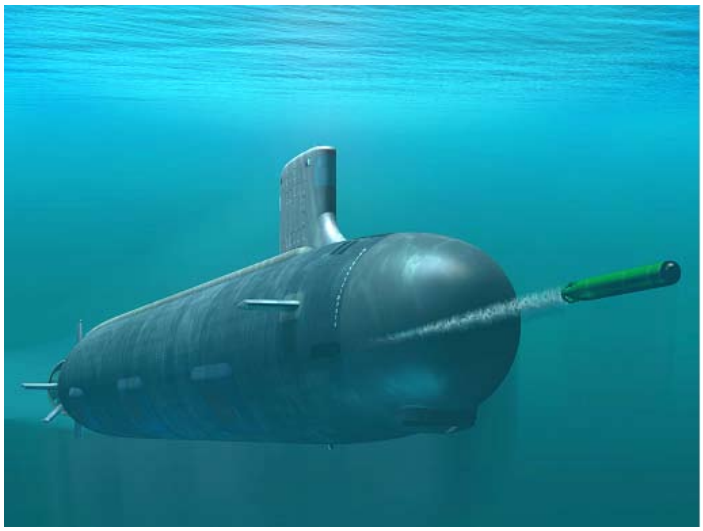
Mk 48 Advanced Capability (ADCAP) Torpedo Mods

Executive Summary

- The Mk 48 Mod 7 Common Broadband Advanced Sonar System (CBASS) torpedo successfully completed shallow-water operational testing in May 2006 and deep-water model and simulation regression testing in July 2007. The torpedo's performance is equivalent to the Mk 48 Advanced Capability (ADCAP) Mod 6.
- Due to the Navy's fielding of the Mk 48 Mod 7 CBASS before completing all operational testing, DOT&E issued an Early Fielding Report on CBASS in June 2007.
- The Navy is incorporating some Mk 48 Mod 7 CBASS software features into the Mk 48 Mod 6 torpedo. Initial operational testing started in September 2007.

System

- The Mk 48 ADCAP torpedo is the primary anti-submarine warfare (ASW) and anti-surface ship warfare (ASuW) weapon used by U.S. submarines.
- Mk 48 ADCAP torpedo mods are a series of hardware and software upgrades to the Mk 48 torpedo.
- Mk 48 Mod 4, Mod 5, Mod 6, Mod 6 Advanced Common Torpedo – Guidance and Control Box (ACOT-GCB), and Mod 7 CBASS are fielded torpedoes.
- Mk 48 ACOT-GCB replaces obsolete Mod 6 hardware and rewrites the software allowing an open architecture torpedo design to allow future software upgrades. Mk 48 ACOT-GCB is designed to have the same performance as the Mk 48 Mod 6.
- The Mk 48 Mod 6 Spiral 1 torpedo is the last planned software upgrade to the Mk 48 Mod 6. This upgrade uses software algorithms from the CBASS to improve shallow-water performance.



- Mk 48 Mod 7 CBASS upgrades the Mk 48 ACOT-GCB with a new sonar and improves torpedo effectiveness through future software upgrades, called Advanced Processor Builds (APB). CBASS is a co-development program with the 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

Activity

- The Navy's Commander, Operational Test and Evaluation Force (COMOPTEVFOR) accredited the Naval Undersea Warfare Center's (NUWC) Weapons Analysis Center (WAF), a hardware-in-the-loop model and simulation, for side-by-side regression testing of the Mk 48 Mod 6 and the CBASS torpedoes in deep water ASW and ASuW scenarios in July 2007.
- The Navy conducted CBASS side-by-side comparison testing with the Fleet baseline Mk 48 Mod 6 torpedo using the WAF simulation from August 2006 to July 2007. This testing focused on deep-water ASW and ASuW performance. The Navy previously completed in-water, shallow-water operational testing of the CBASS in December 2005 and March 2006. COMOPTEVFOR issued their final report on the OT&E of the Mk 48 Mod 7 CBASS torpedo in July 2007.
- The Navy fielded the CBASS in November 2006 without completing deep-water regression operational testing. In accordance with the FY06 National Defense Authorization Act, DOT&E subsequently issued an Early Fielding Report describing the torpedo's operational effectiveness and suitability based on the testing conducted before fielding.
- The Navy conducted a successful Mk 48 Mod 6 warshot Sink Exercise and Surface Weapons Test in May 2007.
- DOT&E approved the Mk 48 Mod 6 Spiral 1 Test and Evaluation Master Plan (TEMP) in July 2007.
- The Navy conducted shallow-water OT&E of the Mk 48 Mod 6 Spiral 1 torpedo in September 2007.

Assessment

- The Navy completed adequate operational testing of the Mk 48 Mod 7 CBASS. CBASS in-water test results indicate CBASS shallow-water performance is similar to the legacy Mk 48 Mod 6 torpedo. WAF side-by-side comparisons also indicate similar deep-water performance. However, the original 1998 CBASS Operational Requirements Document (ORD) demanded a considerable effectiveness improvement in more challenging scenarios. The Navy revised the ORD in 2002, requiring that the first phase of CBASS match current Mk 48 Mod 6 performance. This effectiveness goal is remarkably modest since the Mk 48 Mod 6 did not meet its own requirements thresholds.
- Mk 48 ADCAP performance has remained relatively stagnant for more than a decade, despite multiple hardware and software upgrades. The Navy now hopes to achieve ambitious effectiveness improvements with CBASS delivering full capability by the end of the decade via a software APB process.
- In response to two Mk 48 ADCAP failures during a 2003 Ship Sink Exercise, the Navy conducts annual warshot test firings to verify the inventory. Three torpedoes were successfully fired in 2005, one in 2006, and two in 2007. This process is essential in order to verify performance of the inventory of torpedoes.
- The Navy incorporated some CBASS software algorithms into the Mk 48 Mod 6 Spiral 1 torpedo in an attempt to improve shallow-water torpedo performance. Based on the shallow-water performance of the CBASS and the performance thresholds, DOT&E expects the performance improvements to be marginal and still below the threshold set in the original Mk 48 ADCAP ORD.
- The Navy began software development and developmental testing of future CBASS software APBs without completing a TEMP update to cover the developmental and operational testing.

Recommendations

- Status of Previous Recommendations. The Navy continues to experience test delays, as fleet submarine assets are not available for conducting operational testing. Some improvement has been realized 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 the WAF simulations (FY05). The CBASS torpedo requirements thresholds require significant improvement in torpedo performance in difficult acoustic environments by 2010. The Navy must lay out a credible plan and resources to achieve and test effectiveness improvements with CBASS, delivering full capability by the end of the decade via APB software upgrades (FY06). Although the Navy has started development and developmental testing of future CBASS APBs, a TEMP governing planned development and operational testing has not been developed (FY06).
- FY07 Recommendations.
  1. The Navy must complete an update to the Mk 48 Mod 7 CBASS TEMP.
  2. Operational testing of torpedoes should include a combat system test perspective in achieving mission success of target detection through target kill vice only the combat system element (torpedo) focus.