

## Terminal High-Altitude Area Defense (THAAD)

### Executive Summary

- The Terminal High-Altitude Area Defense (THAAD) system intercepted two short-range targets nearly simultaneously in October 2011. The program completed this multiple simultaneous intercept as part of an IOT&E, which included a full battle sequence from planning through intercept under operationally realistic conditions. DOT&E concluded that the IOT&E demonstrated THAAD is operationally effective, operationally suitable, and survivable against the threats and in the environments tested.
- The THAAD system successfully intercepted a medium-range ballistic missile target for the first time in October 2012.
- All planned THAAD Build 1.0 capabilities have not yet been demonstrated. The most significant example is that the performance of the system using the radar advanced algorithm against a complex target has not been scheduled for test until FY14. The algorithm has been implemented in the operational software, but THAAD flight test profiles prior to FY14 are not expected to trigger demonstration of it.
- Redesign and retesting of a number of components are required to address all of the Army materiel release conditions imposed before full materiel release can be granted. In particular, many reliability improvements are required to meet Army requirements with confidence.

### System

- The THAAD ballistic missile defense system consists of five major components:
  - Missiles
  - Launchers
  - Radars (designated AN/TPY-2 (TM) for Terminal Mode)
  - THAAD Fire Control and Communications (TFCC)
  - Unique THAAD support equipment
- THAAD can accept target cues for acquisition from the Aegis Ballistic Missile Defense (BMD), satellites, and other external theater sensors and command and control systems.
- THAAD is intended to complement the lower-tier Patriot system and the upper-tier Aegis BMD system.

### Activity

- Flight Test THAAD Interceptor-12 (FTT-12) IOT&E occurred in October 2011. The test was a multiple simultaneous engagement of two short-range targets. This test supported materiel release of the first two THAAD batteries and future Beyond Low-Rate Initial Production decisions. The THAAD battery performed battle planning, overseas deployment, emplacement, and mission operations under operationally realistic conditions within the constraints of test range safety.



### Mission

U.S. Strategic Command intends to deploy and employ THAAD, a rapid response weapon system, to protect critical assets worldwide. Commanders will use the THAAD kill vehicle to intercept an incoming threat ballistic missile in the endo-atmosphere or exo-atmosphere, limiting the effects of weapons of mass destruction on battlefield troops and civilian populations.

### Major Contractors

- Lockheed Martin Missile and Fire Control – Dallas, Texas
- Lockheed Martin Space Systems Company – Sunnyvale, California
- Raytheon Integrated Defense Systems – Tewksbury, Massachusetts

- The THAAD battery also conducted additional simulated intercept events against a raid, defeating threats generated by the Simulation Over Live Driver (SOLD).
- The combined developmental/operational Flight Test Integrated-01 (FTI-01) in October 2012 included a THAAD engagement against a medium-range target for the first time. The test evaluated interoperability between THAAD; Aegis BMD; Patriot; Command, Control, Battle Management, and

Communications (C2BMC); and AN/TPY-2 Forward-Based Mode (FBM) elements with multiple live targets.

- Ground Test Integrated-04 Israel (GTI-04 ISR) in November 2011, Ground Test Other-04e (GTX-04e) in April 2012, Fast Eagle Increment 1 Hardware-In-The-Loop (HWIL) in June 2012, and GTI-04e in November 2012 included laboratory HWIL representations of THAAD. Interoperability, engagement coordination between the theater elements, and engagement capabilities against short- and medium-range ballistic missiles were tested using BMDS configurations that are deployed or nearing deployment.
- The MDA conducted testing during FY12 in accordance with the DOT&E-approved Integrated Master Test Plan.

## Assessment

- The THAAD and AN/TPY-2 Radar systems performed a successful engagement of two targets during the FTT-12 test. The classified DOT&E February 2012 THAAD and AN/TPY-2 Radar Operational and Live Fire Test and Evaluation Report concluded the following:
  - THAAD is operationally effective against short-range ballistic missile threats of the types tested to date. It has not been demonstrated against medium-range threats. However, empirical data from short-range flight testing, ground testing, and analyses indicate THAAD likely has capability against medium-range threat missiles.
  - THAAD is operationally suitable. Nevertheless, examination of reliability data, ground test results, challenges encountered during testing, and Soldier feedback indicate that THAAD has suitability-related limitations. Adequate availability and maintainability were demonstrated, but testing identified maintenance shortfalls. Different failure modes were seen in two tests creating uncertainty in the Mean Time Between System Abort. Improvements are also needed in deployability, manpower and training, human factors engineering, and interoperability.
  - THAAD is survivable in chemical, biological, radiological, and external electromagnetic environments. It has not been tested in electronic warfare environments.
- Conditional Materiel Release of the first two THAAD batteries in February 2012 included 39 conditions that need to be resolved before a full materiel release could be granted. The THAAD Project Office and the Army have begun to address these conditions including verification testing of the thermally initiated venting system on the interceptor, electrical stress testing of the optical block in the interceptor flight sequencing assembly, and validation and verification demonstrations of changes and updates to the technical manuals. Four

conditions (equipment grounding, air load certification, spares transport shelter, and the Surface Deployment and Distribution Command-Transportation Engineering Agency transportability certification) have been closed. Analyses of data collected during the FTI-01 test are ongoing, which potentially will close eight additional conditions. Fixes and testing of remaining conditions are scheduled through 2017.

- Initial assessment from the FTI-01 test mission data indicated that the THAAD system successfully intercepted a medium-range ballistic missile target. The interoperability assessment between THAAD and other elements based on FTI-01 test data is ongoing.
- Ground tests utilizing HWIL representations of THAAD demonstrated interoperability and engagement coordination between THAAD and other theater elements revealing problems that need to be addressed for multi-element coordination.

## Recommendations

- Status of Previous Recommendations. The MDA has satisfactorily addressed all previous THAAD recommendations.
- FY12 Recommendations. The MDA and the Army have begun to address the 22 THAAD recommendations contained in the classified DOT&E February 2012 THAAD and AN/TPY-2 Radar Operational and Live Fire Test and Evaluation Report. Fifteen of the recommendations align directly with the Army materiel release conditions, which are being addressed through a corrective action plan agreed to by the THAAD Project Office and the Army. Of the remaining seven recommendations, three are classified (Effectiveness #2, Effectiveness #5, and Survivability #4). The four remaining unclassified recommendations are:
  1. The MDA and the Army should reassess the required spares and tools (including their quantities) that should be on site with the battery based on all available reliability and maintainability data (Suitability #5).
  2. The MDA and the Army should define duties related to THAAD at the brigade level. Until a battalion is established for THAAD, it should also define duties and training for THAAD battery personnel on any required battalion-level duties (Suitability #10).
  3. The MDA and the Army should implement equipment redesigns and modifications identified during natural environment testing to prevent problems seen in testing (Suitability #11).
  4. The MDA and the Army should conduct electronic warfare testing and analysis (Survivability #3).