

Patriot / Medium Extended Air Defense System (MEADS)

Executive Summary

- The Army conducted one major developmental Patriot flight test mission and a Post-Deployment Build-7 (PDB-7) Developmental Test and Evaluation (DT&E) in FY11. The Army conducted three major developmental Patriot flight test missions in early FY12.
- The third guided flight of the Patriot Advanced Capability-3 (PAC-3) Missile Segment Enhancement (MSE) interceptor achieved a successful intercept of a ballistic missile target in the extended PAC-3 MSE battlespace.
- In the first three PDB-7 flight tests, Patriot achieved successful intercepts of four short-range ballistic missile targets using PAC-3 and Guidance Enhanced Missile (GEM) interceptors.

System

- The Patriot is a mobile air and missile defense system that counters missile and aircraft threats. The system includes the following:
 - C-band phased-array radars for detecting, tracking, classifying, identifying, and discriminating targets
 - Battalion and battery battle management elements
 - Communications Relay Groups and Antenna Mast Groups for communicating between battery and battalion assets
 - A mix of PAC-3 hit-to-kill missiles and PAC-2 blast fragmentation warhead missiles for negating missile and aircraft threats
- The newest version of the PAC-3 interceptor is the Cost Reduction Initiative (CRI) missile. In addition, the Army is developing the PAC-3 MSE missile with increased battlespace defense capabilities and improved lethality.
- Earlier versions of Patriot interceptors include the Patriot Standard missile, the PAC-2 Anti-Tactical Missile (ATM), and the GEM family (includes the GEM-T and GEM-C missile variants intended to counter tactical ballistic missiles and cruise missiles, respectively).
- The Medium Extended Air Defense System (MEADS) was intended to be a more deployable, mobile, and capable air



and missile defense system than Patriot. Planned MEADS developments included the following:

- Battle management, command, control, communications, computers, and intelligence elements; Ultra High Frequency-band 360-degree surveillance radars; X-band 360-degree multi-function fire control radars; and missile launchers and reloaders
- MSE missiles developed under the Patriot program

Mission

Combatant commanders using Patriot have the capability to defend deployed forces and critical assets from missile and aircraft attack and to defeat enemy surveillance air assets (such as unmanned aerial vehicles) in all weather conditions, clutter, and electronic countermeasure environments.

Major Contractors

- Raytheon Integrated Defense Systems – Tewksbury, Massachusetts
- Lockheed Martin Missile and Fire Control – Dallas, Texas
- MEADS International, Inc. – Orlando, Florida

Activity

Patriot

- The Army began the PDB-7 DT&E on July 27, 2011, at White Sands Missile Range (WSMR), New Mexico. Ground testing runs for record ended on October 7, 2011. Developmental endurance and flight testing is scheduled to complete in January 2012. Data analysis is ongoing.
- A third MSE missile flight test (Flight Test 7-3) was conducted at WSMR in March 2011. Patriot fired two MSE

interceptors at a ballistic missile target. The first MSE intercepted the target and the second intercepted debris from the first intercept.

- During the first PDB-7 flight test (P7-4) at WSMR in November 2011, Patriot fired two PAC-3 missiles at a short-range ballistic missile target. The first PAC-3 intercepted the target. Data analysis is ongoing.

ARMY PROGRAMS

- During the second PDB-7 flight test (P7-3) at WSMR in November 2011, Patriot fired two GEM interceptors at a short-range ballistic missile target. The first GEM intercepted the target. Data analysis is ongoing.
- During the third PDB-7 flight test (P7-2) at WSMR in November 2011, Patriot fired a GEM-T and GEM-C interceptor at each of two short-range ballistic missile targets. The GEM-Ts intercepted both targets. Data analysis is ongoing.
- The Army updated the Test and Evaluation Master Plan, which DOT&E approved on September 1, 2011.
- The next Patriot operational test, the PDB-7 Limited User Test (LUT), is scheduled to begin in 3QFY12.

MEADS

- The DoD has decided not to field MEADS, although it will continue program development through the design and development phase of the program. It is unknown whether Germany or Italy will continue MEADS development after the U.S. withdraws from the program.
- Three MSE developmental flight tests are planned as part of the MEADS test program. They will contribute to future assessments of MSE capability and will support the build up to the PDB-8 IOT&E.

Assessment

- During flight test 7-3, Patriot demonstrated the capability to kill a tactical ballistic missile target with an MSE interceptor in the extended MSE battlespace. The MSE interceptor performance was consistent with preflight predictions and body-to-body impact was achieved, resulting in the destruction of the target. The system met the mission objectives.
- Based on the PDB-6.5 LUT conducted during FY10, DOT&E assesses the current Patriot system as effective against some threats and partially suitable due to poor radar reliability and system availability. There has been substantial variance in Patriot's reliability and resulting availability as observed during testing. The causes of this variance are unknown. Obstacles to adequate T&E of the Patriot PDB-6.5 system included:
 - The lack of lethality information for aircraft, cruise missile, and air-to-surface missile threats used to assess end-to-end system effectiveness.

- The lack of representative Soldier operators during the PDB-6.5 LUT regression test of the Patriot system software that is now in the field.
- The lack of a robust interoperability event.
- The lack of a robust Force Development Experiment, preventing the Army from thoroughly examining tactical standard operating procedures prior to developing Patriot PDB-6.5 tactics, techniques, and procedures. As a result, the engagement procedures used during the PDB-6.5 LUT against some threats led to decreased system performance.
- Not providing suitable time for organizational-level diagnostics and maintenance during operational performance test phases.

Recommendations

- Status of Previous Recommendations. The Army satisfactorily addressed 10 of the previous 16 open recommendations. The Army should still address the following recommendations:
 - Conduct Patriot testing during joint and coalition exercises.
 - Upgrade the Patriot hardware-in-the-loop systems to model electronic countermeasures and identification friend-or-foe systems.
 - Conduct a Patriot flight test against an anti-radiation missile target to validate models and simulations.
 - Review the risks of not conducting all flight tests against ballistic missiles using two interceptors.
 - Improve Patriot training.
 - Have Patriot participate with live interceptors in Terminal High-Altitude Area Defense (THAAD) flight testing.
- FY11 Recommendations. In addition to addressing the above recommendations, the Army should:
 1. Conduct all operational testing regression tests with representative Soldier operators.
 2. Conduct a robust Force Development Experiment prior to the PDB-8 IOT&E to ensure that tactics, techniques, and procedures are adequate to support a successful operational test.