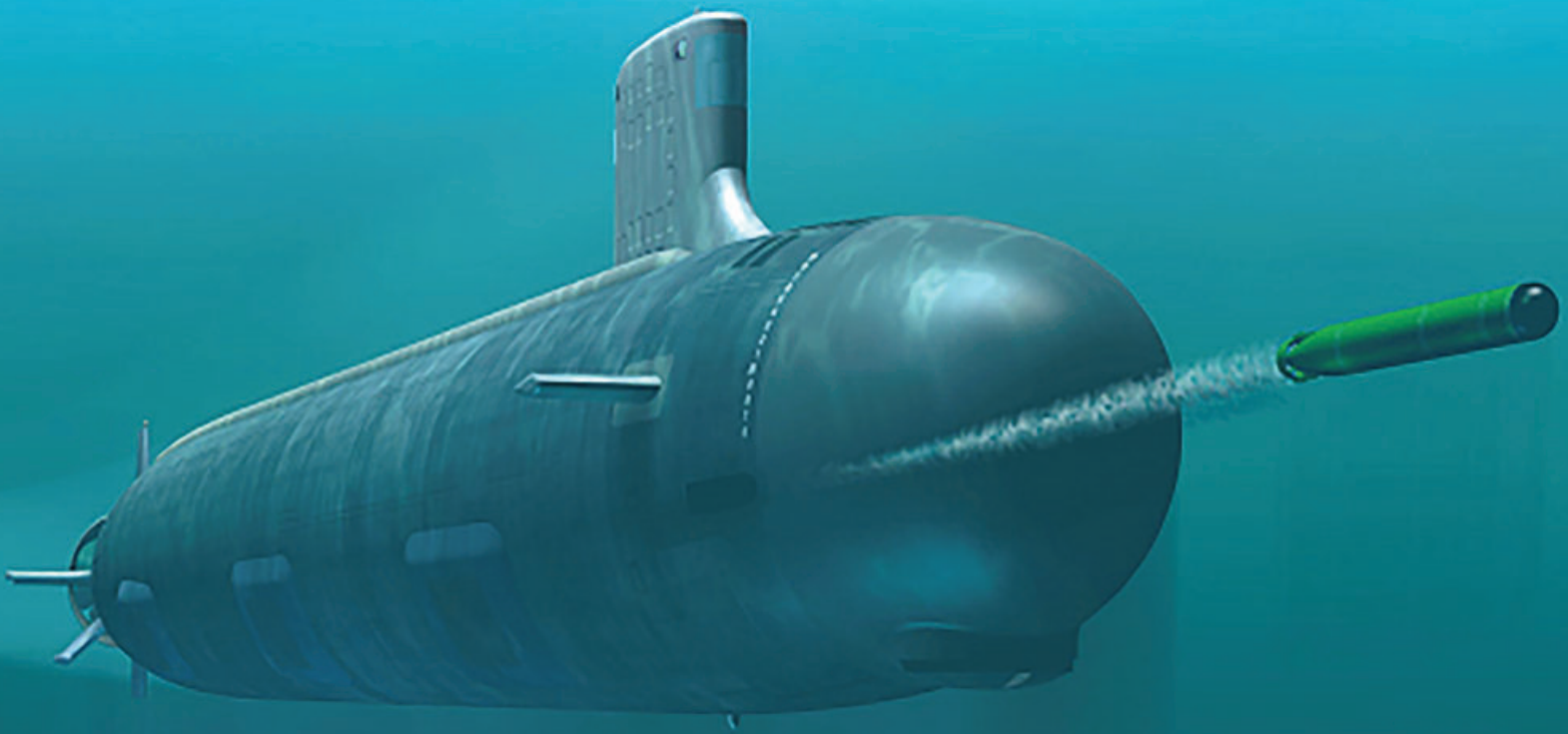


Mk 48 Torpedo Modifications



With DOT&E concurrence, the Navy concluded Mk 48 Mod 7 torpedo Advanced Processor Build (APB) 5 IOT&E in September 2021. DOT&E submitted a classified IOT&E report to Congress in April 2022, finding the Mk 48 Mod 7 APB 5 demonstrated operational effectiveness and suitability. However, some test scenarios were deferred until more representative threat surrogates are available and to reprioritize existing resources to accelerate testing of APB 5-Plus (5+). The cyber survivability of the APB 5 torpedo is classified and addressed in the April 2022 IOT&E report.

In January 2022, the Navy commenced in-water testing of APB 5+. The Navy expects to complete FOT&E of APB 5+ in 1QFY23.

SYSTEM DESCRIPTION

The Mk 48 is a submarine-launched heavyweight torpedo that directs itself towards a target submarine or surface ship based on an operator-developed targeting solution. The Mk 48 uses organic sensors to detect, classify, localize, and close its target.

The Navy intends the latest fielded improvement of the Mk 48 torpedo, APB 5, to improve the torpedo's ability to detect and classify threat submarines and surface ships. A follow-on improvement, APB 5+, transfers targeting functions from the submarine combat system to the torpedo itself, provides the torpedo with higher data exchange rates, and improves operator interface with the torpedo. The next major improvement, APB 6, will deliver capability improvement through software modifications on the Mk 48 Mod 7, and then incorporate Mk 48 Mod 8 hardware improvements that include an upgraded sonar array designed to expand the torpedo's acoustic frequency range and improve spatial resolution.

MISSION

The Submarine Force employs the Mk 48 torpedo to destroy threat submarines and surface ships in all ocean environments.

PROGRAM

The Navy fielded the earliest version of the Mk 48 heavyweight torpedo in 1972. The Navy's latest torpedo improvement program, the Mk 48 Mod 7 torpedo variant, is an Acquisition Category III program and a shared development effort with the Royal Australian Navy. APB 5 is primarily software development with minor hardware updates. DOT&E approved the APB 5 Test and Evaluation Master Plan in November 2017.

