Mk 54 Lightweight Torpedo Upgrades Including the High Altitude Anti-Submarine Warfare Weapon Capability (HAAWC)

The High Altitude Anti-Submarine Warfare Weapon Capability (HAAWC) is operationally effective, demonstrating the capability to accurately deliver the Mk 54 torpedo, from the P-8A, to the intended entry point, as assigned by the P-8A combat system. The HAAWC is not operationally suitable, and is vulnerable in a cyber-contested environment. The Navy expects HAAWC to enter full-rate production in FY22.

While the Navy completed additional torpedo firings in FY21 to advance Mk 54 Mod 1 torpedo IOT&E objectives, test unit and test range availability may challenge the completion of IOT&E and initial operational capability.

System Description

The Mk 54 lightweight torpedo is the primary anti-submarine weapon employed from U.S. surface ships, aircraft, and helicopters. Surface ships employ the Mk 54 from surface vessel torpedo tubes as a reactionary weapon against very close threat submarines and as a vertically launched anti-submarine rocket (VLA) for offensive attack against threat submarines. The Navy developed the Mk 54 to defeat all types of threat submarines in all ocean environments. When fixed to an Air Launch Accessory (ALA) wing kit, the Mk 54 torpedo can also be released from the P-8A Poseidon from higher altitudes than conventional employment. This Mk 54 – ALA configuration is termed HAAWC. The ALA glides the Mk 54 down to an acceptable altitude and then releases the torpedo to an intended torpedo entry point assigned by the aircraft's combat system.

Program

The Mk 54 is an Acquisition Category III program first fielded in 2004. The Navy has since been developing and delivering incremental modifications of the Mk 54 torpedo variants. In 2007, the Navy upgraded the sonar array for the Mk 54 Mod 1 torpedo variant, as well as the torpedo logic, to provide a clearer picture of the intended target within the undersea environment. The Mk 54 Mod 1 torpedo also incorporates the Advanced Processor Build 5 software that was developed and evaluated within the Mk 48 heavyweight torpedo program. The Navy intends to deliver the Mk 54 Mod 1 torpedo in two increments: the Mk 54 Mod 1 Increment 1 is in test, and the Mk 54 Mod 1 Increment 2 is scheduled to be delivered in FY26 with additional software-driven features. The Navy started the Mk 54 Mod 1 Increment 1 IOT&E in December 2019 with the plan for reaching initial operational capability in 4QFY22. The initial operational capability, scheduled for 4QFY22, is at high risk due to the limited

availability of test assets and range locations required to complete IOT&E. The Navy has not approved the Mk 54 Mod 1 torpedo for use in VLA.

HAAWC entered Milestone C in December 2018. The Navy completed IOT&E in January 2021 in support of the full-rate production decision expected in 2QFY22. The Navy is updating the HAAWC software to address deficiencies identified in IOT&E. The upgraded software, operational flight program (OFP) 3.5, will be evaluated in FOT&E, expected to start in 2QFY22. The Navy intends to deliver the FOT&E Test and Evaluation Master Plan in FY22 for DOT&E approval.

Major Contractors

- Raytheon Integrated Defense Systems – Tewksbury, Massachusetts.
- Progeny Systems Corporation – Manassas, Virginia.
- Boeing Company – St. Charles, Missouri.

Test Adequacy

In FY21, the Navy continued to execute the Mk 54 Mod 1 IOT&E that started in December 2019. In May 2021, the Navy conducted additional Mk 54 Mod 1 Increment 1 torpedo firings needed to advance IOT&E. Testing was conducted in accordance with DOT&E-approved test plans. While the Navy reports challenges to obtaining fleet assets to support operational testing of the Mk 54 Mod 1 torpedo, they still project to complete Mk 54 Mod 1 Increment 1 IOT&E by the end of FY22.

In May 2019, the Navy executed the Mk 54 Mod 1 Cooperative Vulnerability and Penetration Assessment and the Adversarial Assessment in accordance with DOT&E-approved test plans.

In March 2021, the Navy completed HAAWC IOT&E. Testing, conducted in accordance with DOT&E-approved test plans, was adequate to determine HAAWC operational effectiveness, suitability, and survivability.

Performance

Effectiveness

Not enough data are yet available to provide a preliminary assessment of the Mk 54 Mod 1 torpedo operational effectiveness to intercept threat submarines.

The HAAWC is operationally effective. HAAWC has demonstrated the capability to accurately deliver the Mk 54 torpedo to the intended entry point, as assigned by the P-8A combat system. The Navy restricted HAAWC release to a temporary threshold due to performance limitations below this altitude, precluding the assessment of the HAAWC release at the Navy's minimum altitude requirement for HAAWC. The Navy also restricted the release airspeed to a temporary threshold, precluding the assessment of HAAWC at the maximum calibrated airspeed within the intended operating envelope for HAAWC release. While the Navy cannot employ the HAAWC from the full range of intended release altitudes, the available range of release altitudes provide an enhanced operational capability. Details are summarized in the classified HAAWC IOT&E report published in July 2021.

Suitability

Preliminary assessment thus far has not highlighted any significant risks to the Mk 54 Mod 1 meeting operational suitability requirements.

The HAAWC is not suitable due to a demonstrated ALA reliability issue. The Navy completed the root cause analyses and implemented OFP 3.5 fixes intended to improve ALA reliability. These fixes will be verified in the HAAWC FOT&E scheduled for FY22.

Survivability

Mk 54 Mod 1 is vulnerable in a cyber-contested environment. The specific vulnerabilities and their effect on warfighting capability will be detailed in the Mk 54 Mod 1 IOT&E report intended to support the initial operational capability decision.

HAAWC is vulnerable in a cyber-contested environment. The specific vulnerabilities and their effect on warfighting capability are detailed in the

classified HAAWC IOT&E report published in July 2021.

Recommendations

The Navy should:

1. Secure the test assets and test ranges required to complete IOT&E of Mk 54 Mod 1 Increment 1 and mitigate the risk to declaring initial operational capability scheduled for 4QFY22.
2. Address all recommendations outlined in the classified HAAWC IOT&E report.
3. Provide the HAAWC Test and Evaluation Master Plan for DOT&E approval prior to OFP 3.5 FOT&E.