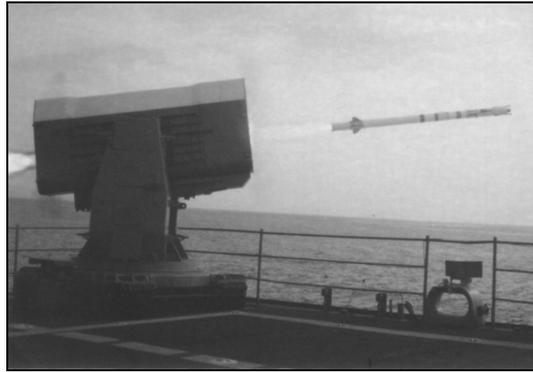


ROLLING AIRFRAME MISSILE (RAM) WEAPON SYSTEM



The Rolling Airframe Missile (RAM) program provides surface ships with an effective, low-cost, lightweight, self-defense system to engage and defeat anti-ship cruise missiles (ASCMs). The RAM Block 0 uses dual mode, passive radio frequency/infrared (RF/IR) guidance. Initial homing for RAM Block 0 is in RF, using an ASCM's RF seeker emissions. If the ASCM's IR radiation is acquired, RAM transitions to IR guidance. RAM Block 1 uses an improved, electro-optical proximity fuze and a new IR seeker and can be launched in an IR all-the-way mode, as well as the dual mode (passive RF, followed by passive IR) used by Block 0. Block 0 rounds are being configured with the new electro-optical fuze that is used in RAM Block 1. The Mod 0 launcher for RAM Block 0 was upgraded to accommodate RAM Block 1 and is designated the Mod 1 launcher. The launching system and missiles comprise the weapon system.

Most current RAM weapon system installations are integrated with the AN/SWY-2 or -3 combat system. On the LSD 41/49-class of amphibious ships, RAM is integrated with the Ship Self Defense System (SSDS) Mark 1. AN/SWY-2 installations use RAM as the only hard-kill weapon. AN/SWY-3 installations use both RAM and NATO Sea Sparrow systems as the hard-kill weapons. For future installations, it is intended that RAM be integrated with the SSDS Mark 2 on LPD 17-class and CVN 68-class ships (also NATO Sea Sparrow on the latter).

RAM Block 0 enhances ship self-protection against several RF-radiating ASCMs that have leaked past outer air defenses. RAM Block I extends that protection against several non-RF radiating missiles.

BACKGROUND INFORMATION:

RAM was developed jointly by the United States and the Federal Republic of Germany. Block 0 IOT&E was completed in FY90. The DOT&E assessment was reported in the DOT&E FY90 Annual Report. Although a B-LRIP report was prepared, the Navy deferred its decision to proceed beyond LRIP. Due to this deferred decision, the B-LRIP report was not forwarded to the congressional defense committees until April 1994, prior to Block 0 missile and launcher full-rate production. The B-LRIP report concluded that the RAM weapon system was operationally effective against the preponderance of RF-emitting ASCMs, although there were exceptions. It also concluded that RAM Block 0 was not operationally suitable. These deficiencies were addressed prior to the decision to proceed beyond LRIP, with the new Block I missile program addressing the more fundamental deficiencies.

The RAM Block 1 OPEVAL was completed on the Self Defense Test Ship (SDTS) in August 1999. DOT&E concluded that RAM Block 1 is operationally effective and lethal against most current ASCMs, and is operationally suitable. An accompanying caveat was that those conclusions could not be decoupled from the combat system that was simulated on the SDTS.

In 1997, the resource sponsor requested that the Program Manager determine what RAM capability existed against helicopter, slow aircraft (less than 250 knots), and surface targets (HAS). This request stipulated that Block 1 anti-ASCM capability was to be retained, but was unaccompanied by operational requirements for the additional target set. Effort has been ongoing to develop missile software modifications to investigate that capability. Separate from, but concurrent with this effort, a new version of the launcher (Mod 3) will be introduced as an ordnance alteration to reduce acquisition and installation cost, address component obsolescence, and reduce manning. This launcher will be functionally equivalent to the Mod 1 launcher and will be capable of firing Block 1 missiles with the HAS software modifications. RAM HAS will be integrated with the Ship Self Defense System (SSDS) Mark 2.