In September 2021, the Navy ended test for IOT&E of Mk 48 Mod 7 APB 5. DOT&E submitted a classified IOT&E report in April 2022.

In 2020, the Navy started developmental testing of APB 5+. In December 2021, the Navy determined APB 5+ was ready for operational test. In January 2022, DOT&E approved an APB 5+ update to the APB 5 Test and Evaluation Master Plan, with the test strategy and test resource plan for the evaluation of APB 5+ in FOT&E. The Navy expects to complete FOT&E in 1QFY23.

» MAJOR CONTRACTORS

- Lockheed Martin Sippican Inc. – Marion, Massachusetts
- Lockheed Martin – Syracuse, New York
- Science Applications International Corp. – Reston, Virginia

TEST ADEQUACY

Mk 48 Mod 7 APB 5 testing was adequate to assess operational effectiveness (in most but not all mission environments), suitability, and survivability. No test events occurred in FY22. In September 2021, DOT&E agreed with the Navy to defer some planned APB 5 testing to either APB 5+ or the future APB 6 program, due to unavailability of a representative threat surrogate or to enable test resources to support the timely delivery of the APB 5+ capability. As a result, APB 5 test data were insufficient to assess the torpedo's effectiveness against submarines evading with certain countermeasures and submarines operating in acoustically challenging environments. The Navy executed APB 5 test events in accordance with DOT&E-approved test plans; DOT&E observed some, but not all, test events due to space limitations on the firing platforms.

In November 2020 and March 2021, the Navy conducted APB 5+ modeling and simulation testing that included fleet operators on representative combat systems. Testing was adequate to characterize the APB 5+ operational interface improvements. The Navy further intends to use modeling and simulation testing at the Environment Centric Weapon Analysis Facility (ECWAF) to validate that APB 5+ modifications do not degrade its effectiveness in comparison to APB 5.

Between January 2022 and February 2022, the Navy

completed one dedicated test event and collected data from one fleet training event to support operational test requirements for APB 5+. These included five anti-submarine warfare scenarios and 12 anti-surface warfare scenarios. The Navy executed APB 5+ test events in accordance with DOT&E-approved test plans; DOT&E observed some, but not all, test events due to space limitations on the firing platforms. The Navy expects to conduct the remaining seven anti-submarine warfare scenarios by the end of 1QFY23. APB 5+ will not be assessed for cyber survivability, as it has no modifications with the potential to impact cybersecurity.

Test adequacy of future APBs depends on representative threats and threat capability surrogates. The Navy is pursuing improved capabilities in this area.

The deferral of test events within some test environments in the APB 5 IOT&E reduces live data available to validate the ECWAF for use in future APB 6 IOT&E. Prior to APB 6 IOT&E, the Navy will need to collect data from fleet events conducted in these environments to validate and accredit the ECWAF for its full use. The full use of the ECWAF will reduce live tests in APB 6 by approximately half of those planned for APB 5 IOT&E.

PERFORMANCE

» EFFECTIVENESS

Although the program did not complete testing, DOT&E was

able to determine that APB 5 is operationally effective and provides a significant improvement in the capability to destroy surface ships. APB 5 demonstrated similar or improved performance in anti-submarine warfare scenarios. Classified details are in the April 2022 IOT&E report.

Preliminary analysis suggests that APB 5+ is operationally effective. Test events to date have demonstrated that APB 5+ simplifies operator control of the torpedo, and modeling and simulation showed torpedo effectiveness of APB 5+ to be equivalent to that of APB 5. DOT&E expects to submit an FOT&E report in FY23 after the Navy completes testing.

» SUITABILITY

APB 5 is operationally suitable, demonstrating operationally sufficient reliability, availability, and maintainability.

Preliminary data suggest that APB 5+ is trending toward meeting its suitability requirements. DOT&E expects to submit an FOT&E report in FY23 after the Navy completes testing.

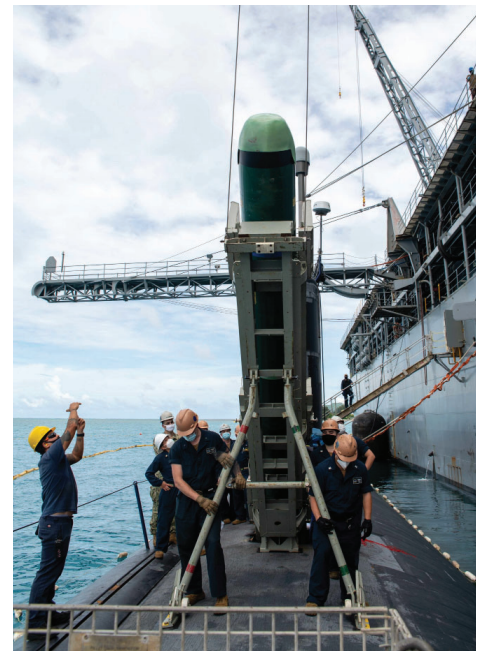
» SURVIVABILITY

The APB 5 cyber survivability assessment is classified. Details are in the April 2022 IOT&E report. APB 5+ will not receive a separate cyber survivability assessment, because its modifications do not affect cybersecurity.

RECOMMENDATIONS

The Navy should:

1. Address all recommendations in the April 2022 IOT&E report.
2. Obtain performance data from test environments deferred in APB 5 IOT&E to support validation of the ECWAF and its use in APB 6 IOT&E.
3. Complete development and validation of surface ship models and reverberation models in the ECWAF and validate their use in APB 6 IOT&E.
4. Fund continued improvements in representative threats and threat capability surrogates.



Mk 48 onload on USS Hampton (SSN 767), October 2021