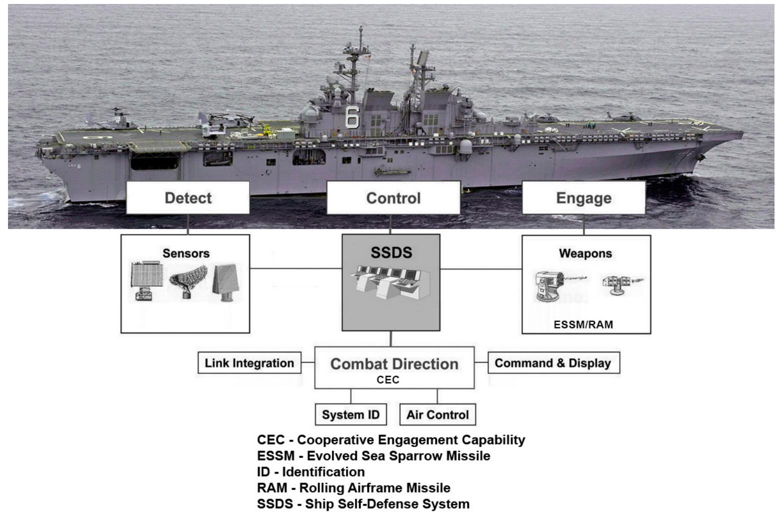
Ship Self-Defense for LHA 6



Executive Summary

- The Navy's Operational Test and Evaluation Force (OPTEVFOR) conducted tracking exercises with low altitude aerial targets and surface targets on USS *America* (LHA 6) from January to February 2017. Test results identified system integration and training deficiencies.
- OPTEVFOR completed the cybersecurity IOT&E test phase in March 2017. The test results are classified.
- OPTEVFOR commenced the Probability of Raid Annihilation (PRA) Modeling and Simulation test bed phase of IOT&E in March 2017. Completion of this test phase is expected in December 2017.

System

- Ship self-defense for LHA 6 is addressed by several legacy combat system elements (including the primary self-defense radars AN-SPS-49A(V)1, AN/SPS-48E(V)10, AN/SPS-73, AN/SPQ-9B, and the NULKA Active Electronic Decoy) and five acquisition programs:
  - Ship Self-Defense System (SSDS)
  - Rolling Airframe Missile (RAM)
  - Evolved Seasparrow Missile (ESSM)
  - Cooperative Engagement Capability (CEC)
  - Surface Electronic Warfare Improvement Program (SEWIP)

SSDS

- SSDS is a local area network that uses open computer architecture and standard Navy displays to integrate a surface ship's sensors and weapons systems to provide an automated detect-track-engage sequence for ship self-defense.
- SSDS MK 1 is the legacy command and control system for LSD 41/49-class ships.
- SSDS MK 2 has six variants:
  - Mod 1, used in *Nimitz* (CVN 68)-class aircraft carriers
  - Mod 2, used in *San Antonio* (LPD 17)-class amphibious ships
  - Mod 3, used in *Iwo Jima* (LHD 7)-class and *Makin Island* (LHD 8)-class amphibious ships
  - Mod 4, used in *America* (LHA 6)-class amphibious ships
  - Mod 5, used in *Whidbey Island* (LSD 41)-class and *Harpers Ferry* (LSD 49)-class amphibious ships
  - Mod 6, in development for *Gerald R. Ford* (CVN 78)-class aircraft carriers

RAM

- The RAM, jointly developed by the United States and the Federal Republic of Germany, provides a short-range, lightweight self-defense system to defeat anti-ship cruise missiles (ASCM).
- There are three RAM variants:
  - RAM Block 0 uses dual-mode, passive radio frequency/infrared guidance to home in on ASCMs.
  - RAM Block 1A adds infrared guidance improvements to extend defense against ASCMs that do not emit radar signals.
  - RAM Block 2 adds kinematic and guidance improvements to extend the capability of RAM Block 1A against newer classes of ASCM threats.

ESSM

- The ESSM, cooperatively developed among 13 nations, is a medium-range, ship-launched, self-defense guided missile intended to defeat ASCM, surface, and low-velocity air threats.
- The ESSM is currently installed on LHA 6 and LHD 8 amphibious ships, DDG 51 Flight IIA destroyers, and CVN 68-class aircraft carriers equipped with the SSDS MK 2 Mod 1 Combat System.
- There are two variants of ESSM:
  - ESSM Block 1 is a semi-active radar-guided missile that is currently in service.
  - ESSM Block 2 is in development and intended to have semi-active and active radar guidance.

CEC

- CEC is a sensor network with an integrated fire control capability intended to significantly improve battle force air and missile defense capabilities by combining data from multiple battle force air search sensors on CEC-equipped units into a single, real-time, composite track picture.
- The two major hardware pieces are the Cooperative Engagement Processor, which collects and fuses radar data, and the Data Distribution System, which distributes CEC data to other CEC-equipped ships and aircraft.

- CEC is an integrated component of, and serves as the primary air tracker for, non-LSD class ships equipped with SSDS MK 2.
- There are two major surface ship variants of CEC:
  - The CEC AN/USG-2/2A is used in selected Aegis cruisers and destroyers, LPD 17/LHD/LHA 6 amphibious ships, and CVN 68-class aircraft carriers.
  - The CEC AN/USG-2B, an improved version of the AN/USG-2/2A, is used in selected Aegis cruisers/destroyers, selected amphibious assault ships including the LHA 6 class, and CVN 68-class aircraft carriers.

