Rolling Airframe Missile (RAM) Block 2

Executive Summary

- Eight Rolling Airframe Missile (RAM) Block 2 developmental missile firings have been conducted in addition to 17 IOT&E missile firings the Commander, Operational Test and Evaluation (COTF) conducted from March 2013 through April 2015, at the Naval Air Warfare Center, Point Mugu, California, and the Naval Weapons Station, Yorktown, Virginia. IOT&E testing was conducted in accordance with a DOT&E-approved test plan.
- The results of developmental and operational testing completed to date indicate:
  - RAM Block 2 effectiveness is comparable to RAM Block 1A's effectiveness against older anti-ship cruise missiles (ASCM) threats. However, DOT&E cannot make a final determination of RAM Block 2 effectiveness against newer ASCM threats until completion of IOT&E in mid 2017.
  - RAM Block 2 has an improved kinematic capability to guide on maneuvering ASCMs and an improved capability to guide on certain ASCM threat emitters over RAM Block 1A.
  - RAM Block 2 demonstrated satisfactory missile reliability with no confirmed reliability failures in the 25 RAM Block 2 firings from the Self-Defense Test Ship (SDTS).
  - Deficiencies in RAM Block 2 integration with the Ship Self-Defense System (SSDS)-based combat system caused several RAM Block 2 missiles to miss their target during one of the IOT&E missile firing scenarios.
  - No assessment of RAM Block 2's capability against Multi-Stage Supersonic Target (MSST)-like ASCM threats is possible due to the lack of an MSST.
  - RAM Block 2 demonstrated lethality comparable to Block 1A and Block 0.
- DOT&E is currently preparing an Early Fielding Report to Congress on the completed testing and will conduct a full assessment of RAM Block 2 effectiveness, suitability, and lethality after IOT&E is completed.

System

- The RAM, jointly developed by the United States and the Federal Republic of Germany, provides a short-range, lightweight, self-defense system to defeat ASCMs. 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 defenses against ASCMs that do not radiate radio frequencies.
  - RAM Block 2 incorporates changes to improve its kinematic capability and capability to guide on certain types of ASCM radio frequency threat emitters in order to defeat newer classes of ASCM threats.

Mission

- Naval component commanders will use RAM to accomplish ship self-defense missions.
- Naval surface forces will use RAM to provide a short-range, hard-kill engagement capability against ASCM threats.

Major Contractors

- Raytheon Missiles Systems – Tucson, Arizona
- RAMSys – Ottobrunn, Germany

Activity

- The Navy conducted 8 RAM Block 2 developmental missile firings and 17 IOT&E missile firings from the SDTS at the Naval Air Warfare Center, Point Mugu, California, from March 2013 through April 2015. COTF conducted the IOT&E missile firings in accordance with a DOT&E-approved test plan.
- COTF conducted an ammunition on-load demonstration as part of IOT&E onboard USS *Arlington* (LPD 24) in April 2015 at the Naval Weapons Station, Yorktown, Virginia.
- RAM Block 2 IOT&E for at-sea testing is ongoing and is scheduled for completion in mid-2016.

- COTF continued planning for the Probability of Raid Annihilation Modeling and Simulation test bed IOT&E test phase. This testing is scheduled to commence in late-2016.
- DOT&E is currently preparing an Early Fielding Report to Congress on the completed testing and will conduct a full assessment of RAM Block 2 effectiveness, suitability, and lethality after IOT&E is completed.

Assessment

- Results of testing completed to date indicate that RAM Block 2 performance is comparable to the RAM Block 1A performance against older ASCM threats. However, DOT&E cannot make a final determination of RAM Block 2 performance against newer ASCM threats until IOT&E is completed in mid-2017.
- RAM Block 2 demonstrated an improved kinematic capability and an improved capability to guide on certain ASCM threat emitters over RAM Block 1A.
- RAM Block 2 demonstrated satisfactory missile reliability with no confirmed reliability failures in the 25 RAM Block 2 firings from the SDTS to date.
- RAM Block 2 demonstrated lethality comparable to Block 1A and Block 0.
- Deficiencies in RAM Block 2 integration with the SSDS-based combat system caused several RAM Block 2 missiles to miss their target during one of the IOT&E missile firing scenarios. The Navy has initiated a formal Failure Review Board to determine the required corrections.
- The CVN and LHA 6 class ships defend themselves against ASCMs by first using the medium-range Evolved SeaSparrow Missile (ESSM) and then the shorter-range RAM. RAM uses radio frequency and/or infrared terminal guidance to home on ASCM threats. Hot debris from prior intercepts and warhead detonations can therefore interfere with RAM's infrared guidance. While the SSDS is designed to schedule RAM and ESSM engagements to avoid this type of interference, it failed to do so during testing.
- The AN/SLQ-32 Electronic Warfare System (EWS) with the Surface Electronic Warfare Improvement Program (SEWIP) Block 1 upgrade was not able to timely detect certain types of ASCM emitter signals. The late detections negatively affected the performance of RAM missiles that the SSDS employed against these ASCM threats. The Navy is addressing this deficiency with the SEWIP Block 2 upgrade to the AN/SLQ-32 EWS.
- Two BQM-74 aerial targets failed to maintain operationally realistic flight parameters in one of the IOT&E missile firing scenarios.
- Due to the lack of an MSST, no assessment of RAM Block 2's capability against MSST-like ASCM threats is possible.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY15 Recommendations. The Navy should:
  1. Complete all planned RAM Block 2 missile firing IOT&E test events.
  2. Correct the identified integration deficiencies with the SSDS-based combat system and RAM Block 2. Demonstrate these corrections in a phase of operational testing.
  3. Correct the SSDS scheduling function to preclude interference from prior intercepts and warhead detonations with RAM's infrared guidance. Demonstrate corrections in a phase of operational testing.
  4. Investigate why the BQM-74 aerial targets failed to maintain operationally realistic flight parameters. Demonstrate any corrections prior to using these targets in similar operational test scenarios.
  5. Continue planning for the Probability of Raid Annihilation Modeling and Simulation IOT&E test phase.