

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 conducted operational testing of the A-RCI APB-06 between March and December 2008. The Navy deployed the first A-RCI APB-06-equipped submarine in June 2008.
- The Navy continues to field and deploy A-RCI APB system upgrades without completing operational testing.
- DOT&E will issue a classified OT&E report covering A-RCI APB-04 and earlier systems in early FY09.

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:
 - 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.

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

Activity

- DOT&E approved the A-RCI TI-06/APB-06 Test and Evaluation Master Plan (TEMP) on June 25, 2008. DOT&E conditionally approved the A-RCI APB-06 operational test plan based on the draft TEMP and draft Capability Production Document (CPD) on March 31, 2008, in order for testers to utilize an available fleet asset for the first operational test event.
- The Navy continues to install and deploy A-RCI upgrades on operational submarines before completing operational testing. Currently eight of the planned 11 submarines planned to receive the A-RCI APB-06 system have the upgrade installed.

The Navy deployed the first A-RCI APB-06-equipped submarine in the summer of 2008 before completing all A-RCI APB-06 operational testing.

- The Navy is finishing development of A-RCI APB-07.
- The Navy conducted two OT&E events for the TI-06 APB-06 system to evaluate performance in mission areas for SSN submarines. During the planning for these tests, DOT&E urged the Navy to combine sonar, combat control, and weapons tests into single “end-to-end” tests wherever possible. The Navy combined the A-RCI and AN/BYG-1 combat

control testing. In addition to reducing costs and test assets, this provided a total mission performance evaluation.

- The Navy tested TI-06/APB-06 in a high-density shipping area to assess the crew's situational awareness in a difficult littoral environment in March 2008. However, submarine materiel problems delayed the start of testing at sea and poor weather in the test area prevented accomplishing an adequate test. The Navy plans to reschedule the test for early 2009.
- The Navy tested TI-06/APB-06 passive sonar search performance in an exercise with a cooperative Italian Navy diesel-electric submarine (SSK) in September 2008.
- The Navy is preparing requirements documents and a TEMP for A-RCI TI 06/APB07 and TI-08/APB-07.
- The Navy's Commander, Operational Test and Evaluation Force (COTF) issued an A-RCI APB-04 report in December 2007.
- COTF is evaluating data for the completed A-RCI tests and plans to issue a report on the A-RCI APB-06 system in 2QFY09, provided all required testing is complete.
- DOT&E will issue a classified consolidated A-RCI report on all operational test results of A-RCI for the APB-04 and prior systems in early FY09.

Assessment

- Although the Program Executive Officer introduced more discipline over the last two years into A-RCI development and testing, the majority of A-RCI requirements document and TEMP development and approval occurs in parallel with A-RCI APB development and installation. Navy testers begin some operational testing before the Service deploys the APB; however, most testing is not complete when the Navy's fleet commanders deploy the submarine. This schedule-driven process prevents determination of the system's operational effectiveness and suitability before the Navy deploys the system to forward theaters and before operators understand how to fully employ the system. This process also prevents timely feedback into the next A-RCI APB development cycle.
- The Navy implemented a Memorandum of Agreement (MOA) between all organizations involved in A-RCI development and testing, detailing the time frames for completing actions and milestones in the A-RCI TI/APB development-to-fielding cycle. Also the Navy plans to slow the insertion of new functionality into A-RCI in FY09. The MOA and slowing of the insertion rate into A-RCI should improve the Navy's ability to complete adequate test planning and execution before the A-RCI APB is fielded.
- The Navy has not completed operational testing of the A-RCI APB-06 system.
- A-RCI is a technological improvement over the legacy sonar systems; however, insufficient test data exists to conclude that

annual A-RCI APB upgrades improve mission capability. In addition, despite annual APB developments, the Navy has not changed most A-RCI requirements thresholds from the original September 1999 Operational Requirements Document.

Completed operational testing indicates some performance measures remain below established thresholds. DOT&E believes the new functionality in each APB should enable a trained operator's performance to improve at sea; however, operational testers have not substantiated or measured significant performance improvements in realistic operational environments.

- The DOT&E classified report on A-RCI performance for all testing conducted with TI-04 APB-04 and the preceding four APB systems concludes the following:
 - A-RCI passive sonar capability is effective against some classes of submarines in most easy to moderate acoustic environments, but 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 significantly improved and meets thresholds, but is not effective for the safe transit of a minefield.
 - Overall, A-RCI is not suitable due to problems with reliability, training, documentation, and poor performance of supporting sub-systems

Recommendations

- Status of Previous Recommendations. The Navy has made progress in addressing five of the six previous recommendations. The FY05 recommendation to develop platform level metrics with thresholds for the combat system has not been implemented.
- FY08 Recommendations. The Navy should:
 1. Complete requirements development, TEMP development, and approval for TI-08/APB-07 and for future TIs and APBs to support initiation of development.
 2. Implement the recommendations in DOT&E's A-RCI report.
 3. Follow the MOA for developing and testing A-RCI.
 4. Continue to conduct combined testing of A-RCI and AN/BYG-1 to enable a full end-to-end evaluation of submarine capability in the applicable mission areas.