

AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM)

Executive Summary

- In 2009, key stakeholders, including the Program Office and DOT&E, suspended progression of the AIM-120D to operational testing due to four performance and reliability deficiencies. Raytheon addressed the four deficiencies, and DOT&E signed the revised AIM-120D Test and Evaluation Master Plan (TEMP) and separate, detailed operational test plan on May 25, 2012.
- The Air Force completed an Operational Test Readiness Review on May 31, 2012, and certified the AIM-120D Advanced Medium-Range Air-to-Air Missile (AMRAAM) to begin operational testing in June 2012. AIM-120D operational testing will consist of seven live missile shots and multiple captive-carry events. The Services are projected to complete operational testing in FY14.
- During operational testing to date, the Air Force has accomplished three AIM-120D shots, the first of which was unsuccessful. The unsuccessful shot was due to a reliability failure of a legacy Shortened Control Actuation System. The Air Force has re-executed this shot and is awaiting data analysis to determine its success.
- The AMRAAM Electronic Protection Improvement Program (EPIP) is a software upgrade to AIM-120C3-C7 variants currently in integrated testing, under the separate EPIP TEMP that DOT&E approved in April 2012.

System

- The AIM-120 AMRAAM is an all-weather, radar-guided air-to-air missile with capability in both the beyond-visual-range and within-visual-range arenas. A single launch aircraft can engage multiple targets with multiple missiles simultaneously when using AMRAAM.
- The AMRAAM program develops and incorporates phased upgrades periodically. AMRAAM EPIP is a software upgrade to AIM-120C3-C7.



- The latest version, the AIM-120C7, incorporated an upgraded antenna, receiver, signal processor, and new software algorithms to counter new threats. The use of smaller system components created room for future growth.
- The AIM-120D is currently in development, and the Air Force intends for it to deliver performance improvements beyond the AIM-120C7 through the use of an internal GPS, an enhanced datalink, and new software.

Mission

- The Air Force and Navy, as well as several foreign military forces, use various versions of the AIM-120 AMRAAM to shoot down enemy aircraft.
- All U.S. fighter aircraft use the AMRAAM as the primary beyond-visual-range air-to-air weapon.

Major Contractor

- Raytheon Missile Systems – Tucson, Arizona
- Rocket Motor Subcontractors:
 - Alliant Techsystems (ATK) – Arlington, Virginia
 - Nammo – Raufoss, Norway

Activity

AIM-120D

- Production of the AIM-120D began in 2006, and developmental testing, which included three integrated developmental/operational test missile shots, began in 2007.
- In 2009, key stakeholders, including the Program Office and DOT&E, suspended progression of the AIM-120D to operational testing due to four performance and reliability deficiencies, including missile lockup, built-in test failures,

aircraft integration problems, and poor GPS satellite acquisition.

- The Air Force accomplished the final developmental/operational test shot in August 2011. Raytheon addressed the four deficiencies, and DOT&E signed the TEMP and separate operational test plan on May 25, 2012. The Air Force conducted an Operational Test Readiness Review in May 2012, and certified the program to begin operational testing in June 2012. Testing

is progressing in accordance with the DOT&E-approved TEMP and test plan.

- AIM-120D operational testing will consist of seven live missile shots and multiple captive-carry events. The Services are projected to complete operational testing in FY14.

AMRAAM EPIP

- DOT&E approved the AMRAAM EPIP TEMP on April 13, 2012, after which integrated testing began.

Lot Acceptance Test/Rocket Motors

- Beginning in December 2011, propellant hot spots, burn through, and failures at low temperatures (-65 degrees Fahrenheit) caused unpredictable Lot Acceptance Test (LAT) failures. ATK, the subcontractor who produces the rocket motors, continues to investigate these failures.
- The Program Office, Raytheon, and AMRAAM safety communities coordinated to certify Nammo to become an approved alternative rocket motor supplier.
- The Program Office has suspended performance-based payments until resolution of the shortage of rocket motors due to unacceptable LAT performance.

Assessment

- The Air Force originally planned for AIM-120D to begin operational testing in 2008; it is now approximately four years behind schedule.
- The Air Force adequately addressed fixes to the four performance and reliability deficiencies that precluded AIM-120D from proceeding to operational testing:
 - Raytheon fixed the built-in test false alarm with a software modification.
 - Raytheon fixed the GPS failure problem with a GPS filter, which was verified with multiple laboratory events and a successful live missile shot.
 - The Air Force and Navy requirements sponsors clarified software requirements, and subsequent software changes reduced the frequency of missile lockups.
 - Software changes mitigated some aircraft integration problems, but more problems will need resolution in a

System Improvement Program following operational testing.

- Since the start of operational testing, the Air Force has executed three live missile shots. The first was a reliability failure most likely due to a grounding wire common to all AMRAAM variants going back to the AIM-120C5. The second live missile shot was the first AIM-120D launch from an F-22 and resulted in a direct hit on the drone. The third was a re-execution of the first live missile shot and the Air Force is awaiting data analysis to determine its success. Additionally, captive-carry performance has been nominal and the Air Force has yet to quantify system reliability.
- The shortage in rocket motors due to unacceptable LAT performance should not significantly affect AIM-120D testing, but it has created a backlog in production. After Insensitive Munitions certification in October 2012, Nammo will be the only AIM-120D and AIM-120C7 rocket motor producer for the foreseeable future. The government and Raytheon are still reviewing a path forward for ATK production.

Recommendations

- Status of Previous Recommendations. The FY07 recommendation for the Program Office to seek changes to the Air Force's full-scale and sub-scale target programs to ensure proper target presentation, target reliability, and availability remains valid. The Air Force has adequately addressed all other previous recommendations.
- FY12 Recommendations.
 1. The Air Force should complete a System Improvement Program within one year of the completion of operational testing to address any remaining aircraft integration problems, as well as any problems discovered during operational testing.
 2. The Program Office should continue root cause analysis of rocket motor LAT failures and keep the Air Force, Navy, and OSD updated on potential impacts to cost, schedule, and performance.