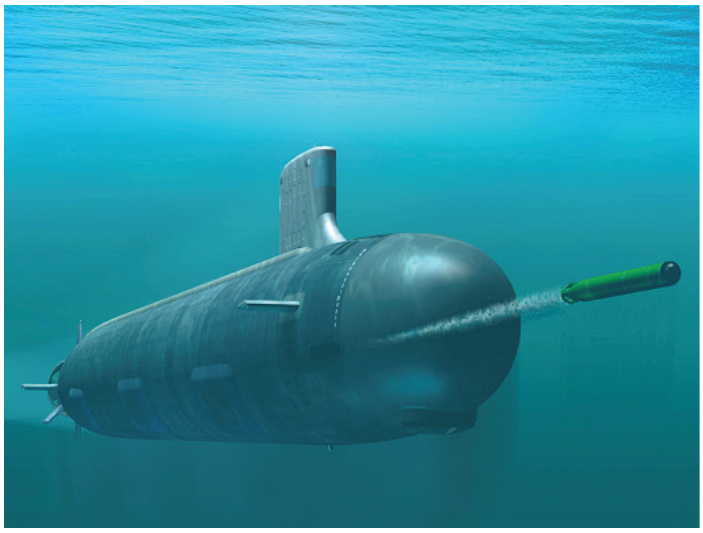
Mk 48 Advanced Capability (ADCAP) Torpedo Modifications

Executive Summary

- In FY11, the Navy began operational testing of the Advanced Processor Build 4's (APB4) tactical software for the Mk 48 Advanced Capability (ADCAP) Mod 7 Common Broadband Advanced Sonar System (CBASS) torpedo and Mk 48 ADCAP Mod 6 Advanced Common Torpedo (ACOT). OT&E is expected to continue through the end of FY12.
- From January to February 2011, the Navy conducted a Quick Reaction Assessment (QRA) of the Mk 48 APB4 to evaluate the torpedo's capability against an emerging submarine threat. In March 2011, the Navy's Program Executive Officer authorized a limited early fleet fielding of the Mk 48 APB4 torpedo to deploying submarines.
- On March 18, 2011, DOT&E delivered an Early Fielding Report on the Mk 48 APB4 torpedo to the congressional defense committees. DOT&E assessed that testing to date indicated the Mk 48 APB4 has a limited capability against the threat identified in the Urgent Operational Needs Statement (UONS) under certain operational conditions; however, the Navy did not have adequate threat surrogates for the evaluation. DOT&E's assessment also reported that the APB4 torpedo did not demonstrate improvements over the legacy torpedo, and may degrade current capabilities in certain warfare scenarios.

System

- The Mk 48 ADCAP torpedo is the primary anti-submarine warfare and anti-surface ship warfare weapon used by U.S. submarines. Mk 48 ADCAP torpedo modifications are a series of hardware and software upgrades to the weapon.
- Mk 48 Mod 5, Mod 6, Mod 6 Spiral 1, Mod 6 Advanced Common Torpedo – Guidance and Control Box (ACOT), and Mod 7 CBASS Phase I are fielded torpedoes.
- Mk 48 Mod 7 CBASS upgrades the Mk 48 ACOT with new sonar designed to improve torpedo effectiveness through future software upgrades. Phase 1 torpedoes deliver the initial hardware and software; Phase 2 torpedoes are required to deliver full capability.



- The software developed for CBASS Phase 2 is designated APB4. The Navy subsequently determined that APB 4 software can run on ACOT weapons as well. As a result, APB4 is being tested on both CBASS and ACOT weapons. The Navy has authorized the limited fielding of Mk 48 APB4 torpedoes.
- CBASS is a co-development program with the Royal Australian Navy.

Mission

The Submarine Force employs the Mk 48 ADCAP torpedo as a long-range, heavy-weight weapon:

- For destroying surface ships or submarines
- In both deep-water open-ocean and shallow-water littoral environments

Major Contractor

Lockheed Martin Sippican Inc. – Marion, Massachusetts

Activity

- The Navy's Fifth Fleet issued a UONS in March 2010 requesting solutions to address an emerging submarine threat; the Navy identified the Mk 48 ADCAP with APB4 software as a solution. In November 2010, the Navy tasked the Commander, Operational Test and Evaluation Force (COTF), to conduct a QRA to support the early fielding of the Mk 48 APB4 to address the emerging threat. COTF observed and analyzed the results of the program office and fleet in-water Mk 48 APB4 exercises and developmental testing from January to February 2011. In addition, COTF conducted modeling and simulation assessments, using the Weapons Analysis Facility (WAF) located at the Naval Undersea Warfare Center, Newport, Rhode Island, to examine Mk 48 APB4 performance in baseline warfare scenarios.