SEWIP

- SEWIP is an evolutionary development program providing block upgrades to the AN/SLQ-32 electronic warfare system to address critical capability, integration, logistics, and performance deficiencies.
- There are three major SEWIP block upgrades:
  - SEWIP Block 1, used on LHA 6-class ships, replaced obsolete parts in the AN/SLQ-32 and incorporated a new, user-friendly operator console, an improved electronic emitter identification capability, and an embedded trainer.
  - SEWIP Block 2 incorporated a new receiver antenna system intended to improve the AN/SLQ-32's passive electronic warfare capability.
  - SEWIP Block 3 is in development and will incorporate a new transmitter antenna system intended to improve the AN/SLQ-32's active electronic warfare capability.

Mission

- Naval Component and Unit Commanders use SSDS, RAM, ESSM, SEWIP, CEC, and many legacy systems to accomplish ship self-defense missions.
- Naval surface units use the:
  - SSDS to provide automated and integrated detect to engage ship self-defense capabilities against ASCM, air, and surface threats
  - RAM to provide a short-range, hard-kill engagement capability against ASCM threats
  - ESSM to provide a medium-range, hard-kill engagement capability against ASCM threats
  - CEC to provide accurate air and surface threat tracking data to SSDS
  - SEWIP-improved AN/SLQ-32 as the primary electronic warfare sensor and soft-kill weapons system for air defense (to include self-defense) missions

Major Contractors

- SSDS (all variants): Raytheon – San Diego, California
- RAM and ESSM (all variants): Raytheon – Tucson, Arizona
- CEC (all variants): Raytheon – St. Petersburg, Florida
- SEWIP
  - Block 1: General Dynamics Advanced Information Systems – Fair Lakes, Virginia
  - Block 2: Lockheed Martin – Syracuse, New York
  - Block 3: Northrop Grumman – Baltimore, Maryland

Activity

- OPTEVFOR conducted tracking exercises with low altitude/low speed aerial targets and surface targets at the Naval Air Warfare Center, Point Mugu, California, from January to February 2017 in accordance with a DOT&E-approved test plan.
- OPTEVFOR commenced the PRA Modeling and Simulation test bed phase of IOT&E at the Naval Research Laboratory, Washington, District of Columbia, in March 2017 in accordance with a DOT&E-approved test plan. Completion of this test phase is expected in December 2017.
- OPTEVFOR completed the cybersecurity IOT&E test phase on the LHA 6 at Naval Base San Diego, California, in March 2017. The test results are classified.

Assessment

- Results of the January/February 2017 surface target tracking exercise identified integration deficiencies between the SSDS and the AN/SPS-73 radar. These deficiencies adversely affected the ability of the crew to maintain self-defense situational awareness against surface threats.
- Results of the January/February 2017 tracking exercises identified problems with the ship's sensors erroneously reporting dual tracks (two tracks for one target) and incorrect target positions. Preliminary analysis identified crew training deficiencies associated with radar sensor alignment and monitoring contributed to the problems.

Recommendations

- Status of Previous Recommendations. The Navy has satisfactorily addressed some previous recommendations. However, the Navy has not resolved the following previous recommendations related to LHA 6 ship self-defense:
  1. Optimize SSDS MK 2 weapon employment timelines to maximize weapon Probability of Kill.
  2. Develop an open-loop seeker subsonic ASCM surrogate target for ship self-defense combat system operational tests.
  3. Correct the identified SSDS MK 2 software reliability deficiencies.
  4. Correct the identified SSDS MK 2 training deficiencies.
  5. Develop and field deferred SSDS MK 2 interfaces to the Global Command and Control System – Maritime and the TPX-42A(V) command and control systems.
  6. Improve the ability of legacy ship self-defense combat system sensor elements to detect threat surrogates used in specific ASCM raid types.
  7. Improve SSDS MK 2 integration with the MK 9 Track Illuminators to better support ESSM engagements.

8. Develop combat system improvements to increase the likelihood that ESSM and RAM will home on their intended targets.
9. Correct the cause of the ESSM missile failures and demonstrate the correction in a future phase of operational testing.
10. Investigate means to mitigate the chances of an ESSM pre-detonating on debris before approaching its intended target.
11. Investigate why target emitters continue to be reported as valid by the AN/SLQ-32 electronic warfare system with the SEWIP Block 1 upgrade after the target is destroyed. Test any corrections in a future operational test phase.
12. Correct the SSDS scheduling function to preclude interference with the RAM infrared guidance stemming from prior intercepts and warhead detonations. Demonstrate corrections in a phase of operational testing.
13. Correct integration problems with the SSDS-based combat system and the AN/SPQ-9B radar to ensure that all valid AN/SPQ-9B detections are used by the combat system when tracking targets. Demonstrate the corrections in a phase of operational testing.
14. Update the LHA 6 and SSDS Test and Evaluation Master Plans to include at-sea and PRA test bed operational test phases to enable evaluation of the ship self-defense capabilities of LHA 8 equipped with the new Enterprise Air Surveillance Radar.
15. Continue to take action on the classified recommendations contained in the March 2011 and November 2012 DOT&E reports to Congress on the ship self-defense mission area.
16. Provide a plan of action and milestones for introduction and operational testing of Fire Control Loop Improvement Program (FCLIP) improvements.
17. Investigate and correct the combat system time synchronization problem that prevented the launch of a full salvo of ESSMs.
18. Investigate and correct the SSDS processing of threat surrogate emitters and sensor detection deficiency.
19. Develop an adequate Multi-Stage Supersonic Target (MSST) and electronic warfare target surrogates for operational testing.

- FY17 Recommendations. The Navy should:
  1. Correct the integration deficiencies between SSDS and the AN/SPS-73 radar that adversely affected the crew's ability to maintain self-defense situational awareness against surface threats.
  2. Provide ship crews with adequate radar sensor alignment and monitoring training.