# Ship Self-Defense System (SSDS) Mk 2 Integrated Combat Systems



Clockwise from top left: SSDS Mk 2 Mod 3 on LHD 8; Mod 6 on CVN 78; Mod 5 on LSD 51; Mod 2 on LPD 20; Mod 4 on LHA 6; and Mod 1 on CVN 68

Between February and March 2024, the Navy's Operational Test and Evaluation Force (OPTEVFOR) conducted cyber survivability testing of Mod 6 of the Ship Self-Defense System (SSDS) Mk 2 Baseline 10 aboard USS *Gerald R. Ford* (CVN 78). OPTEVFOR expects to complete cyber survivability evaluation and continue operational test of Mod 6 with at-sea tests for cyber survivability and a live fire demonstration against anti-ship cruise missile (ASCM) targets aboard CVN 78 in FY25. The Navy did not conduct the remaining operational tests for Mod 5 of SSDS Mk 2 Baseline 10 in FY24. The Navy continued development of SSDS Mk 2 Baseline 12 in FY24 and expects to commence operational test in FY27.

## SYSTEM DESCRIPTION

SSDS Mk 2 is the command and control system aboard amphibious ships and aircraft carriers. It comprises a local area network with processors that host tactical programs, and interfaces to external systems. SSDS Mk 2 integrates the following systems: horizon search radars (i.e., SPQ-9B and SPY-3), volume search radars (i.e., SPS-48, SPS-49, SPY-4, and SPY-6), MK 9 tracker illuminator system for Evolved Sea Sparrow Missile (ESSM), SLQ-32 electronic warfare system, Cooperative Engagement Capability (CEC) sensor fusion and netting system, ESSM and Rolling Airframe Missile (RAM) launchers, and Close-In Weapon System 20mm Gatling gun. SSDS includes operator workstations that display realtime tactical information.

SSDS Mk 2 has six variants referred to as mods. Each mod represents the integration of a unique set of sensors and self-defense weapon systems for a specific ship class.

- 1. Mod 1 on *Nimitz*-class aircraft carriers (CVN 68 class)
- 2. Mod 2 on *San Antonio*-class amphibious transport dock ships (LPD 17 class)
- Mod 3 on Wasp-class landing helicopter dock ships (LHD 1 class)
- 4. Mod 4 on *America*-class landing helicopter assault ships (LHA 6 class)

- Mod 5 on Whidbey Islandclass and Harpers Ferry-class dock landing ships (LSD 41 and LSD 49 classes)
- 6. Mod 6 on *Ford*-class aircraft carriers (CVN 78 class)

SSDS Mk 2 capability improvements are delivered via software and hardware baselines within each mod. Individual ships in a class may have different SSDS software and hardware baselines, but they have the same SSDS mod. Most SSDS-based ships have baselines up to and including SSDS Mk 2 Baseline 10. The Navy is developing SSDS Mk 2 Baseline 12, which includes major changes to engagement doctrine and weapon scheduling algorithms intended to improve ship survivability.

# MISSION

Navy commanders use SSDS Mk 2 for timely engagement of ASCM threats, aircraft, and unmanned aerial vehicles to defend their ships. Moreover, SSDS Mk 2 contributes to the commander's tactical picture during air, surface, amphibious, and undersea warfare missions by combining participating units' sensor data into a real-time composite target track picture of the battlespace.

## PROGRAM

SSDS Mk 1 achieved Milestone C in 1998. In 2005, the Navy transitioned to SSDS Mk 2. SSDS Mk 2 is an Acquisition Category IC program. The Navy completed testing of the Mods 2, 3, and 4 of SSDS Mk 2 prior to May 2018, when DOT&E approved Revision C of the SSDS Mk 2 TEMP. That revision included operational tests of Mod 1 of SSDS Mk 2 (an untested capability demonstrating force-level interoperability), Mod 5 of SSDS Mk 2 Baseline 10 on LSD 41 and LSD 49 classes, and Mod 6 of SSDS Mk 2 Baseline 10 on CVN 78.

The Navy continues to develop the Air Warfare Ship Self-Defense Enterprise TEMP 1910, which also serves as the SSDS Mk 2 Baseline 12 TEMP for all mods, except Mod 5, which the Navy currently does not have identified for upgrade to Baseline 12. The Navy plans to start operational testing of SSDS Mk 2 Baseline 12 in FY27 using the Navy's Self-Defense Test Ship.

### » MAJOR CONTRACTORS

- Lockheed Martin Corporation
  Bethesda, Maryland
- Raytheon, a subsidiary of RTX – Arlington, Virginia

# **TEST ADEQUACY**

Between February and March 2024, OPTEVFOR conducted cyber survivability testing of Mod 6 of SSDS Mk 2 Baseline 10 aboard USS *Gerald R. Ford* (CVN 78), in accordance with a DOT&Eapproved test plan and with DOT&E observation. The test occurred with CVN 78 pierside and was informed by results from the land-based test site evaluation detailed in the FY23 Annual Report. OPTEVFOR intends to complete cyber survivability testing of Mod 6 of SSDS Mk 2 Baseline 10 from the CVN 78 when it is underway in FY25.

