

## Technology Programs

### Executive Summary

- The Missile Defense Agency (MDA) advanced the development of a number of technology programs, in particular, the Airborne Laser (ABL), the Precision Tracking Space System (PTSS), and the Airborne Infrared (ABIR) system.
- In February 2010, the ABL negated a liquid-fueled, metal-casing missile. A subsequent attempt to negate a similar target at twice the engagement range ended unsuccessfully due to a technical problem. In 2QFY10, the ABL became a national test bed, known as the Airborne Laser Test Bed (ALTB). The Department of Defense is currently assessing the future of the ALTB.
- The Precision Tracking Space System (PTSS) is pursuing a vigorous pre-launch technology development program, incorporating innovative infrared focal plane arrays, optical telescope designs, cooling systems, and on- and off-board data processing. In addition, PTSS is using the Space Tracking and Surveillance System (STSS) and the Near-Field Infrared Experiment (NFIRE) satellites to collect background and target flight test data to inform the PTSS design. In FY10, the MDA identified eight PTSS knowledge points with estimated completion dates through FY15.
- For the ABIR technology program, the MDA used existing unmanned aerial vehicle platforms and sensors to collect data during two flight tests in FY10. The MDA is currently working to identify a set of ABIR knowledge points with tentative completion dates through 1QFY13.

### Systems

#### ALTB

The ALTB is a national test bed operated by the MDA. It consists of:

- A modified Boeing 747-400F commercial aircraft.
- A megawatt-class chemical oxygen-iodine laser.
- A laser turret on the aircraft nose and two illuminator lasers on a bench in the fuselage.
- Optical benches with highly sensitive cameras, sensors, and mirrors.
- Hardware and software for battle management, command, control, communications, computers, and intelligence.
- Ground support equipment for storing, mixing, transporting, and loading laser chemicals.

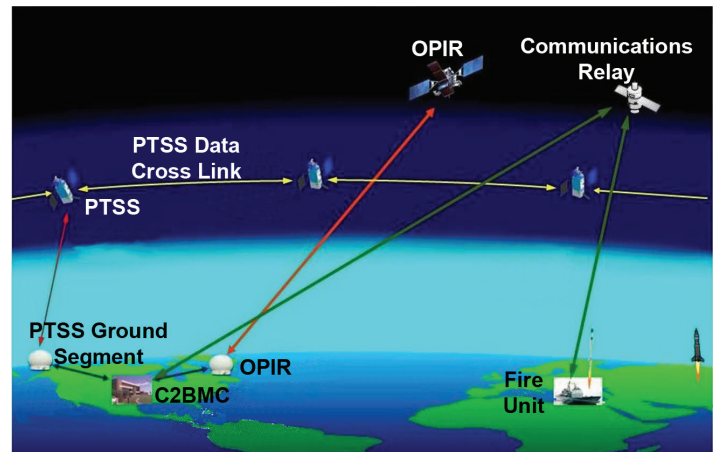


ALTB

#### PTSS

The PTSS, a follow-on to the STSS, is an advanced technology program that will consist of a:

- Low-earth-orbit satellite constellation (space segment) capable of the optical detection, tracking and characterization of ballistic missile target complexes from post-boost through the re-entry stages of flight.
- Ground segment capable of forwarding cues and tasking to the space segment and, receiving and processing sensor image data, and relaying detection information to command and control nodes.



C2BMC – Command, Control, Battle Management, & Communications

OPIR – Overhead Persistent Infrared

PTSS – Precision Tracking Space System

#### PTSS

#### ABIR

The ABIR is an advanced technology program that will consist of:

- Existing unmanned aerial vehicles (UAVs) modified to carry sensors, which can detect ballistic missiles in early stages of flight.
- Ground control stations for forwarding taskings to UAVs and relaying detection and tracking messages to command and control nodes.



ABIR

## Missions

### ALTB

As a test bed, the ALT B does not have an operational mission and is not equipped to be an operational asset. The future function and direction of the test bed, including amount and type of testing, is still being assessed. Currently, the ALT B has the capability to:

- Autonomously acquire and track threat ballistic missiles using its passive infrared sensors.
- Establish precise track on the missile nose and an aimpoint on the propellant tank using its illuminator lasers.
- Potentially destroy a missile by placing laser thermal energy on the tank or motor case to weaken the casing, allowing internal pressure to rupture the tank.

