

Advanced Anti-Radiation Guided Missile – Extended Range (AARGM-ER)



The Navy has completed six developmental test (DT) shots (DT1-DT6) since FY21 for the AGM-88G Advanced Anti-Radiation Guided Missile – Extended Range (AARGM-ER), to identify and fix problems before beginning integrated operational testing. The Navy executed three developmental free-flight tests in FY23 from F/A-18Fs in November 2022 (DT4), April 2023 (DT5), and July 2023 (DT6). AARGM-ER IOT&E free-flight tests are scheduled to begin in 1QFY24.

SYSTEM DESCRIPTION

The AARGM-ER, is an air-to-ground missile designed to passively detect and guide on radio frequency emissions from a threat

radar site and then transition to an active millimeter wave (MMW) terminal radar seeker to detect, track, and suppress or destroy radio frequency-enabled, surface-to-air missile systems. AARGM-ER reuses the same MMW radar as AARGM (non-extended range) and

introduces a new warhead and a larger diameter, but shorter, rocket motor for increased lethality at relevant ranges against modern surface-to-air threats. The F/A-18E/F and EA-18G are threshold employment platforms for AARGM-ER, while the F/A-18C/D

and F-35A/B/C (internal carriage for the F-35 A and C variants) are designated objective employment platforms with associated key schedule parameters.

MISSION

Operational commanders will employ AARGM-ER to suppress or destroy enemy air defenses. The AARGM-ER missile targets relocatable, integrated air-defense radars and other targets that can employ shutdown tactics. The multi-mode seeker of AARGM-ER counters those enemy shutdown tactics.

PROGRAM

AARGM-ER is an Acquisition Category IB program. DOT&E approved the AARGM-ER Milestone C Test and Evaluation Master Plan in May 2021 and an updated cyber survivability test strategy in August 2022. The production and deployment phase, with the low-rate initial production contract award, came after the Navy's Knowledge Point-4 program review in July 2021. AARGM-ER operational testing began with the first phase of cyber survivability testing, a cooperative vulnerability and penetration assessment (CVPA), in 4QFY23. IOT&E free flights will begin in 1QFY24. The Navy is planning for initial operational capability in 3QFY24.

» MAJOR CONTRACTOR

- Alliant Techsystems Operations, LLC, a subsidiary of Northrop Grumman Corporation – Northridge, California

TEST ADEQUACY

The program completed six DT shot events (DT1-DT6) since FY21 to identify and fix problems before beginning integrated operational testing, along with a CVPA, per the DOT&E-approved Test and Evaluation Master Plan and associated test plans. DOT&E observed the testing. The F/A-18F has conducted all the DT free flight events to date; EA-18G Growler has not yet executed a free flight test event as the other designated threshold platform. Free flight events occurred at Point Mugu Sea Range, California, and the China Lake Ranges, California, through coordination and integration with the Nevada Test and Training Range, Nevada.

The missiles fired prior to DT5 incrementally incorporated new AARGM-ER hardware components. DT5 incorporated the complete low-rate initial production AARGM-ER hardware, but not the fielding-representative software. DT6 included the low-rate initial production AARGM-ER hardware and the most current version of AARGM-ER software at the time of the test. DT4 took place in November 2022 and engaged a moving maritime target, whereas DT5 conducted in April 2023,

and DT6 conducted in July 2023, engaged threat-representative, land-based, integrated air defense targets. These test events provided opportunities to identify discrepancies and implement fixes; however, the discrepancies required software updates that proved more complex than anticipated, requiring additional time to correct and implement. The time necessary to analyze data, develop, and incorporate fixes resulted in delays to Flight Test Vehicle delivery, revisions to the test schedule, and delays in the final software delivery, all of which delayed Integrated Test One (IT1) from 4QFY23 to 1QFY24.

AARGM-ER has yet to execute a successful end-to-end test that achieves threshold range employment, anti-radiation homing guidance with a transition to MMW seeker target discrimination, and engagement of the designated threat with the newly designed anti-radiation homing subsystem. FY24 will contain IT events to test the end-to-end system processes at threshold range, and operational test (OT) events to test the end-to-end processes with the newly designed warhead, under governing range safety restrictions. IT will occur after the final software is delivered from Northrop Grumman in 1QFY24, which will require a series of regression tests of the new software, including multiple captive carry missile events in a compressed time period. After the first IT event, there is a scheduled IOT&E free-flight event approximately every two weeks, beginning in October 2023 through 2QFY24. The

compressed schedule will likely challenge the program's ability to continue to identify anticipated discrepancies and implement fixes rapidly. The schedule will also stress the program's ability to analyze data and inform models and simulations for follow-on flight events.

The extended range and advanced capabilities of AARGM-ER exceed the capabilities of most test range infrastructures, as does the requirement to test against advanced target sets in threat-representative and contested, electromagnetic operational environments. As a result, range availability and suitability have been challenges for the program, resulting in test plan adjustments and scheduling delays. DT6 demonstrated some progress as cooperation between the Air Force's Nevada Test and Training Range and the Navy's China Lake Range enabled a cross-range-complex employment of AARGM-ER, shot from one range at a target set in the other range, through coordination with the Federal Aviation Administration, in the pursuit of threshold-distance shot employments to test the weapon.

The operational test program uses DT and IT events to collect data to verify and validate modeling and simulation. The data collection plan assumes that the current model will successfully predict performance in future test events. If this assumption proves incorrect, additional test events, including captive-carry events, may be required to complete verification, validation, and accreditation.

The Navy conducted its fifth and final AARGM-ER warhead arena ground test event in 4QFY23. DOT&E plans to observe select future test events and will report on the adequacy of warhead lethality, cyber survivability, and free flight testing once all event data has been received.

PERFORMANCE

» EFFECTIVENESS, LETHALITY, SUITABILITY, AND SURVIVABILITY

The current data available are inadequate to provide a preliminary assessment of AARGM-ER operational effectiveness, lethality, suitability, or survivability. Additional testing and flight data are required from both F/A-18E/F and the EA-18G threshold platforms. Successful end-to-end functionality of all AARGM-ER-designed missile components, employed from the threshold range, has not yet been demonstrated.

RECOMMENDATIONS

The Navy should:

1. Demonstrate a successful end-to-end operational test of AARGM-ER, by employing at or beyond the threshold range out to the objective range, demonstrate anti-radiation homing guidance, transition to MMW seeker target discrimination, and engage the designated

threat with the newly designed warhead, in a threat representative environment.

2. Increase the completeness and adequacy of data availability for modeling and simulation by incorporating the EA-18G threshold platform for flight events, with an overall increase of captive carriage events, to better anticipate discrepancies before initial operational capability and assist during a compressed FY24 testing period.