

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



In July 2022, the Navy conducted an operational test of the Ship Self-Defense System (SSDS) Mk 2 Baseline 10 of the Mod 6 variant for USS *Gerald R. Ford* (CVN 78), assessing SSDS's tracking capability against fast inshore attack craft and unmanned aerial vehicles (UAVs). In FY22, the Navy conducted no testing of the SSDS Mk 2 Mod 6 self-defense capability against anti-ship cruise missiles (ASCMs), and no operational test on SSDS Mk 2 Mod 1 through Mod 5.

SYSTEM DESCRIPTION

SSDS 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 integrates the following systems: horizon search radars (i.e., SPQ-9B and SPY-3), volume search radars (i.e., SPS-48, SPS-49, and SPY-4), close-in weapon system, MK 9 tracker illuminator system, SLQ-32 electronic warfare system, cooperative engagement capability, Evolved Sea Sparrow Missiles, and Rolling Airframe Missiles. SSDS includes operator workstations that display real-time 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. Individual ships in a class may have different SSDS baselines, but will be the same mod.

- Mod 1 on *Nimitz*-class aircraft carriers (CVN 68-class)
- 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)
- Mod 4 on *America*-class landing helicopter assault ships (LHA 6-class)
- Mod 5 on *Whidbey Island*-class and *Harpers Ferry*-

class landing dock ships (LSD 41/49-classes)

- Mod 6 on *Gerald R. Ford*-class aircraft carriers (CVN 78-class)

SSDS Mk 2 capability improvements derive from software baselines that are integrated within the mod. On commissioned ships, there are different SSDS baselines, up to Baseline 10. The Navy is developing Baseline 12 that integrates new sensors and weapons, and includes major changes to engagement doctrine and weapon scheduling algorithms that the Navy intends to improve ship survivability.

MISSION

Navy commanders depend on SSDS to effectively integrate their ship's sensors and weapon systems and enable timely engagement of the diverse spectrum of air threats to the ship. The integrated SSDS combat system provides the ship self-defense capability against ASCMs and threat aircraft. Further, SSDS contributes to the commander's tactical picture during air, surface, amphibious, and undersea warfare missions.

PROGRAM

SSDS Mk 1 achieved Milestone C in 1998. In 2005, the Navy transitioned to SSDS Mk 2 and was designated as an Acquisition Category IC program. In May 2018, DOT&E approved Revision C of the SSDS Mk 2 Test and

Evaluation Master Plan (TEMP), which included operational test of SSDS Mk 2 Mod 4 with Baseline 9 on LHA 6-class, Mod 5 with Baseline 9 on LSD 41/49, and SSDS Mk 2 Mod 6 with Baseline 10 on CVN 78. The Navy plans to conduct FOT&E of each SSDS Mk 2 Mod and baseline combination.

The Navy completed operational test on SSDS Mk 2 Mod 4 in 2017 during the IOT&E of *USS America* (LHA 6). The Navy has been in test on SSDS Mk 2 Mod 5 since 2016 and SSDS Mk 2 Mod 6 since 2019.

The Navy is developing an Air Warfare (AW) Ship Self-Defense Enterprise TEMP that includes follow-on testing of SSDS Mk 2. Testing will assess performance of updates to SSDS Mk 2 Mods to address significant changes to the ship class systems and will include SSDS Mk 2 Mod 4 with Baseline 12 on *USS Bougainville* (LHA 8), SSDS Mk 2 Mod 2 with Baseline 12 on *USS Harrisburg* (LPD 30), and SSDS Mk 2 Mod 6 with Baseline 12 on *USS John F. Kennedy* (CVN 79). Testing will also address the back-fit of Baseline 12 on existing ships.

» MAJOR CONTRACTOR

- Lockheed Martin, Rotary and Mission Systems – Moorestown, New Jersey

TEST ADEQUACY

In July 2022, the Navy continued evaluation of SSDS Mk 2 Mod 6 with test events on *USS Gerald R. Ford* (CVN 78), that evaluated performance to track surface

targets and UAVs. DOT&E observed the tests and they were conducted with some deviation from the DOT&E-approved test plan due to surface target failures.

