Air Warfare (AW) Ship Self-Defense Enterprise

Air Warfare Ship Self-Defense components include, from left to right: Close-in Weapons System, Rolling Airframe Missile, and Evolved Sea Sparrow Missile

In FY22, the Navy commenced development of a next-generation Air Warfare (AW) Ship Self-Defense Enterprise Test and Evaluation Master Plan (TEMP) for the determination of the ship self-defense capability of PCU *John F. Kennedy* (CVN 79), USS *Bougainville* (LHA 8), and USS *Harrisburg* (LPD 30) against threat anti-ship cruise missiles (ASCMs). DOT&E and the Navy have not yet agreed on the required test resources for adequate test. Further, the Navy has yet to complete tests in the original Enterprise TEMP (2008) for littoral combat ships (LCS) and USS *Gerald R. Ford* (CVN 78).

SYSTEM DESCRIPTION

The AW Ship Self-Defense Enterprise is a Navy test strategy to assess the Probability of Raid Annihilation (PRA) requirements for several ship classes (mostly aircraft carriers and amphibious ships). The system under test is the combat system that enables the ship to execute self-defense against ASCMs. The combat systems aboard ships are a system-of-systems, including: 1) interacting combat systems elements with continuously evolving software; 2) radars for target detection; 3) target trackers; 4) an electronic warfare system; 5) a command and control system that integrates input from the sensors and trackers to calculate engagement options; 6) interceptor missiles; and 7) guns.

The systems that contribute to the PRA are:

- SPQ-9B horizon search radar;
- SPS-48 and SPS-49 air search radars;
- SPY-6(V)2 and SPY-6(V)3 Enterprise Air Surveillance Radars;
- Mk 9 Tracker Illuminator System;
- SLQ-32 electronic warfare system;
- SPY-3 Multi-Function Radar;
- SPY-4 Volume Search Radar;
- SeaRAM Ship Defense System;
- Cooperative Engagement Capability;
- Rolling Airframe Missile Block 2, 2A, and 2B;

- Evolved Sea Sparrow Missile (ESSM) Block 1 and 2;
- Close-In Weapon System; and
- Ship Self-Defense System (SSDS) Mk 2 Baseline 10 and Baseline 12.

The Navy has two AW Ship Self-Defense Enterprise T&E programs. The original AW Ship Self-Defense Enterprise TEMP from 2008 covers LCSs, *America*-class (LHA 6-class) amphibious assault ships, USS *Zumwalt*-class (DDG 1000-class) destroyers, and the USS *Gerald R. Ford* (CVN 78). The new, or next-generation, AW Ship Self-Defense Enterprise TEMP covers CVN 78-class with CVN 79 modifications, second flight LHA 6-class, second flight LPD 17-class, and back-fit of SSDS Mk 2 Baseline 12 on existing ships in the fleet. Ship self-defense testing of the USS *Zumwalt* transitioned to the PMS 500 Program Office and is reported within the DDG 1000 entry of this Annual Report.

MISSION

The Navy depends on the integrated combat system to enable the crews of the ships to defend themselves against threat ASCMs. The goal of the AW Ship Self-Defense Enterprise program is to quantify the PRA that the ships can achieve against raids of ASCMs. Because of the high cost, as well as safety risk, of live test events against ASCM surrogates, the Navy cannot cover the operational space of threat ASCMs and scenarios in live test events alone. The Navy strategy depends upon limited live testing against threat ASCM surrogates to demonstrate a limited capability and then to validate modeling and simulation (M&S) used to quantify performance with statistical confidence and to expand the tested operational space.

PROGRAM

In 2005, the Navy started the AW Ship Self-Defense Enterprise T&E program to leverage testing across multiple ships and combat system element-level test programs, and reduce the overall resources needed to evaluate PRA and program specific test requirements. In 2008, the Navy formalized the strategy in the AW Ship Self-Defense Enterprise TEMP. In July 2021, a Naval Capabilities Board approved the continuance of an Enterprise test strategy for follow-on capability, including that of the CVN 79, LHA 8, and LPD 30. The Navy expects to deliver a TEMP for DOT&E approval in FY23.