TEST & EVALUATION ACTIVITY:

Activity consisted of firing a Block 1 missile that had undergone shipboard storage for the requisite period of time. This was an area that was not addressed during the OPEVAL and was conducted in conjunction with ship training at the Atlantic Fleet Weapons Training Facility in Puerto Rico during January 2001. This test was conducted again in July 2001 at the Naval Air Warfare Center (NAWC) Weapons Division sea range near Point Mugu, CA. Planning for FOT&E of RAM Block 1 and T&E of the RAM Helicopter-Aircraft-Surface (HAS) target mode was carried out as part of the TEMP update.

Further activity included preparations for contractor testing of the RAM HAS mode modification against HAS targets, using a RAM launcher located on San Nicolas Island on the NAWC sea range.

TEST & EVALUATION ASSESSMENT:

RAM Block 0. DOT&E's assessment of RAM Block 0 is that it is operationally effective against most of the RF-emitting ASCMs (based on the 1990 OPEVAL) and that it is now operationally suitable, after deficiencies were addressed. Performance against targets executing evasive maneuvers was never tested because these targets were not available, nor was the SDTS available for OT of RAM Block 0 against the most realistic threat attack profiles.

RAM Block 1. RAM Block 1, as supported by the SSDS Mark 1, integrating an AN/SPS-49A search radar, a CIWS Block 1B, and an AN/SLQ-32(V)3 electronic warfare system, is operationally effective against most current ASCMs. The CIWS Block 1B radar was essential in tracking targets and supporting RAM Block 1 launches. By no means can the operational effectiveness assessment of RAM Block 1 be divorced from the combat systems suite used in testing. RAM Block 1 is operationally suitable and is lethal against most current ASCMs. Its capability was examined against representative targets from all ASCM threat categories but one. That category is projected to have slow expansion and is currently populated by a single threat. FOT&E for Block 1 still needs to address missile capability against the threat category that was not tested during the OPEVAL; missile capability against a

supersonic, maneuvering sea-skimmer under more stressing conditions; and missile capability against ASCMs under conditions of EA to the combat system sensors, low visibility (high aerosol environment), and other IR sources.

For the threat category not tested in OPEVAL, there has been little progress in target development, with the only available target unrealistic in terms of no RF emissions and an IR signature lower than that of the predicted threat. For examining missile capability against ASCMs under conditions of electronic attack against the combat system sensors, the Program Manager considers this to be an area beyond his control and does not want to fund such T&E. Without such testing, the fleet users of the system will remain uninformed about their capability to defend themselves in an electronic attack environment.

Follow-on testing of RAM Block 1, intended to demonstrate missile reliability after requisite shipboard storage time, was conducted during stressing weather in January 2001. The PM reports that the unexpected results of this testing are still under review. The missile reliability test was conducted again in July, under more benign conditions, with the missile successfully intercepting its target.

RAM HAS Mode. Although it was understood that the program sponsor would issue detailed performance goals for RAM HAS in FY02 after completion of a performance characterization/evaluation phase, that no longer appears to be the case. The current proposal for fielding RAM HAS is to conduct:

- Combined DT/OT of Block 1A rounds (Block 1 rounds upgraded with HAS software) to demonstrate retention of Block 1 capability against ASCMs. This would occur in FY03, using the RAM Mod 1 launcher on the SDTS.
- DT in FY03-04 with the same missile round configuration against a small number of representative HAS targets (three surface, one helicopter, one light aircraft) from an upgraded RAM launcher operated in a stand-alone mode.
- DT/OT from a manned ship with the same missile round configuration against an aerial target drone in FY04, accompanied by a maintenance demonstration and evaluation of the Mod 3 launcher.
- DT/OT from a manned ship with RAM HAS fully integrated with SSDS Mark 2 against HAS targets. This is anticipated in FY05-06.

Navy's Surface Warfare Development Group would have full access to the test data to assist in defining capabilities and limitations of the HAS mode and to develop recommended tactics for fleet use. From an OT&E perspective, the proposed program is deficient in testing against the HAS target set. Further, the absence of operational requirements undermines objective assessment of OT results.

Both RAM Block 0 and Block 1 underwent LFT&E to evaluate their lethality against various ASCMs before proceeding to full-rate production. In late 2001, DOT&E designated RAM HAS for lethality LFT&E oversight based on its new target set. Because previous versions of the missile were not used or evaluated against helicopters, aircraft, or surface ships, there are few existing data on the RAM warhead's lethality against those targets. Testing is needed to gather basic information on the lethality of the weapon and to develop lethality simulations that can be used to predict lethality/effectiveness against those threats under a variety of scenarios. The LFT&E strategy for RAM HAS should include ground testing of the warhead against whole targets and/or components, flight testing, and simulation-based analyses.

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