In FY22, the Navy conducted no additional testing of the SSDS Mk 2 Mod 6 self-defense capability against ASCMs. DOT&E submitted a classified report in April 2022 that detailed system performance from completed test events, specifically three live operational firing test events against the Self Defense Test Ship (SDTS) configured with a representation of SSDS Mk 2 Mod 6. The Navy has funded and plans to conduct OT firing and tracking ASCM events on USS *Gerald R. Ford* (CVN 78) in FY24.

There may not be enough data available to determine the operational effectiveness and suitability of the SSDS Mk 2 Mod 6 self-defense capability against ASCMs at the completion of IOT&E. The Navy will not complete the remaining planned firing events against the SDTS configured with a representation of SSDS Mk 2 Mod 6 due to there being no AN/SPY-3 radar set available to install on the SDTS. Additionally, the Navy planned to use data from live operational firing events from the USS *Zumwalt* (DDG 1000) IOT&E, but modifications to the DDG 1000 AN/SPY-3 radar no longer support the use of the DDG 1000 test data for validation of the Probability of Raid Annihilation (PRA) test bed. The PRA test bed is the high fidelity model and simulation the Navy intends to

provide the remainder of the SSDS Mk 2 Mod 6 performance data.

The Navy has yet to schedule the planned cooperative vulnerability and penetration assessment and adversarial assessment to determine survivability of SSDS Mk 2 Mod 6 against cyber threats.

In FY22, the Navy conducted no tests on SSDS Mk 2 Mod 1 (*Nimitz*-class) or Mk 2 Mod 5 (*Whidbey Island*-class and *Harpers Ferry*-class), as a result of funding shortfalls, prioritization of remaining funding to conduct CVN 78 operational test on the SDTS, and Strike Group availability. The Navy has yet to execute any of the SSDS Mk 2 Mod 1 testing or eight of the nine test events for SSDS Mk 2 Mod 5 that are planned in Revision C of the May 2018 DOT&E-approved TEMP.

SSDS Mk 2 Mod 1 test data are insufficient to determine operational effectiveness with respect to force level interoperability, command and control, and weapons control functionality, when integrated into a Strike Group environment. The Navy intends to capture interoperability, command and control and weapons control functionality operational test requirements for SSDS Mk 2 Mod 1 in Enterprise TEMP 1910 for SSDS Baseline 12.

SSDS Mk 2 Mod 5 test data are inadequate to determine effectiveness and suitability. The Navy has deployed these ships since 2016.

PERFORMANCE

» EFFECTIVENESS

SSDS Mods 1 and 3 with Baseline 10 exhibit deficiencies related to the integration of an upgraded Mk 9 tracker illuminator system. The Navy deploys these ships with mitigations applied against these deficiencies, but the mitigations are not validated with operational testing.

No data were collected in FY22 that would change previously provided assessment of effectiveness for SSDS Mk 2 Mod 4 and SSDS Mk 2 Mod 5.

Insufficient data are available to determine operational effectiveness of SSDS Mk 2 Mod 6. Classified observations of self-defense capability against ASCM surrogates using the SDTS are provided in the USS *Gerald R. Ford* (CVN 78) – AW Self-Defense Interim Assessment report submitted in April 2022. No preliminary assessment of the SSDS Mk 2 Mod 6 tracking capability of small boats and UAVs from the July 2022 event is available; analysis is in progress.

» SUITABILITY AND SURVIVABILITY

No data were collected in FY22 that would change previously provided assessment of suitability and survivability for SSDS Mk 2 Mod 1 through SSDS Mk 2 Mod 5.

Insufficient data are available to determine the operational suitability of SSDS Mk 2 Mod 6.

RECOMMENDATIONS

The Navy should:

1. Fund and execute all planned testing of the SSDS Mk 2 Mod 6 capability to provide CVN 78 with self-defense against ASCMs.
2. Develop, validate, and accredit the PRA M&S test bed to support its intended use during operational assessment of SSDS Mk 2 Mod 6 in FY24.
3. Address all recommendations in the April 2022 classified report for CVN 78 on ship self-defense against ASCMs.
4. Validate with operational testing the correction of SSDS Mk 2 Mod 1 and 3 with Baseline 10 integration issues with upgraded Mk 9 tracker illuminator system.
5. Submit the AW Ship Self-Defense Enterprise TEMP for DOT&E approval in FY23.
6. Complete SSDS Mk 2 Mod 5 testing to characterize ship self-defense performance of LSD 41/49 ship classes.