- The Navy released the Mk 48 APB4 torpedo for limited operational use in March 2011.
- DOT&E delivered a report of early operational fielding to the congressional defense committees in March 2011. DOT&E considered test data and reporting from Mk 48 APB4's developmental testing, the QRA, and the performance of legacy Mk 48 torpedoes in preparing the Early Fielding Report.
- The Navy updated the Joint Test and Evaluation Master Plan to cover the APB4 with Mk 48 ADCAP CBASS and Mk 48 ADCAP ACOT, and to address the UONS threat. The Test and Evaluation Master Plan is being routed for Navy approval signatures.
- The Navy developed a Submarine Launched Countermeasure Emulator (SLACE) to support Mk 48 APB4 testing. The SLACE emulator enables the Navy to conduct realistic torpedo operational testing against threat submarine surrogates that can employ mobile countermeasures. The Navy also developed a Steel Diesel Electric Submarine surrogate to evaluate torpedo performance against submarine threats in limited operational scenarios.
- The Navy's program office fired 33 Mk 48 APB4 weapons between May and August 2010 as part of the shallow water technical evaluation. Between January and September 2011, the Navy fired over 70 additional Mk 48 APB4 weapons during fleet training events and the Navy's QRA. These torpedo shots supported the completion of developmental testing as well as operationally realistic regression testing.
- In August 2011, DOT&E directed the Navy to submit for approval Operational Test Authority-developed test plans for QRAs planned to support a fielding decision for programs on the DOT&E oversight list.
- DOT&E approved the OT&E test plan for Mk 48 APB4 on July 14, 2011. DOT&E agreed to use operationally realistic test and exercise data collected during the Mk 48 APB4 QRA and technical evaluation to examine the new UONS threat and to use operationally realistic fleet Mk 48 APB4 torpedo firings for regression testing in order to reduce the torpedo test resources required for OT&E. COTF and DOT&E selected at-sea test events to focus on the new capabilities identified in the Mk 48 requirements documents. Dedicated Mk 48 APB4 testing is expected to continue through the summer of CY12.
- In September 2011, the Navy conducted 10 Mk 48 APB4 torpedo events using the Steel Diesel Electric Submarine target surrogate at a shallow water site off the Virginia coast. The purpose was to gain additional torpedo performance information against stationary submarine threats.
- In December 2011, the Navy proposed several Mk 48 APB4 torpedo software changes to correct problems identified in completed testing and by fleet operators. The Navy's testers are evaluating possible revisions to operational testing.
- The Navy conducted two successful Mk 48 Mod 6 Service Weapons Test events in FY10 and FY11, using torpedoes selected from the warshot inventory. These test events confirmed the warhead performance of in-service and stored Mk 48 torpedoes.

Assessment

- The Navy's QRA and WAF testing of the Mk 48 APB4 torpedo enabled a limited assessment of its performance. DOT&E assessed that testing to date indicated the Mk 48 APB4 has a limited capability, under certain operational conditions, against the threat identified in the UONS; however, the Navy did not have adequate threat surrogates for the evaluation. DOT&E's assessment also reported that the APB4 torpedo did not demonstrate expected improvements over the legacy torpedo, and may degrade current capability in certain warfare scenarios.
- Additional information on Mk 48 APB4 performance can be found in DOT&E's classified Mk 48 ACOT and CBASS APB4 Early Fielding Report dated March 18, 2011.
- The completed Mk 48 APB4 test events are being assessed for operational realism and validity incrementally as the fleet training and test events are completed. Due to delays in completing the development of the SLACE mobile countermeasure surrogate, some important operational testing to confirm performance has not begun. DOT&E assesses that Mk 48 APB4 performance against SLACE-like threats is high risk because the program office completed little in-water developmental testing. DOT&E expects the SLACE testing, and the remainder of the dedicated testing, will complete in FY12. Initial regression testing results indicate performance in deep water areas has not substantially changed; however, insufficient testing has been completed in other areas to allow assessment.

Recommendations

- Status of Previous Recommendations. The Navy has addressed six of the eight previous recommendations. The Navy continues to experience test delays, as fleet submarine assets are not available for conducting operational testing. Some improvements have been made by conducting regression testing in conjunction with scheduled fleet training events and by using WAF simulations; the Navy should continue to address reducing test delays and improve these simulations (FY05). The Navy conducts limited torpedo training and testing in shallow waters because they do not have adequate shallow water ranges or methods to expeditiously locate and recover exercise torpedoes. Locating and recovering a torpedo in open-ocean requires dedicated and expensive air and surface assets. The Navy should develop shallow-water test and training areas and modernize the exercise torpedo locating and recovery systems (FY08).
- FY11 Recommendations. The Navy should:
  1. Complete development of threat representative target and countermeasure surrogates for torpedo testing. In addition to representing the physical and signature characteristics of the threat, the surrogate should be capable of emulating appropriate operational profiles of the threat.
  2. Continue conducting the Mk 48 APB4 torpedo testing in FY12. Testing should include the evaluation of torpedo performance against submarine surrogates that employ the SLACE countermeasure.