

## Ship Self-Defense

### Executive Summary

- The ship self-defense mission for aircraft carriers and amphibious warfare ships coordinates several legacy shipboard systems, as well as four major acquisition programs: Ship Self-Defense System (SSDS), Rolling Airframe Missile (RAM), Evolved SeaSparrow Missile (ESSM), and Cooperative Engagement Capability (CEC). These comprise a self-defense capability for in-service ships, as well as the LPD-17, LHA-6, and CVN 78 ship classes still in acquisition.
- DOT&E issued a classified report to Congress in March 2011 entitled “Ship Self-Defense Operational Mission Capability Assessment Report.”
- While the integration of sensor and weapon systems with the command and decision system enhances the ships’ self-defense capability over non-integrated combat systems, the ability to effectively complete the self-defense mission against the types of threats for which the overall system was designed has not been successfully demonstrated. In addition, reliability problems further degrade the ships’ ability to complete this mission.
- The Navy must complete the currently planned operational test program and conduct additional testing to demonstrate the correction of significant deficiencies with SSDS Mark 2, RAM, ESSM, CEC, and legacy ship self defense combat system elements.

### System

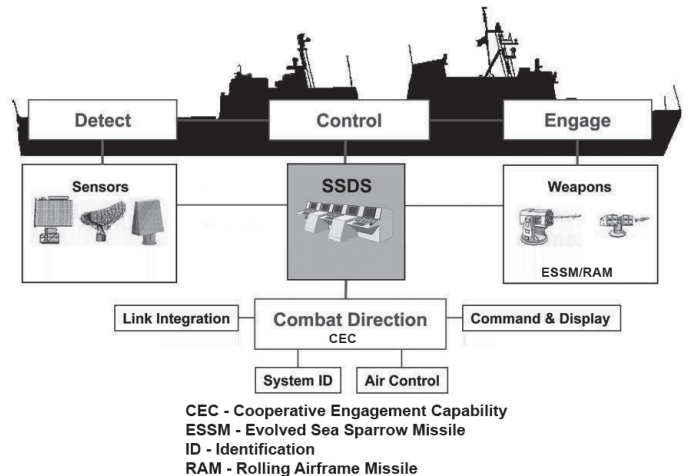
- Surface ship self-defense is addressed by several legacy combat system elements (ship class-dependent) and four acquisition programs: SSDS, RAM, ESSM, and CEC.

#### 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 Mark 1 is the command and control system for LSD-41/49 class ships.
- SSDS Mark 2 has six variants:
  - Mod 1, used in CVN 68 class aircraft carriers.
  - Mod 2, used in LPD-17 class amphibious ships.
  - Mod 3, used in LHD-1 class amphibious ships.
  - Mod 4, in development for LHA-6 class amphibious ships.
  - Mod 5, in development for LSD-41/49 class amphibious ships
  - Mod 6, in development for 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 (ASCMs). RAM is currently installed in all aircraft carriers and amphibious ships (except LPD-4 class).

- There are four RAM variants:
  - RAM Block 0 uses dual mode, passive radio frequency/infrared guidance.
  - RAM Block 1 adds infrared guidance improvements to extend defense against non-radio-frequency-radiating ASCMs.
  - RAM Block 1A extends the capability of RAM Block 1 against non-ASCM targets including helicopters, slow aircraft, and surface threats.
  - RAM Block 2 is in development and will 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 designed to defeat ASCM, surface, and low velocity air threats. The ESSM is currently installed on DDG-51 Flight IIA Destroyers as well as CVN 68 class aircraft carriers and LHD-1 class amphibious ships equipped with the SSDS Mark 2 Mod 1 Combat System. The Navy is planning for future ESSM installations in CG-47 Class Cruisers, LHA-6 Class Amphibious Assault Ships, CVN 78 Class Aircraft Carriers, and the DDG-1000 Class Destroyers.

#### CEC

- CEC is a sensor network with integrated fire control capability that is 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

exchanges the Cooperative Engagement Processor data. CEC is an integrated component of, and serves as the primary air tracker for, SSDS Mk 2-equipped ships.

- There are four major variants of CEC:
  - The CEC USG-2 is used in selected Aegis cruisers and destroyers, LPD-17/LHD amphibious ships, and CVN 68 class aircraft carriers.
  - The CEC USG-2A, an improved version of the USG-2, is used in selected Aegis cruisers and destroyers.
  - The CEC USG-3 is used in the E-2C Hawkeye 2000 aircraft.
  - The CEC USG-3B is in development for use in the E-2D Advanced Hawkeye aircraft.

