

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

### Executive Summary

- Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion for SONAR AN/BQQ-10 (V) (A-RCI) APB-00 completed Operational Evaluation (OPEVAL) in September 2003. The Navy has not completed operational testing of A-RCI APB-01, APB-02, or APB-03, but has obtained a partial resolution of APB-00 deficiencies.
- Due to the rapid Advanced Processor Builds (APB) cycle, new systems are not adequately operationally evaluated.
- The Navy continues to deploy submarines with A-RCI systems that are not adequately operationally tested and evaluated.

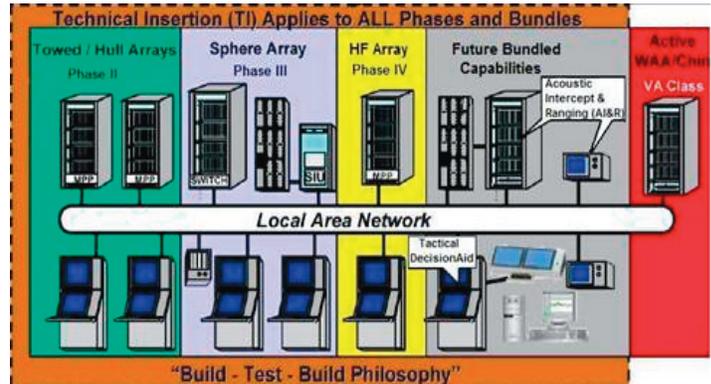
### System

A-RCI is an open architecture sonar designed for rapid fielding of hardware and software changes to maintain the acoustic advantage over threat submarines. It includes:

- Sonar System for the *Virginia* class submarine.
- Replacement sonar system backfit into *Los Angeles* SSN, *Trident* SSBN/SSGN, and *Seawolf* SSN submarines.
- Utilizes legacy sensors and replaces central processors with COTS computer technology and software in an open architecture.
- Annual software upgrades called APB and biannual hardware upgrades called Technology Insertions (TI).
- Improvements are intended to provide expanded capabilities for Anti-Submarine Warfare (ASW) and Mine Warfare (MW) particularly in littoral waters and against diesel submarines.

### Mission

Submarine crews equipped with the A-RCI sonar can 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 either on the ocean bottom or in the water volume
- Covertly collect acoustic Intelligence Surveillance/Reconnaissance (ISR)
- Covertly conduct Anti-Submarine Warfare, Anti-Surface Warfare, Mine and Submerged Object Detection and Avoidance, Strike Warfare, ISR, and Special Forces Operations missions
- Conduct under-ice operations

### Activity

- The Navy continued to install A-RCI systems on operational submarines without completing operational testing. The Navy started installing A-RCI TI-04 and APB-04 on submarines in October 2005.
- DOT&E conditionally approved the A-RCI Test and Evaluation Master Plan (TEMP) for testing of TI-02 and APB-03 on September 12, 2005. In the approval memorandum, DOT&E directed the Navy to obtain approval of requirements documents for TIs and APBs in a timely manner in order to support program development, and to submit a TEMP revision to support TI-04 and APB-04 testing by February 2006. The Navy is attempting to comply with the TEMP by combining A-RCI testing with other at-sea exercises.
- The Navy conducted a Follow-on Operational Test and Evaluation (FOT&E) and Verification of Correction of Deficiencies (VCD) from the FY03 APB-00 High Frequency Sonar OPEVAL in March 2005. The Navy conducted the VCD in combination with the Pre-Deployment Workup training for the test platform. The VCD resolved some effectiveness deficiencies; however, A-RCI continues to have reliability and suitability deficiencies. The VCD was inadequate for evaluating about half of the deficiencies therefore a follow-up test is required.
- The Navy started developing requirements documents for A-RCI APBs and TIs during FY05.

- The Navy conducted FOT&E and VCD from the FY02 Passive Sonar OPEVAL in June 2005. The VCD was conducted in conjunction with a fleet exercise. The test was overridden by exercise priorities and was inadequate for resolving deficiencies.
- Lack of test assets, poor system reliability, and a low priority on operational testing continues to prevent adequate evaluation of A-RCI upgrades. Because the Navy is not conducting dedicated operational testing, DOT&E and Navy testers participated in several at-sea fleet exercises and laboratory testing in an attempt to obtain insights into A-RCI system performance.

## Assessment

- Currently more than 30 submarines have A-RCI versions installed that have not been adequately operationally tested. When these submarines deploy, the A-RCI APB is, in essence, fielded.
- The Navy's efforts to combine A-RCI operational testing with other fleet activities results in increased test time to resolve effectiveness and suitability issues. Too often test objectives are lower priority or conflict with exercise and training objectives thus resulting in inadequate tests that do not resolve the critical operational test issues.
- The A-RCI APB-00 system, which underwent OPEVAL in FY02 and FY03, did not meet all effectiveness and suitability thresholds; however, A-RCI was an improvement over legacy systems. DOT&E observation of shipboard performance indicates the APB-03 system performance likely improved over APB-00 systems; however adequate operational tests have not been conducted to confirm this observation.
- Recent testing of the High Frequency Mine Sonar capability in APB-03 shows improvement in some mission areas, yet the system continues to have reliability and suitability deficiencies.
- System reliability has not improved significantly since the APB-00 OPEVAL and continues to be a concern. Newly installed A-RCI systems typically require six to 12 months of frequent contractor repairs and changes to ensure longevity. Reliability should increase once all legacy components are replaced by commercial off-the-shelf components.

- Although the Navy has not adequately operationally tested A-RCI, the Navy is conducting several thorough developmental tests, especially in the laboratory environment, which show good results.

## Recommendations

1. DOT&E recommended the Navy's development of new A-RCI APBs be event-based versus annually to ensure developmental testing, crew training, and operational testing and evaluation are completed. The Navy continues to develop and field A-RCI on an annual basis. The rapidity of the APB process hinders the resolution of deficiencies of previous builds and prevents adequate testing. Event-based development would also allow the Navy to develop realistic and testable operational requirements and measurable and meaningful thresholds for evaluating A-RCI developments.
2. DOT&E recommends the Navy establish compliance with their Internal Navy Memorandum of Agreement, which identifies responsibilities for all activities in the development and testing of A-RCI. Currently parties to the agreement are not in compliance.
3. Navy Commander, Operational Test and Evaluation Force (COMOPTEVFOR) should examine all fleet exercises as candidates for testing opportunities. DOT&E recommends that future combined test and fleet activities give priority to obtaining adequate test results or dedicated operational testing be scheduled. Since fleet goals often conflict with testing goals, dedicated tests may be necessary to fully evaluate new systems. We also recommend an annual dedicated test period, under COMOPTEVFOR control, to sufficiently evaluate each APB build.
4. DOT&E recommends that end-to-end testing is accomplished and appropriate platform-level requirements and performance metrics with thresholds be adopted and approved for all A-RCI upgrades.