### PTSS

Combatant Commanders intend to use the PTSS, a space based sensor element of the Ballistic Missile Defense System (BMDS), to:

- Track medium-range and intermediate-range ballistic missiles from post-boost through re-entry based on boosting tracks provided to PTSS by other space-based assets.
- Provide individual sensor track data to Command, Control, Battle Management, and Communications (C2BMC) for the

generation of engagement quality tracks. Initially, PTSS will support Standard Missile-3 engagements while the support for engagements using other interceptors will be developed later.

### ABIR

Combatant Commanders intend to use ABIR, together with other forward sensors to:

- Acquire, track, and assess ballistic missile events during early stages of flight.
- Report tracking information to C2BMC for engaging ballistic missile threats.

### Major Contractors

- ALT B: Boeing, Integrated Defense Systems – Chicago, Illinois
- PTSS: To-be-determined following competitive bids and contractor selection
- ABIR: To-be-determined following competitive bids and contractor selection

## Test and Evaluation Activity and Knowledge Point Progress

For the technology programs, the MDA uses knowledge points to measure development progress by focusing on the set of critical activities that define each program's risk. This approach allows the MDA to make informed decisions on advancement of a development activity.

### ALTB

- Since becoming a test bed managed outside the MDA, the system no longer has knowledge points.
- In January 2010, in accordance with the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, Section 235, DOT&E submitted a Report to Congress on the Assessment of Operational Effectiveness, Suitability, and Survivability of the Airborne Laser (ABL).
- In February 2010, the system had its first lethality demonstration, negating a liquid-fueled missile with a metal casing.
- In September 2010, after overcoming a number of technical problems during ground and flight test preparations, a subsequent attempt to negate a similar target at twice the engagement range of the February 2010 demonstration ended unsuccessfully when an automatic safety feature shut down the laser before it could successfully negate the target.

### PTSS

- The STSS demonstration program and the NFIRE program are supporting the development and fielding of PTSS by acting as surrogate sensors. A series of targeted observations already have increased and will continue to increase the PTSS team's knowledge of the low-earth-orbit

environment and possible constellation operational concepts.

- In addition to flight testing, the MDA plans to use the combination of analysis and hardware-in-the-loop testing to address the following PTSS knowledge points:
  1. Provisional identification of payload wavebands. The MDA completed this knowledge point in FY10.
  2. Provisional Quality of Service levels and deadlines; mass raid scheduling algorithms. The MDA completed this knowledge point in FY10.
  3. Provisional communications architecture defined; analysis of throughput, latency, and failure modes. The MDA completed this knowledge point in FY10.
  4. Concept of operations, end-to-end functional flow, and timing budgets under realistic raid loads. The MDA completed this knowledge point in 4QFY10.
  5. Optical payload processor and communication payload that can handle raid environment. The MDA plans to complete this knowledge point in 4QFY11.
  6. Payload design successfully operates against realistic backgrounds and signatures. The MDA plans to complete this knowledge point in 4QFY12.
  7. Space qualified payload successfully operates under realistic raid loads. The MDA plans to complete this knowledge point in 2QFY14.
  8. End-to-end operational readiness test of space segment (two spacecraft) and ground segment. The MDA plans to complete this knowledge point in 3QFY15.

## ABIR

- The MDA is executing a plan that uses a combination of existing UAV platforms and sensors and a sequence of knowledge points to demonstrate the ABIR capability.
- In FY10, ABIR participated in two Ground-based Midcourse Defense (GMD) flight tests, Flight Test GMD-06 (FTG-06) in January 2010 and BVT-01 in June 2010. The platform, sensor, and ground equipment performed nominally and collected interceptor launch data. ABIR also participated in three additional flight tests during FY10, the Navy's Stellar Daggers flight test in December 2009, the ALTB lethality demonstration in February 2010, and THAAD's FTT-14 in June 2010. The ABIR team is analyzing the flight test data.
- The MDA identified the following candidate knowledge points, which will be completed using flight testing with the existing hardware:
  1. Measure ability of ABIR to generate a 2-dimensional track with sufficient accuracy and timeliness to support Aegis engagements. The MDA plans to complete this knowledge point in 4QFY11.
  2. Measure the ability to extract feature data with a two-color infrared sensor for discrimination. The MDA plans to complete this knowledge point in 3QFY12.
  3. Measure the raid size capacity of ABIR. The MDA plans to complete this knowledge point in 1QFY13.

## Recommendations

- Status of Previous Recommendations. There were no recommendations for FY09.
- FY10 Recommendations. None.

# BALLISTIC MISSILE DEFENSE SYSTEMS