

Mk 54 Lightweight Torpedo

Executive Summary

- Production of Mk 54 torpedoes resumed following a one-year delay due to quality assurance problems.
- The Navy needs to develop requirements documents, acquisition strategies, and associated Test and Evaluation Master Plans (TEMPS) to address the Mk 54 Pre-Planned Product Improvement (P3I) program and the Mk 54 High-Altitude Anti-submarine Warfare Weapons Capability (HAAWC).

System

- The Mk 54 Lightweight Torpedo is the primary anti-submarine warfare (ASW) weapon used by U.S. surface ships, fixed-wing aircraft, and helicopters.
- The Mk 54 combines the advanced sonar transceiver of the Mk 50 torpedo with the legacy warhead and propulsion system of the older Mk 46. An Mk 46 torpedo can be converted to an Mk 54 via an upgrade kit.
- The Mk 54 sonar processing is an expandable open-architecture system. It combines algorithms from the Mk 50 and Mk 48 torpedo programs with the latest commercial off-the-shelf technology.
- The Navy designed the Mk 54 sonar processing to operate in shallow-water environments and in the presence of sonar countermeasures.
- The Navy has designated the Mk 54 torpedo to replace the Mk 46 torpedo as the payload section for the Vertical Launch Anti-submarine Rocket (VLA) for rapid employment by surface ships.
- The HAAWC program will provide an adapter kit to permit long-range, high-altitude, GPS-guided deployment of the Mk 54 by a P-8A Maritime Patrol Aircraft.
- The Navy is planning a series of near-term improvements to the Mk 54, including an improved sonar array and block upgrades to the tactical software.



Mission

The Navy surface and air elements employ the Mk 54 torpedo as their primary anti-submarine weapon:

- For offensive purposes, when deployed by ASW aircraft and helicopters
- For defensive purposes, when deployed by surface ships
- In both deep-water open-ocean and shallow-water littoral environments
- Against fast, deep-diving nuclear submarines, and slow-moving, quiet, diesel-electric submarines

Prime Contractor

- Raytheon

Activity

- The Navy halted production of Mk 54 torpedoes in March 2007 due to quality assurance, workmanship, and assembly problems at the prime contractor's facility. After the Navy and prime contractor instituted a remediation program, production was resumed in March 2008.
- To support high-altitude deployment of the Mk 54 torpedo from the new P-8A maritime patrol aircraft, the Navy conducted a demonstration of the HAAWC proof of concept prototype from a P-3C aircraft in May 2007. Three manufacturers are currently competing for the contract.
- The Navy is developing requirements documents for HAAWC as well as the initial set of P3I hardware and software

upgrades. Those requirements are necessary to support development of the associated acquisition strategies and TEMPS.

- The Navy conducted developmental testing of the VLA with an Mk 54 torpedo payload in November 2007. Of the six missiles fired, none were successful. In December 2007, the Navy cancelled operational testing pending remediation of the problems. The Navy corrected all known VLA problems and plans to restart operational testing in February 2009.
- In August 2006, the Navy began FOT&E to evaluate the terminal homing phase of the Mk 54 torpedo attack. During

the test, the Weapons Set-to-Hit Torpedo Threat Target (WSTTT) surrogate sank due to a system malfunction. Throughout 2007, the Navy test community engaged in Navy discussions to salvage the WSTTT and to allow for FOT&E completion and resolution of a Critical Operational Issue (COI) for Mk 54 effectiveness and lethality. The Navy's FOT&E remained incomplete throughout FY08 due to the lack of test target assets. On September 12, 2008, the Navy's Commander, Operational Test and Evaluation Force identified a threat-representative set-to-hit target as a test resource shortfall and a severe limitation for evaluating the Mk 54 Mod 0 torpedo.

- DOT&E placed the Mk 54 torpedo program on oversight in FY08.

Assessment

- The Navy completed the IOT&E of the Mk 54 Mod 0 torpedo in 2004. The Navy's IOT&E report identified a major limitation to test and inconclusive test data for evaluating the terminal homing phase of the Mk 54 torpedo's attack profile. DOT&E agrees with the Navy testers that the lack of a threat-representative set-to-hit target is severe limitation to test. DOT&E believes completing the Mk 54 FOT&E is critical for resolving the effectiveness and lethality of the Mk 54 Mod 0 torpedo and future planned upgrades of the torpedo.
- The six VLA developmental testing failures were due to multiple causes including the fire control software, Mk 54 reliability, and VLA canister hardware. The program believes that it has addressed all of these deficiencies and plans to

resume testing in early FY09. Due to Fleet safety rules, Navy ships cannot fire the VLA against manned submarines; instead, the Navy plans to use an unmanned Mk 30 vehicle as the target. Navy testers and DOT&E agree that this VLA testing will only address VLA missile delivery performance but will not adequately assess torpedo effectiveness and end-to-end weapon performance.

- The Mk 54 program is being guided by requirements set in 1995. While the program is moving ahead with several initiatives, including HAAWC and P3I upgrades, it still lacks the formal requirements documents necessary to guide their development. Firm requirements and program definition are essential before the program can develop adequate acquisition and operational test strategies.
- Because of incomplete operational testing and the Mk 54 torpedo being the Navy's primary surface ship, helicopter, and Maritime Patrol Aircraft ASW weapon, DOT&E placed the Mk 54 torpedo program on DOT&E Oversight in FY08.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY08 Recommendations. The Navy must:
 1. Define the program requirements for the Mk 54 torpedo planned improvements and develop an Acquisition Strategy and an overall test strategy.
 2. Provide the resources to resolve the limitations to test and deficiencies identified in the 2004 Mk 54 Mod 0 Operational Test Report.