## Mission

Naval Component Commanders use SSDS, RAM, ESSM, and CEC, as well as many legacy systems, to provide faster, more effective accomplishment of ship self-defense missions.

- Naval surface forces use SSDS to provide automated and integrated detect-to-engage ship self-defense capability against ASCM, air, and surface threats.
- Naval surface forces use RAM to provide a short-range hard kill engagement capability against ASCM threats.
- Naval surface forces use ESSM to provide a medium-range hard kill engagement capability against ASCM, surface, and low velocity air threats.
- Naval surface forces use CEC to provide accurate air and surface threat tracking data to SSDS.

## Major Contractors

- SSDS: Raytheon – San Diego, California
- RAM and ESSM: Raytheon – Tucson, Arizona
- CEC: Raytheon – St. Petersburg, Florida

## Activity

- DOT&E issued a classified report to Congress on the ship self-defense mission area in March 2011. The report covers ship self-defense related operational testing conducted from January 2008 through March 2010 aboard USS *Ronald Reagan* (CVN 76), USS *San Antonio* (LPD-17), USS *New Orleans* (LPD-18), USS *Makin Island* (LHD-8), and the Self-Defense Test Ship (SDTS).
- The Commander, Operational Test and Evaluation Force continued planning for operational testing of the ship self-defense mission area during FOT&E of the SSDS Mark 2 Mod 1 and ESSM on the SDTS. Testing is scheduled to continue in November 2011.
- The Commander, Operational Test and Evaluation Force continued planning for IOT&E testing of the LHA-6 class ship self-defense combat system on the SDTS. Testing is scheduled to commence in August 2012.

Treaty Organization (NATO) SeaSparrow Missile System performance, as well as deficiencies with the recommended engagement tactics provided for use against multiple ASCM threat classes.

- Due to the similarities between the CVN 68, LPD-17, and LHD-8 ship self-defense combat system elements and software commonality, most of the specific ship class combat system assessments are applicable to all CVN 68, LHD-1, and LPD-17 ship class combat systems.
- Further ship self-defense mission area assessments are classified and are contained in the March 2011 DOT&E report to Congress on the ship self-defense mission area.

## Assessment

- The DOT&E March 2011 ship self-defense mission area report includes the following assessments:
  - The LPD-17 and CVN 68 ship class combat systems continue to have difficulty defeating certain ASCM raid types. In particular, the legacy combat system sensor elements have limited capability against the threat surrogates used in those raid types.
  - Some elements of the LHD-8 ship class combat system continue to have reliability problems. In addition, the LHD-8 combat system has difficulty engaging certain classes of asymmetric threats.
  - The CVN 68 ship class combat system has several problems that keep it from successfully completing the ship self-defense mission. Specific problems include deficiencies in weapon employment timelines, sensor coverage, system track management, and North Atlantic

## Recommendations

- Status of Previous Recommendations. The Navy has not resolved the following previous annual report recommendations:
  1. Optimize SSDS Mark 2 weapon employment timelines to maximize weapon probability of kill.
  2. Acquire range-safe supersonic sea-skimming ASCM surrogate targets for ESSM FOT&E with the Aegis Combat System.
  3. Ensure availability of a credible open-loop seeker subsonic ASCM surrogate target for ship self-defense combat system operational tests.
  4. Correct the identified SSDS Mark 2 software reliability deficiencies.
  5. Correct the identified SSDS Mark 2 training deficiencies.
  6. Develop and field deferred SSDS Mark 2 interfaces to the Global Command and Control System-Maritime and the TPX-42A(V) command and control systems.
  7. Continue to implement the Program Executive Office for Integrated Warfare Systems' plan for more robust, end-to-

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- end systems engineering and associated developmental/operational testing of ship self-defense combat systems.
  - 8. Provide a capability to launch a raid of four supersonic sea-skimming targets at the Naval Air Warfare Center/Weapons Division, Point Mugu, California, test range to support Test and Evaluation Master Plan-approved Air Warfare/Ship Self-Defense Enterprise testing planned for FY16.
  - 9. Demonstrate through operational testing the correction of identified problems with CVN, LHD-1, and LPD-17 ship class self-defense combat systems, supporting the deployment schedule of those ships.
- FY11 Recommendations. The Navy should:
    1. Ensure required missile assets are available for all planned FY12 ship self-defense operational testing.
    2. Improve the ability of legacy ship self defense combat system sensor elements to detect threat surrogates used in specific ASCM raid types.
    3. Ensure availability of adequate and credible target resources for ship self-defense and electronic warfare operational testing as well as the classified recommendations contained in the March 2011 DOT&E report to Congress on the ship self-defense mission area.

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