

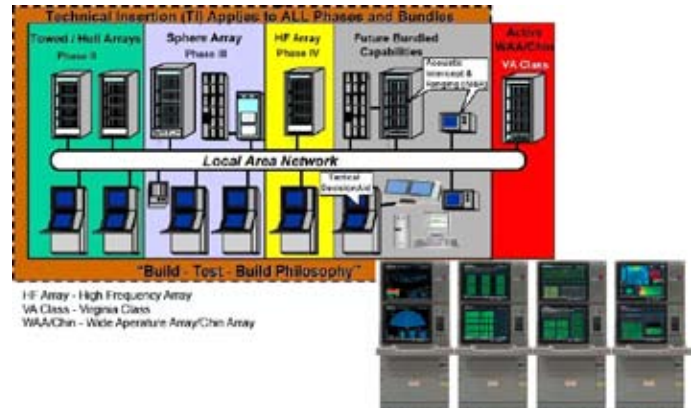
## Acoustic Rapid Commercial Off-the-Shelf (COTS) Insertion for Sonar AN/BQQ-10 (V) (A-RCI)

### Executive Summary

- The Navy conducted operational testing of the Acoustic Rapid Commercial off-the-shelf (COTS) Insertion (A-RCI) Sonar Advanced Processor Build-04 (APB-04) between November 2006 and June 2007.
- The Navy's operational testers evaluated A-RCI APB-04 under-ice navigation sonar as operationally effective, but not operationally suitable. Significant deficiencies include system reliability, maintainability, crew training, and documentation.
- Due to the rapid APB cycle, the Navy does not adequately operationally test and evaluate A-RCI APBs before the systems are fielded and deployed.

### System

- A-RCI is an open architecture sonar system designed 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)
- Improvements are intended 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 collect acoustic Intelligence Surveillance/Reconnaissance information
- Covertly conduct Special Forces Operations missions
- Conduct under-ice operations

### Activity

- DOT&E conditionally approved the A-RCI TI-04/APB-04/APB-05 Test and Evaluation Master Plan (TEMP) in January 2007 based on a draft Capability Production Document (CPD). The Navy approved the TI-04/APB-04/APB-05 CPD in May 2007.
- The Navy continues to install and deploy A-RCI upgrades on operational submarines before completing operational testing. Currently 12 submarines have A-RCI APB-04 systems and six submarines have A-RCI APB-05 systems installed.
- The Navy is developing requirements documents and a TEMP for A-RCI TI-06/APB-06. However, the Navy is installing this version on four submarines and is planning for an operational test in 2QFY08.
- The Navy conducted four OT&E events for the TI-04 APB-04 system to evaluate performance in mission areas for SSGN and SSN submarines.
  - The Navy tested the High Frequency (HF) under-ice sonar during an under-ice transit and deployment in November 2006.
  - The Navy tested passive sonar search performance in conjunction with the SSGN class conversion operational evaluation in March 2007. This dedicated test evaluated an SSGN TI-04/APB-04 sonar against a SSN also equipped with the same system.
  - The Navy tested HF mine avoidance on an SSGN class submarine in April 2007.
  - The Navy tested TI-04/APB-04 in a high-density shipping area to assess the crew's situational awareness in a difficult littoral environment in June 2007.
- The Navy's Commander, Operational Test and Evaluation Force (COMOPTEVFOR) issued an A-RCI APB-04 HF under ice sonar report in June 2007. COMOPTEVFOR is evaluating

data for the remainder of the A-RCI tests and plans to issue a consolidated report in 1QFY08.

## Assessment

- Although the Program Executive Officer introduced more discipline over the last two years, the majority of the A-RCI requirements documents preparation and testing still occur in parallel with the A-RCI installations, completing after some ships have deployed. This schedule-driven process prevents determination of the system's operational effectiveness and suitability before the Navy deploys the system. It also prevents timely feedback into the next A-RCI APB development cycle. A-RCI upgrade installations need to be preceded by adequate operational testing and evaluation so that operational effectiveness and suitability of what is being fielded is understood up-front.
- A-RCI is an improvement over the legacy sonar systems; however, insufficient test data exists to conclude that A-RCI improves mission capability between APBs. The A-RCI APB-04 system contains features and capabilities to improve performance, but because of reliability failures or lack of crew training, these enhancements appear untapped. DOT&E believes the new functionality should enable a trained operator's performance to improve at sea; however, significant performance improvements have not been substantiated or measured in realistic operational environments.
- COMOPTEVFOR reported the APB-04 HF under-ice sonar as effective, but not suitable. The HF under-ice performance is an improvement over legacy systems; however, the low system reliability led COMOPTEVFOR to recommend the system not be used for operations in shallow water under pack-ice until system reliability was improved. COMOPTEVFOR reported significant shortfalls in reliability, maintainability, crew training, and documentation. DOT&E agrees with this assessment.
- Operational testing of the SSGN variant of HF mine detection and avoidance sonar showed improved reliability compared to

the *Los Angeles* class A-RCI HF. The reliability improvement appears related to the installation of a new integrated HF sonar on the SSGNs (active sonar is not installed on pre-conversion SSBNs) while the *Los Angeles* submarines must interface with legacy sonar projectors, hydrophones, and signal amplification equipment. Independent of the reliability deficiencies, the APB-04 HF mine detection sonar demonstrated improvement over legacy systems, and introduced computer-aided detection features that improved effectiveness.

- SSGN A-RCI APB-04 search performance against a nuclear submarine appears equivalent to APB-04 search performance on a *Los Angeles* class submarine.

## Recommendations

- Status of Previous Recommendations. The Navy has not implemented an event-based methodology for developing and testing A-RCI (FY05). However, the Navy is implementing a memorandum of agreement between all organizations involved in A-RCI development and testing, detailing the timeframes for completing actions and milestones in the A-RCI TI/APB development-to-fielding cycle. The Navy plans to slow the insertion of new functionality into A-RCI in FY08. The Navy conducted combined testing of A-RCI and other submarine combat control systems in 2007 and is planning for more combined testing in 2008 (FY05). The Navy has not developed platform level metrics with thresholds for the combat system; however, the Navy is conducting more end-to-end combat system testing (FY05). The Navy has not developed a dedicated minefield for testing and/or training. However, the temporary minefield installed for SSGN APB-04 testing was adequate for operational testing (FY06).
- FY07 Recommendation.
  1. The Navy should complete requirements development, TEMP development, and approval for APB-06 and for future APBs to support initiation of APB development.