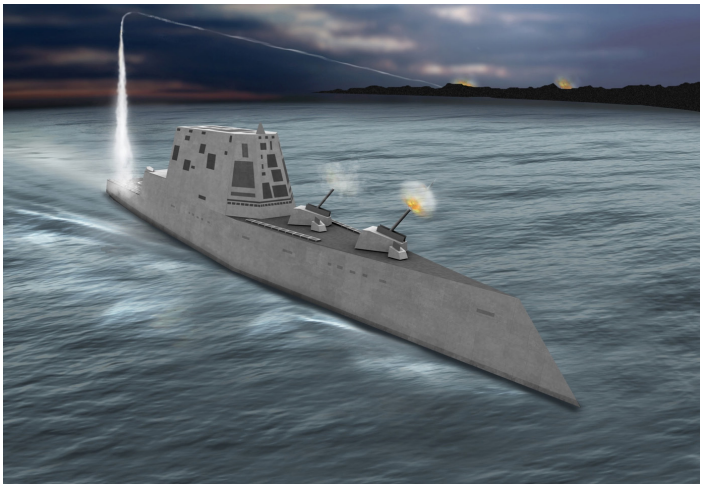
Ship Self Defense for DDG 1000

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.
- Multi-Function Radar (MFR/SPY-3) – The new X-band radar going on DDG 1000-class guided-missile destroyers and the USS *Gerald R. Ford* (CVN 78).
- 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
- CEC: Raytheon Company, Integrated Defense Systems – St. Petersburg, Florida

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.