

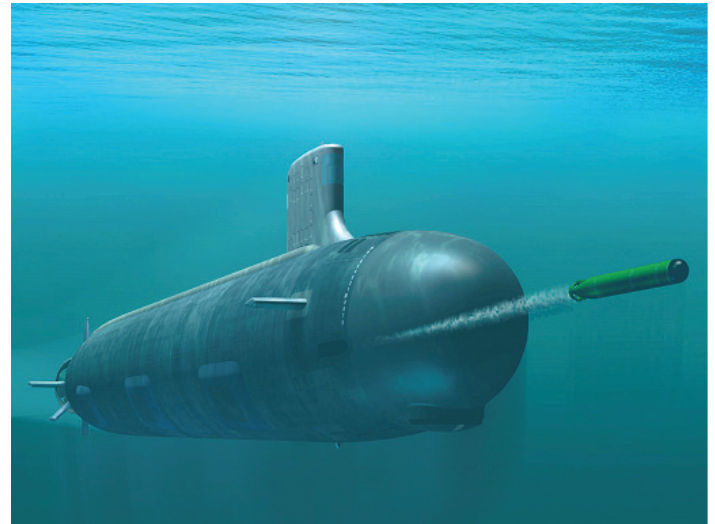
Mk 48 Advanced Capability (ADCAP) Torpedo Modifications

Executive Summary

- In FY13, the Navy completed operational testing of the Spiral 4 operational software for the Mk 48 Advanced Capability (ADCAP) Modification (Mod) 7 Common Broadband Advanced Sonar System (CBASS) torpedo and Mk 48 ADCAP Mod 6 Advanced Common Torpedo (ACOT).
 - DOT&E issued an FOT&E report on that testing in May 2013.
 - Operational testing and regression results indicate overall Mk 48 Spiral 4 performance in deep-water and shallow-water areas has not substantially changed over legacy Mk 48 torpedo performance.
 - The Spiral 4 software does show some limited improvements in certain specific warfare scenarios but does not meet the Navy's original key performance goals. Performance in Anti-Surface Warfare (ASuW) needs improvement.
 - The Navy authorized fielding of Spiral 4 in May 2013.
- DOT&E is working with the Navy to develop a Test and Evaluation Master Plan to support assessment of Advanced Processor Build (APB) 5 software. (Note that the Navy changed the naming convention for updates to the software from "spiral" to "APB.")
- Initial developmental testing is scheduled to begin in FY15, with operational testing commencing in FY18 to support Initial Operational Capability (IOC) in FY20.

System

- The Mk 48 Advanced Capability torpedo is the only Anti-Submarine Warfare and Anti-Surface Ship Warfare weapon used by U.S. submarines.
- Mk 48 Mod 6, Mod 6 ACOT, and Mod 7 CBASS are currently fielded in the fleet.
- The Mk 48 Mod 7 CBASS upgraded the Mk 48 ACOT with a new sonar designed to improve torpedo effectiveness through future software upgrades. Phase 1 torpedoes (IOC 2006)



delivered the initial hardware and software; Phase 2 torpedoes (IOC 2013) were required to deliver full capability.

- The Navy determined the Spiral 4 software developed for CBASS Phase 2 can run on ACOT weapons as well. The Navy has authorized the fielding of Mk 48 Mod 6 ACOT and Mod 7 CBASS torpedoes with Spiral 4 software.
- 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 against surface ships or submarines in both deep-water open ocean and shallow-water littoral environments.

Major Contractor

Lockheed Martin Sippican Inc. – Marion, Massachusetts

Activity

- In FY13, the Navy employed Spiral 4 weapons during four Submarine Command Course exercises at the Atlantic Undersea Test and Evaluation Center and the Pacific Missile Range Facility, thus completing operational testing of the Spiral 4 operational software for the Mk 48 ADCAP Mod 6 ACOT and the Mk 48 ADCAP Mod 7 CBASS torpedoes.
 - The majority of Mk 48 test data come from fleet training exercises, in particular the Submarine Command Courses,

which serve as exams for prospective U.S. submarine commanders.

- To conserve test resources, DOT&E agreed to utilize these torpedo events as regression testing to evaluate the performance of the Mk 48 Spiral 4 in some deep-water scenarios.
- The Navy conducted testing in accordance with DOT&E-approved test plans.

NAVY PROGRAMS

- In August 2013, the Navy conducted two successful Service Weapons Tests using war-shot torpedoes. These test events confirmed the warhead performance of in-service and stored Mk 48 torpedoes.
- DOT&E issued a Spiral 4 FOT&E report in May 2013. The Navy authorized fielding of Spiral 4 in May 2013.
- DOT&E is working with the Navy to develop a Design of Experiments and Test and Evaluation Master Plan to support assessment of APB 5 software. Initial developmental testing is scheduled to begin in FY15, with operational testing commencing in FY18 and an IOC goal of FY20.

Assessment

- Operational testing and regression results indicate overall Mk 48 Spiral 4 performance in deep-water and shallow-water areas has not substantially changed over legacy performance. Spiral 4 does show some limited improvements in certain specific warfare scenarios but it still does not meet the Navy's original key performance goals. Performance in ASuW needs improvement.
- The Mk 48 Mod 6 and Mod 7 weapons continue to be operationally suitable.
- Additional information on Mk 48 Spiral 4 performance can be found in DOT&E's classified Mk 48 ACOT and CBASS Spiral 4 FOT&E report dated May 2013.

Recommendations

- Status of Previous Recommendations. Of the previous years' recommendations, the following three remain unresolved:
 1. While the Navy is in the process of improving the Weapons Analysis Facility simulations with the development of

the Torpedo Operational Testing Using Modeling and Simulation (TOTUMS) project, further work is required to complete the TOTUMS project and determine its usefulness in support of testing. TOTUMS is intended to implement improved false target emulation, multiple wake models, and range-dependent propagation environments where ocean composition and depth vary to allow more realistic emulation of representative threat environments.

2. As the Navy continues to conduct limited torpedo training and testing in shallow water, they should develop shallow-water test and training areas and modernize the exercise torpedo locating and recovery systems.
 3. The Navy should 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.
- FY13 Recommendations. The Navy should:
 1. Evaluate torpedo performance against small diesel-electric submarine threats using in-water testing against a validated surrogate.
 2. Evaluate alternate acoustic technologies that can be incorporated to enhance ASuW performance.