Multi-Static Active Coherent (MAC) System

Executive Summary

- The Navy completed the integration of the Multi-Static Active Coherent (MAC) Phase I system on P-8A Poseidon aircraft and conducted FOT&E in accordance with a DOT&E-approved test plan from March 2014 through February 2015.
- P-8A FOT&E results indicate that the MAC Phase I system provides P-8A aircraft with an early wide-area Anti-Submarine Warfare (ASW) search capability in some operational environments and in select scenarios, but it does not meet the MAC Phase I program’s requirements in other environments or scenarios. The P-8A’s MAC wide-area ASW search capability is similar to the capability on P-3C aircraft.
- The FOT&E did not fully examine the capability of MAC across all operational conditions, representative operational environments, and target types.
- DOT&E submitted an FOT&E report on the P-8A’s wide-area ASW search capability with the MAC Phase 1 system in December 2015. The report also updated DOT&E’s assessment of the ASW mission capability provided by the MAC system on the P-3C aircraft.
- The Navy plans to install MAC system software and display improvements on the P-8A with Increment 2 Engineering Change Proposal (ECP) 2 in FY15 and FY16 and conduct the P-8A aircraft wide-area ASW search assessment in mid-FY16.

System

- The MAC system is an active sonar system composed of two types of sonobuoys (source and receiver) and an acoustic processing and aircraft mission computer software suite. It is employed by the Navy’s maritime patrol aircraft (P-3Cs and P-8As) to search for and locate threat submarines in a variety of ocean conditions.
- MAC replaces the Navy’s current Improved Extended Echo Ranging (IEER) system, which employs non-coherent sources to produce loud sounds that reflect off submarine targets. MAC employs new coherent source buoys that enable multiple pings, optimized waveforms, and various ping durations, none of which the legacy IEER system provided. The Navy is planning a series of enhancements to the MAC software and improvements to the MAC buoys.

Mission

The Navy intends for P-3C and P-8A crews equipped with MAC to support the search, detect, and localization phases of the ASW mission. MAC is particularly focused on large-area active acoustic searches for threat submarines.

Major Contractors

- Lockheed Martin – Manassas, Virginia
- Sparton Electronics Florida, Inc. – De Leon Springs, Florida
- Ultra Electronics, Undersea Sensor Systems Incorporated (USSI) – Columbia City, Indiana
- Boeing Defense, Space, and Security – St. Louis, Missouri

Activity

- The Navy completed integrating the MAC Phase 1 system onto the P-8A aircraft and conducted FOT&E of the P-8A’s early wide-area search capability with the MAC from March 2014 through February 2015. The Navy completed IOT&E of the MAC Phase 1 system on the P-3C Multi-mission Aircraft in October 2013. The Navy conducted the operational testing in accordance with a DOT&E-approved test plans.
- DOT&E submitted an FOT&E report on the P-8A’s wide-area ASW search capability with the MAC system.
The Navy uses ASPECT/Multi-static Planning Acoustics Toolkit to develop MAC search plans and to estimate theoretical system performance. In addition to the incomplete environmental databases used by ASPECT when modeling many threat operating areas, the planning tool performance estimates are highly dependent on the wide-range of potential mission planning input parameters estimated by the mission planner. As a result, ASPECT performance estimates can widely vary when compared to test results. The Navy’s Oceanographic Office is updating these environmental databases, focusing first on forward operating areas. Since ASPECT does not have a good estimate for the operator recognition of the submarine target, it overestimates ASW detection performance.

- Status of Previous Recommendations. The Navy is making progress on the FY13 and FY14 recommendations. The status of significant unclassified recommendations remaining include:
  1. The Navy Program Office is investigating fleet exercise data to assess detection performance and to gather data for developing future algorithm and software improvements. The fleet exercise data include new environments where the fleet operates in peacetime. The Navy is planning the outstanding MAC operational testing against different target types. This testing will be in conjunction with P-8A Increment 2 ECP-2 FOT&E.
  2. The Navy has not completed development of a sustainable MAC training program or completed the formal updates to tactics guidelines and documentation.
  3. The Navy has not developed processes for aircrews to better understand the environmental conditions in the search area. The Navy developed a complex process for estimating the environmental conditions in operational test areas to improve ASPECT predictions; however, the process is not timely or usable by typical aircrews. The Navy should continue to investigate methods for aircrews to measure environmental conditions in the search area and to adjust the MAC search plan appropriately when the conditions change.
  4. The Navy is investigating the MAC system’s capability for longer-range detections based on the environmental conditions in the search area.

- FY15 Recommendations. The Navy should implement the recommendations found in DOT&E’s P-8A with the MAC System FOT&E report. DOT&E provided 14 recommendations to improve the MAC system performance and 6 recommendations to improve test realism, minimize test limitations, and improve data collection. Significant unclassified recommendations include:
  1. Investigate and develop tactics to improve the operator’s ability to transition system detections to high confidence target detection. Consider measures to balance operator...
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workload and update search plans based on the actual conditions experienced in the search area.

2. Investigate the system’s capability for longer-range detections based on the environmental conditions in the search area.

3. Investigate and develop improvements to the ASPECT planning system and the supporting databases.