior systems in October 2009.

Assessment

- The Navy's independent test agency, COTF, found A-RCI APB-06 to be not effective against threat diesel-electric submarines (SSKs) and not suitable for most operations. The Navy also found APB-06 to demonstrate poor situational awareness in high traffic areas. However, the Navy believes A-RCI to be an improvement over previous APB versions based on developmental test data and a qualitative assessment. Additionally, COTF found that A-RCI sonar training was improved. DOT&E agrees with the effectiveness and suitability assessment. However, while some laboratory data indicates minor performance improvement, this has not been evident with operators at sea. Additional comparative testing is required to assess these changes.
- The Navy has not completed operational testing of the A-RCI APB-07 system; however, development of APB-09 is complete. The Navy's schedule-driven process prevents operational test results from supporting development of the follow-on APBs.
- The DOT&E classified report on A-RCI performance for all testing conducted with TI-06/APB-06 and the preceding systems concludes the following:
 - A-RCI passive sonar capability is effective against older classes of submarines in most benign to moderate acoustic environments, but is not effective in more harsh acoustic environments or against modern threats of record.

- A-RCI is not effective in supporting operator situational awareness and contact management in areas of high contact density.
 - A-RCI high-frequency sonar is effective for arctic, under ice, and ice keel avoidance operations, but has significant reliability problems.
 - A-RCI high-frequency mine performance is improved and meets thresholds, but is not effective for transiting a minefield.
 - Overall, A-RCI is not suitable due to problems with reliability, training, documentation, and poor performance of supporting sub-systems.
- The program is not following the requirements of the Acquisition Process (Department of Defense Instruction 5000.02 of December 2008) for an evolutionary development. Requirements documents and TEMPs are developed and approved in parallel with APB development and installation. As a result, while some operational testing occurred, most was not complete before the system was deployed.

Recommendations

- Status of Previous Recommendations. The Navy has made progress in addressing seven of the 10 previous recommendations.
- FY09 Recommendations. The Navy should:
 1. Implement the recommendations in DOT&E's A-RCI report.
 2. Since testing is interdependent, consolidate the A-RCI, TB-33, and TB-34 TEMPs into a capstone document and continue to conduct combined testing with the AN/BYG-1. This will increase testing efficiency and enable a full end-to-end evaluation of submarine capability in the applicable mission areas.
 3. Develop operationally relevant metrics to evaluate A-RCI performance. These metrics should allow for comparison testing between APBs and assessment of the system's planned improvements as well as overall performance.
 4. Institute a reliability growth program for A-RCI software.