The Navy conducted no additional operational test of SSDS Mk 2 Baseline 10 in FY24. The demonstration of force-level interoperability that had been planned in conjunction with Mod 1 of SSDS Mk 2 testing will instead be conducted with Mod 6 of SSDS Mk 2 Baseline 12, per the drafted TEMP 1910. DOT&E concurs that the intent of this test can be met with Mod 6. Remaining operational test requirements for SSDS Mk 2 Baseline 10 include:

- Mod 5 Eight of nine test events outlined in the 2018 SSDS TEMP have yet to be conducted. The Navy has not scheduled this testing.
- Mod 6 DOT&E agreed to a reduction of live fire test events aboard CVN 78 against ASCM targets, due to changes in employment of the ship's defense missiles that combined with test restrictions - prevent collecting some originally intended data. The Navy expects to complete the remaining shipboard test events in FY25. Adequate evaluation of the Mod 6 capability requires runs from the CVN 78 Probability of Raid Annihilation modeling and simulation (M&S) test bed. The Navy requires live fire test events from CVN 78 in FY25 to complete verification, validation, and accreditation (VV&A) of the test bed. Furthermore, 10 live fire test events in the DDG

1000 Zumwalt-class IOT&E Strategy that were intended to support VV&A of the AN/ SPY-3 radar performance modeled in the CVN 78 test bed cannot be used due to modifications made to the DDG 1000 AN/SPY-3 radar system that no longer make it representative for Mod 6 performance evaluation. The loss of these data may prevent a complete determination of the operational effectiveness of the Mod 6 self-defense capability against ASCMs.

In December 2023 and March 2024, the Navy conducted two land-based developmental test (LBDT) events of SSDS Mk 2 Baseline 12 in the Mod 6 and Mod 4 configurations at the Surface Combat Systems Center in Wallops Island, Virginia. The Navy intends to conduct seabased developmental test of SSDS Mk 2 Baseline 12 in the Mod 2 configuration on USS Richard M. McCool Jr. (LPD 29) in early FY25 and commence operational testing of the SSDS Mk 2 Baseline 12 in FY27.

## PERFORMANCE

#### » EFFECTIVENESS AND SUITABILITY

No data were collected in FY24 that would change previously provided assessment of operational effectiveness and suitability for Mods 1 and 5 of SSDS Mk 2 Baseline 10. Insufficient data are available to determine the operational effectiveness of Mod 6 of SSDS Mk 2 Baseline 10 against ASCMs, or change preliminary assessments detailed in the classified USS *Gerald R. Ford* (CVN 78) reports of April 2022 and April 2023. DOT&E will report operational effectiveness and suitability of Mod 6 of SSDS Mk 2 Baseline 10 after completion of IOT&E that the Navy expects to occur in FY26.

SSDS Mk 2 Baseline 12 remains in development, so no assessment of operational effectiveness and suitability can be made.

#### » SURVIVABILITY

No data were collected in FY24 that would change previously provided assessment of survivability for Mods 1 and 5 of SSDS Mk 2 Baseline 10.

Insufficient data are available to assess cyber survivability of Mod 6 of SSDS Mk 2 Baseline 10 on CVN 78. DOT&E will address Mod 6 of SSDS Mk 2 Baseline 10 cyber survivability in a CVN 78 report, after completion of at-sea evaluation that the Navy expects to occur in FY25.

SSDS Mk 2 Baseline 12 remains in development, so no assessment of cyber survivability can be made.

# RECOMMENDATIONS

As recommended in the FY23 Annual Report, the Navy should:

 Address all recommendations for Mod 6 of SSDS Mk 2 Baseline 10 performance in the classified USS *Gerald R. Ford* (CVN 78) reports of April 2022 and April 2023.

 Complete Mod 5 of SSDS Mk 2 Baseline 10 testing to characterize ship selfdefense performance of LSD 49 ship class.

Additionally, the Navy should:

- Complete remaining anti-air warfare testing aboard CVN 78 to support demonstration of capability of Mod 6 of SSDS Mk 2 Baseline 10 against surrogate threat ASCMs.
- Complete development and VV&A of the CVN 78 Probability of Raid Annihilation M&S suite in FY25, to support assessment of Mod 6 of the SSDS Mk 2 Baseline 10.
- Complete development of and submit to DOT&E for approval in FY25, the Air Warfare Ship Self-Defense Enterprise TEMP 1910 for operational testing of SSDS Mk 3 Baseline 12 including a force-level interoperability test for Mod 6.
- Complete an at-sea cyber survivability evaluation onboard CVN 78 in FY25 to assess Mod 6 of SSDS Mk 2 Baseline 10 resilience to cyber-attack.
- Validate with operational testing the correction of Mods 1 and 3 of SSDS Mk 2 Baseline 10 integration issues discussed in the FY22 Annual Report.