Ship Self Defense for DDG 1000

Executive Summary

- The USS Zumwalt (DDG 1000) shipboard air defense combat system is currently undergoing testing on the Self-Defense Test Ship. Testing has been delayed due to problems discovered with the combat system.
- Additional delays may occur if the Navy removes SPY-3, intended to be installed onboard DDG 1002, from the test ship prior to executing the one remaining planned test event.
- The Navy no longer plans to execute five events on the Self-Defense Test Ship due to schedule delays, prior test performance, or unacceptably low performance predictions.

System

The DDG 1000 ship self-defense combat system, Zumwalt Combat System (ZCS), consists of several programs:
- Total Ship Computing Environment (TSCE) – The command and control architecture unique to ZCS.
- AN/USG-2B Cooperative Engagement Capability (CEC) – The tracker and sensor data fusion and distribution system.
- Surface Electronic Warfare Improvement Program (SEWIP) Block 2 (SLQ-32A(V)6) – The passive electronic sensor used to detect and identify hostile radars and missiles.
- Evolved Sea Sparrow Missile (ESSM) Block 1 with Joint Universal Weapon Link (JUWL) – The short-range missile interceptor used to defeat air threats at close-in ranges, and the system used for radar-missile communication and support. Within the U.S. Navy, only the DDG 1000-class ships and the USS Gerald R. Ford (CVN 78) use the ESSM with JUWL.
- Standard Missile 2 (SM-2 Block IIIAZ) with JUWL – The unique ZCS variant of SM-2 used to defeat air threats at longer ranges.
- MK 57 Vertical Launch System (VLS) – The DDG 1000-only vertical missile launcher variant.

Mission

Commanders use the DDG 1000 self-defense systems (TSCE, SPY-3, CEC, SEWIP Block 2, ESSM and SM-2 with JUWL, and VLS) to protect the ship and its sailors from enemy air threats in both clear and jammed environments.

Major Contractors

- TSCE and SPY-3: Raytheon Company, Integrated Defense Systems – Tewksbury, Massachusetts
- ESSM and SM-2 with JUWL, VLS: Raytheon Missile Systems – Tucson, Arizona
- SEWIP Block 2: Lockheed Martin – Syracuse, New York

Activity

- In FY20, the Navy conducted one developmental test on the Self-Defense Test Ship. To date, the Navy has conducted 5 of the 10 DDG 1000 tests planned for the Self-Defense Test Ship (4 of 6 developmental tests, and 1 of 4 integrated tests) and has canceled the remaining 3 integrated tests and 2 developmental tests because of schedule delays, prior test performance, or unacceptably low performance predictions.
- All tests have been conducted in accordance with the DOT&E-approved test plan.
- The Navy intends to repeat a previously executed integrated test in December 2020.
- To address problems discovered during this phase of integrated testing, the Navy executed three engineering tests and two tracking exercises aboard the Self-Defense Test Ship.
- The DDG 1000 Probability of Raid Annihilation (PRA) modeling and simulation testbed has been a critical portion of developmental testing and risk reduction. It is still undergoing development and finalization prior to the operational test runs for record (planned for 2022).
- Lead ship developmental testing continued with four tracking exercises conducted in 2019 and 2020. An SM-2 Block IIIAZ
developmental testing missile firing was conducted on October 14, 2020.

Assessment
- Several problems have been uncovered during the DDG 1000 Self-Defense Test Ship events. In particular, issues with radar-to-missile support put the test program on hold until the root cause of the problem(s) is identified and the corrections are implemented.
- The DDG 1000 self-defense test program will not be adequate if all remaining Self-Defense Test Ship events are not completed. If these events are not completed, those resources should be allocated to execute air defense scenarios on the USS Zumwalt.
- The remaining planned test event is at risk of not occurring for several reasons:
  - The Navy is considering removing the SPY-3 radar on the Self-Defense Test Ship for installation on DDG 1002.
  - Determining the root cause of and correcting problems found in developmental and early integrated testing has repeatedly delayed event execution.
  - Several other test programs are competing for aerial target resources, Self-Defense Test Ship time, and range time.

Recommendations
The Navy should:
1. Develop a schedule, funding, and execution strategy for completing the DDG 1000 self-defense assessment on the Self Defense Test Ship.
2. Consider carrying over resources not used for the DDG 1000 Self-Defense Test Ship events to execute air defense scenarios aboard USS Zumwalt.
3. Continue to develop and improve the DDG 1000 PRA Testbed, in particular its missile, radar, and electronic warfare models.