

Terminal High-Altitude Area Defense (THAAD)

Executive Summary

- The Missile Defense Agency (MDA) conducted one tracking exercise to demonstrate Terminal High-Altitude Area Defense (THAAD) interoperability with the Patriot system.
- The Army Research Laboratory Survivability/Lethality Analysis Directorate (ARL/SLAD) conducted a Cooperative Vulnerability and Penetration Assessment (CVPA) with THAAD to identify cybersecurity vulnerabilities. The Army Threat Systems Management Office (TSMO) conducted an Adversarial Assessment (AA) with THAAD to support a cybersecurity survivability assessment.
- THAAD participated in three Ballistic Missile Defense System (BMDS) ground tests, providing information on THAAD interoperability and functionality within the BMDS for various regional/theater scenarios.
- The THAAD program continued to address deficiencies from the first conditional materiel release in February 2012. The program completed urgent software releases of THAAD system software builds TH 2.8.2 and TH 2.8.3.
- The THAAD program made progress in resolving missing documentation and addressing limitations that affect THAAD models and simulations. The BMDS Operational Test Agency accredited two THAAD models and simulations with associated limitations.
- Testing in FY18 demonstrated that THAAD training, documentation, and reliability deficiencies, previously reported in DOT&E Annual Reports, persist.

System

- THAAD complements the lower-tier Patriot system and the upper-tier Aegis Ballistic Missile Defense (BMD) system. It is designed to engage threat ballistic missiles in both the endo- and exo-atmosphere.
- THAAD consists of five major components:
 - Missiles
 - Launchers
 - AN/TPY-2 Radar (Terminal Mode)
 - THAAD Fire Control and Communications
 - THAAD Peculiar Support Equipment
- THAAD can provide and accept target cues for acquisition from Aegis BMD, from other regional sensors, and through command and control systems.



Mission

The U.S. Northern Command, U.S. Indo-Pacific Command (USINDOPACOM), U.S. European Command (USEUCOM), and U.S. Central Command (USCENTCOM) intend to use THAAD to intercept short- to intermediate-range ballistic missile threats in their areas of responsibility. The U.S. Strategic Command deploys THAAD to protect critical assets worldwide from these same threats.

Major Contractors

- Prime: Lockheed Martin Corporation, Missiles and Fire Control – Dallas, Texas
- Interceptors: Lockheed Martin Corporation, Missiles and Fire Control – Troy, Alabama
- AN/TPY-2 Radar (Terminal Mode): Raytheon Company, Integrated Defense Systems – Tewksbury, Massachusetts

Activity

- The MDA conducted all testing in accordance with the DOT&E-approved Integrated Master Test Plan.
- The THAAD program re-prioritized and accelerated capability development to support the U.S. Forces Korea (USFK) Joint Emergent Operational Need (JEON), issued in February 2017.
- Three BMDS ground tests using THAAD hardware-in-the-loop representations and THAAD Digital representations provided information on THAAD interoperability and functionality in various regional/theater scenarios:

FY18 BALLISTIC MISSILE DEFENSE SYSTEMS

- In Ground Test Integrated-07b (GTI-07b) USEUCOM/USCENTCOM (E/C) in April 2018, the MDA examined USEUCOM and USCENTCOM defense using THAAD 3.0.0 software.
 - In Ground Test-18 (GT-18) Sprint 1 in April 2018, the MDA examined USINDOPACOM defense using THAAD 3.0.0 software.
 - In Ground Test Distributed-07b (GTD-07b) (E/C) in September 2018, the MDA again examined USEUCOM and USCENTCOM defense using THAAD 3.0.0 software.
 - The MDA conducted one tracking exercise, Flight Test Other-35 (FTX-35), in April 2018 at White Sands Missile Range, New Mexico, to test THAAD and Patriot interoperability.
 - THAAD tracked a close-range ballistic missile (CRBM) target, exchanged messages with a Patriot battery, and supported a THAAD Fire Control/Communications firing solution.
 - The THAAD battery consisted of THAAD Configuration 2 hardware, THAAD 3.0.0 software, one launcher equipped with simulated interceptors, THAAD Fire Control and Communications, and the AN/TPY-2 radar (Terminal Mode) with x86 architecture.
 - ARL/SLAD, in support of the MDA, conducted a CVPA on the THAAD battery with THAAD 3.0.0 software in March 2018 in accordance with the DOT&E-approved test plan.
 - TSMO, in support of the MDA, conducted an Adversarial Assessment (AA) on the THAAD battery with THAAD 3.0.0 software in April 2018 in accordance with the DOT&E-approved test plan.
 - The THAAD program continued to address deficiencies from the first conditional materiel release. The program completed urgent software releases of the THAAD system software builds TH 2.8.2 and TH 2.8.3.
- will be published in the classified DOT&E “FY18 Assessment of the BMDS” in February 2019. THAAD made progress in addressing model limitations and both Simulation Over Live Driver and Real-time Integrated Simulation and Tactical Software received accreditation recommendations, with associated limitations, for the GTD-07b event.
- In FTX-35, the MDA demonstrated THAAD interoperability with a Patriot battery by exchanging messages over tactical networks while simultaneously tracking a CRBM target.
 - Testing in FY18 demonstrated that THAAD training and documentation deficiencies persist. DOT&E detailed these problems and made recommendations to fix them in the FY17 DOT&E Annual Report.
 - To address THAAD launcher reliability problems, the Army tested five launchers using prototype 3-kilowatt generators with hardware improvements at WSMR, demonstrating the potential to improve the generator reliability to meet the manufacturer’s specification for Mean Time Between Failure. The Army has addressed workmanship, maintenance, and procedural issues uncovered during testing and the Expeditionary Energy and Sustainment Systems Project Office (3-kilowatt generator project office) has plans to test.
 - During FTX-35, the unit (soldiers and contractor logistical support) experienced numerous problems integrating the new x86 radar and synchronizing the new prime power unit (PPU) with legacy PPU. Details are classified and will be published in the classified DOT&E “FY18 Assessment of the BMDS” in February 2019.
 - The MDA and the Army continued to address deficiencies from the Army’s first conditional materiel release in FY12 and the conditional software materiel release for THAAD system software build TH 2.2.0 that affect fielded hardware and software. The THAAD program successfully addressed all conditions for the Institutional Conduct of Fire Trainer, transitioning it to a full training materiel release.

Assessment

- The THAAD Project Office improved its approach to cybersecurity assessments in FY18 by working across the MDA and with the Army to develop a comprehensive test plan. Its approach serves as a model for cybersecurity testing on other BMDS programs.
- During GTI-07b (E/C), GT-18 Sprint 1, and GTD-07b (E/C), the MDA demonstrated aspects of THAAD functionality in different theater scenarios to support BMDS Increment 5, European Phased Adaptive Approach (EPAA) Phase 3, and USFK JEON. The BMDS Operational Test Agency reported findings that affect THAAD interoperability, track management, and radar functions. Details are classified and

Recommendations

The MDA should:

1. Address limitations stated in the MDA and BMDS Operational Test Agency accreditation for ground testing of THAAD models and simulations.
2. Address the cybersecurity findings from the FY18 CVPA and AA.
3. Coordinate with the Office of the Deputy Assistant Secretary of Defense (Developmental Test and Evaluation) to evaluate cybersecurity during DT prior to OT.