Advanced Medium Range Air-to-Air Missile (AMRAAM)

SUMMARY

- The Phase 3 missile that we will test in follow-on operational test and evaluation (FOT&E) is largely a new missile with distinct capability upgrades from previous versions of the Advanced Medium Range Air-to-Air Missile (AMRAAM).
- Operational testers plan to fire only ten missiles in this FOT&E period, so modeling and simulation will be a key part of our assessment of effectiveness.
- There are enough full-scale targets available for this test period, but future AMRAAM testing (after approximately FY10) will require the department to find a replacement for the QF-4 full-scale target.
- The Test and Evaluation Master Plan (TEMP) is current as of August 2004 and adequate for this FOT&E period.

The AIM-120 is currently employed by the F-15C, F-15E, F-16, F/A-18C/D, and the F/A-18E/F, as well as allied fighter aircraft.

SYSTEM DESCRIPTION AND MISSION

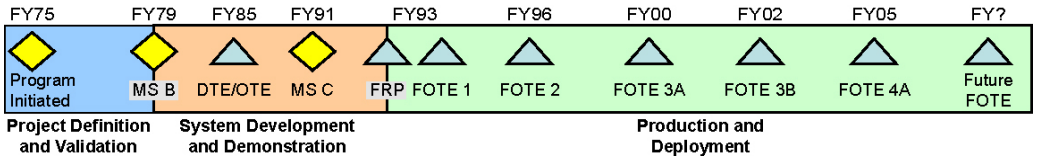
The AIM-120 AMRAAM is an all-weather, radar-guided air-to-air missile with launch-and-leave capability in both the beyond-visual-range and within-visual-range combat arenas. It enables a single-launch aircraft to simultaneously engage multiple targets with multiple missiles in a single pass. The Air Force and Navy, as well as several foreign military forces, use various versions of the AIM-120. The AIM-120 is currently employed by the F-15C, F-15E, F-16, F/A-18C/D, and the F/A-18E/F, as well as allied fighter aircraft. It will also be employed by the F/A-22 and the F-35 Joint Strike Fighter (JSF).

The AMRAAM program uses an acquisition strategy that improves missile capability through incremental software and hardware modifications that have been grouped into three pre-planned product improvement (P3I) phases. All are known as the AIM-120C. Phase 1 (AIM-120C-3) was developed in the mid-1990s and incorporated clipped wings to enable the F/A-22 to carry additional missiles in its internal weapons bays. This variant is compatible with all aircraft that carried earlier variants of the AIM-120. Phase 2 improvements incorporated a new warhead (AIM-120C-4), lengthened rocket motor (AIM-120C-5), and new target detection device (AIM-120C-6). All current production deliveries to U.S. forces are the Phase 2 configuration.

Phase 3 of the AMRAAM P3I development program plans to improve weapons systems effectiveness and lethality and provide the system with the capability to deal with emerging threats. The Phase 3 missile, designated AIM-120C-7, includes new guidance section hardware and software. Raytheon incorporated the following key changes in the Phase 3 upgrade:

- Upgraded antenna, receiver, and signal processing portions of the missile to satisfy operational requirements to counter new threats.
- Smaller electronic components to create room for future system growth.
- Re-hosting some elements of the existing software to a new higher-order programming language (C++).
- Re-hosting and modifying some existing software to function with the new hardware.
- Developing new software algorithms that will enable the system to deal with newly defined Phase 3 threats.

TEST AND EVALUATION ACTIVITY



DOT&E approved the initial AMRAAM TEMP for the P3I Phase 3 missile in June 2002. DOT&E approved the revised TEMP which time-phases the Phase 3 development and defers certain operational capabilities to a follow-on software upgrade program in August 2004. Developmental test and evaluation of the Phase 3 missile is complete. It included captive-carry missions, hardware-in-the-loop laboratory testing, and live end-to-end guided launches of instrumented test missiles.

During the development test phase, the test team attempted nine Phase 3 missile launches over six discrete launch scenarios. One scenario was repeated twice (hangfire, control section failure); a second scenario was repeated once (shooter aircraft miscue). Six launches met the development test objectives necessary to obtain the end-game scoring data essential to development and validation of the modeling and simulation suite of computer models used in the AMRAAM program to determine overall missile effectiveness.

The Air Force's 53d Wing and the Navy's Air Test and Evaluation Squadron NINE will conduct the Phase 3 FOT&E under the oversight of the Air Force Operational Test and Evaluation Center and the Navy's Commander Operational Test and Evaluation Force starting in late 2004, and continuing through the end of 2005. The FOT&E will consist of captive-carry missions, an extensive computer simulation effort using the Tactical AMRAAM Simulation model developed by Raytheon, and live guided missile launches. Raytheon delivered the AMRAAM modeling and simulation suite to the government organizations that must understand and validate its use in determining overall weapons system effectiveness during FOT&E. Raytheon has trained government analysts in the use of the Tactical AMRAAM Simulation model.

During the FOT&E, ten missiles will be launched against threat-representative aerial targets operating in various demanding operationally realistic tactical scenarios. The evaluation will include integration of the missile on the F-15, F-16, F/A-18C/D, and F/A-18E/F aircraft. In accordance with the TEMP, free-flight missile events will be repeated as necessary to ensure that AMRAAM capabilities in the discrete test scenarios are fully evaluated.

TEST AND EVALUATION ASSESSMENT

The Phase 3 missile is largely a new missile with distinct capabilities from previous variants of the AIM-120. In particular, there are significant hardware and software changes in the guidance section of the missile. The Navy and Air Force desire these improvements in system performance and capability to increase their air-to-air combat capabilities. However, as acknowledged in the revised TEMP, the current program will not deliver all Phase 3 capabilities originally required in its joint operational requirements document, with some capabilities now being deferred to a follow-on software upgrade program. In the upcoming FOT&E, DOT&E will independently assess the impact of any required capability that is not fully developed and operationally tested when reporting on the operational effectiveness and suitability of the missiles actually tested.

During the development test and evaluation effort, a number of aircraft integration issues were encountered. These included problems with aircraft radar fire control systems, stores management software, and missile launchers. The Air Force assessed these issues as not pertinent to the technical development of the P3I missile, but the Services must address them in order to properly use the capabilities inherent in the P3I missile in operational service.

DOT&E continues to monitor development of the Tactical AMRAAM Simulation model and progress of the Phase 3 FOT&E program. The limited number of planned live test launches during FOT&E places a strong reliance on the use of modeling and simulation to confirm the full missile employment envelope and the overall operational effectiveness of the P3I Phase 3 AMRAAM missile. In the event that the modeling and simulation suite cannot be validated, operational testers will need to conduct additional live test shots during the FOT&E to ensure that the fleet and combat air forces receive the required P3I Phase 3 missile capability.