

## Mk 54 Lightweight Torpedo

### Executive Summary

- The Navy conducted adequate operational testing of the Mk 54 Vertical Launched Anti-Submarine Rocket (VLA) in 2009.
- The Mk 54 VLA is not operationally effective in its primary mission environment because the ship's Anti-Submarine Warfare (ASW) Combat System cannot effectively target the threat submarine. However, if the threat submarine could be accurately targeted, the VLA method of delivering the Mk 54 torpedo is operationally effective. The Mk 54 VLA is operationally suitable.
- Production of Mk 54 torpedoes continues, but release of the torpedo to the Fleet has been delayed pending compatibility improvements between the weapon and the launch platform's weapons control systems to reduce the torpedo's sensitivity to a stray fire control system voltage.

### System

- The Mk 54 Lightweight Torpedo is the primary 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 VLA for rapid employment by surface ships.



- The High-Altitude Anti-submarine Warfare Weapons Capability (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 Integrated Defense Systems, Tewksbury, Massachusetts

### Activity

- The Navy conducted operational testing of the VLA with an Mk 54 torpedo payload at the Pacific Missile Range Facility in February 2009. An *Arleigh Burke* class guided missile destroyer served as the launch platform for six VLAs. Since Navy safety regulations prevent employment of the VLA against a manned submarine target, the Navy utilized Mk 30 Mobile ASW targets for the operational tests. All six of the missiles flew to the designated aim-point and delivered working Mk 54 torpedoes.
- The Navy's Commander, Operational Test and Evaluation Force (COTF) issued an IOT&E report on the Mk 54 VLA in June 2009 and assessed the Mk 54 VLA as effective

and suitable, but identified that the ship's sensors were not effective in locating and targeting the submarine threat.

- The Navy delayed Fleet release of Mk 54 capability other than Mk 54 VLA pending modifications to mitigate a platform compatibility issue. For all launch platforms, testers discovered a stray voltage in the interface between the torpedo and launch platform's weapon control system that affects torpedo pre-launch settings. Mk 54 torpedo payloads deployed via VLA are not affected.
- To support high-altitude deployment of the Mk 54 torpedo from the new P-8A Maritime Patrol Aircraft, the Navy

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conducted demonstrations of several HAAWC proof of concept prototypes. The program has initiated a competition for the HAAWC design and development.

- On September 12, 2008, COTF identified the lack of a threat-representative set-to-hit target as a severe test resource limitation for evaluating the Mk 54 Mod 0 torpedo. The Navy's testing to evaluate the terminal homing phase of the Mk 54 torpedo attack was pre-maturely terminated in August 2006 when the Weapons Set-to-Hit Torpedo Threat Target surrogate sank. This testing remains incomplete.

## Assessment

- The Mk 54 VLA is not operationally effective in its primary mission environment because the ship's ASW Combat System cannot effectively detect, classify, and target a threat submarine and the Mk 54 torpedo has not demonstrated satisfactory performance. However, if the threat submarine could be accurately targeted, the VLA method of delivering the Mk 54 torpedo is operationally effective. The Mk 54 VLA is operationally suitable.

- The Navy has not completed sufficient operational testing of the Mk 54 torpedo payload to verify its effectiveness. The testing completed so far indicates the Mk 54 torpedo may not be effective in attacking the target.
- DOT&E is preparing a classified OT&E Report expected to be delivered in early FY10.

## Recommendations

- Status of Previous Recommendations. The Navy is making progress in writing requirements for the Mk 54 upgrades but has not implemented the other FY08 recommendation.
- FY09 Recommendations. The Navy should:
  1. Implement the recommendations in the DOT&E OT&E Report and COTF's report.
  2. Investigate the need for improvements to the AN/SQQ-89 ASW Combat System to detect, classify, and target new threat submarines.
  3. Obtain needed set-to-hit target and complete the terminal homing testing of the Mk 54 torpedo.