» MAJOR CONTRACTORS

- SSDS: Lockheed Martin, Rotary and Mission Systems – Moorestown, New Jersey
- SPY-3: Raytheon Integrated Defense Systems – Tewksbury, Massachusetts
- SPY-4: Lockheed Martin – Moorestown, New Jersey
- SPY-6: Raytheon Missiles & Defense – Marlborough, Massachusetts
- Rolling Airframe Missile and ESSM: Raytheon Missiles and Defense – Tucson, Arizona
- Cooperative Engagement Capability: Raytheon Co. – Largo, Florida
- SLQ-32 with SEWIP Block 1: General Dynamics Mission Systems – Fairfax, Virginia
- SLQ-32 with SEWIP Block 2: Lockheed Martin Corp., Rotary Mission Systems – Liverpool, New York

TEST ADEQUACY

The program's test strategy uses a three-phase approach for both the 2008 Enterprise and the next-generation Enterprise:

- Phase 1: Live missile firings of ASCM surrogates against a self-defense test ship (SDTS) configured with the integrated combat system of the ship under test.
- Phase 2: Live missile firings of ASCM surrogates against the ship under test (primarily the lead ship of a ship class).
- Phase 3: M&S runs in the Enterprise test bed against ASCM threat models.

2008 Enterprise:

In FY22, the Navy conducted no operational test of self-defense capability of LCS against ASCMs. Both *Independence*-class and *Freedom*-class ships have deployed without operational test of this capability.

In FY22, the Navy conducted no operational test of the self-defense capability of CVN 78 against ASCMs. The Navy plans to conduct live fire missile against the lead

ship (phase 2) and M&S runs (phase 3) necessary to evaluate the operational effectiveness and suitability of the integrated combat system of the CVN 78 in FY24. However, the Navy must complete development and validation of the intended M&S suite to support the phase 3 testing.

Next-generation Enterprise:

In FY22, the Navy started development of the next-generation AW Ship Self-Defense Enterprise TEMP to determine an overarching test strategy and test resources to assess the self-defense capability of CVN 79, LHA 8 and LPD 17 Flight II ships against threat ASCMs. DOT&E and the Navy have not yet agreed on required test resources for adequate test.

The Navy may not have a sufficient excess of ESSM Block 1 missiles in fleet inventory to support operational testing of CVN 79 and LHA 8. These missiles, required for combat system testing in FY25 and beyond, are no longer in production. The Navy acknowledges the ESSM limitation and intends to work with DOT&E to overcome this limitation and maintain an adequate test.

The Navy scheduled repairs to the existing SDTS (e.g., former USS *Paul F. Foster*) in FY24. The availability of an unmanned test capability will be required to execute the test strategy.

PERFORMANCE

» EFFECTIVENESS, SUITABILITY, AND SURVIVABILITY

Performance evaluations of ships covered by the 2008 Enterprise are included in the SSDS and ship class articles of this Annual Report. Effectiveness, suitability, and survivability of ships covered by the 2008 Enterprise are included in the SSDS and ship class articles of this Annual Report.

No data are available yet to assess ships covered by the next-generation AW Ship Self-Defense Enterprise.

Cyber survivability is reported within ship-class and SSDS program articles of this Annual Report.

RECOMMENDATIONS

The Navy should:

1. Address all recommendations for ship self-defense testing against threat ASCMs provided in the SSDS and ship class articles of this Annual Report, which include the development and validation of the M&S suite for CVN 78 testing.
2. Monitor funding and execution of SDTS repairs to ensure its readiness to support integrated combat system testing of CVN 79, LHA 8 and LPD 17 Flight II ships.
3. Evaluate options for adequate test should excess ESSM Block 1 missiles in fleet inventory be insufficient to support operational test.
4. Monitor the development and test of the elements of the integrated combat system elements. If needed, take actions to ensure their availability to support the AW Ship Self-Defense Enterprise test strategy.