

Sensors

Executive Summary

- In July 2008, the Missile Defense Agency (MDA) conducted the Flight Test Other-03 (FTX-03) non-intercept sensors-only flight test that used the AN/TPY-2 (Forward-Based Mission (FBM)) radar, the Aegis AN/SPY-1 radar, the Sea-based X-band (SBX) radar, and the Upgraded Early Warning Radar-Beale (UEWR-Beale). However, a target subsystem failure precluded the collection of some important sensor data.
- The MDA used several other field test targets of opportunity and multi-sensor satellite track calibration exercises to gather data for verification, validation, and accreditation of models and simulations of critical system functions including Sensor Registration, System Track, and Discrimination. Although progress is being made, no Ballistic Missile Defense System (BMDS) sensors have high fidelity performance models and simulations verified, validated, and accredited for use by the BMDS Operational Test Agency (OTA) Team.

System

The BMDS sensors are:

- Cobra Dane radar: An L-band single-face (120-degree azimuth field of view), phased array radar located at Shemya, Alaska.
- SBX radar: An X-band single-face, phased array radar on a movable mount, positioned on a fifth generation twin-hulled, semi-submersible, self-propelled ocean-going platform, home-ported at Adak, Alaska.
- Upgraded Early Warning Radars (UEWRs): Ultra High Frequency fixed site, fixed orientation, phased array radars located at Beale Air Force Base, California (2 faces, 240-degree azimuth field of view), and Fylingdales, England (3 faces, 360-degree azimuth field of view).
- AN/TPY-2 (FBM) for Forward-Based (formally called Forward based X-band Transportable (FBX-T) Radar): A Terminal



Cobra Dane



SBX



UEWR



AN/TPY-2

High-Altitude Area Defense high resolution, X-band, phased array radar with modified software to provide acquisition and tracking of ballistic missiles of all ranges in the boost phase and transition to midcourse phase of flight. The radar is operationally deployed at Shariki, Japan.



Aegis BMD

- Aegis Ballistic Missile Defense (BMD) radars: Aegis AN/SPY-1 radars modified to provide surveillance and tracking of long-range ballistic missiles.
- Space-Based Infrared System (SBIRS): An infrared satellite constellation and ground station that provides the BMDS with the initial notification of a ballistic missile launch and defended area determination.



SBIRS/DSP

Mission

U.S. Strategic Command, U.S. Northern Command, U.S. European Command, U.S. Pacific Command, and U.S. Central Command warfighters will use the BMDS sensors to:

- Detect, track, and classify ballistic missile threats targeting the United States, its allies, and its friends
- Provide situational awareness data to the BMDS Command, Control, Battle Management, and Communications (C2BMC) element
- Generate weapon task plans for ballistic missile defensive systems such as Aegis BMD and Ground-based Midcourse Defense (GMD)

Prime Contractors

- Aegis AN/SPY-1: Lockheed Martin
- AN/TPY-2: Raytheon
- Cobra Dane: Raytheon
- SBIRS: Lockheed Martin
- SBX: Boeing
- UEWRs: Raytheon

Activity

- **Cobra Dane:** Due to its location and field of view, Cobra Dane cannot participate in current BMDS intercept flight test events. During the past year, it participated in several ground test events, culminating in the system-level Ground Test Distributed (GTD)-02 and Ground Test Integrated (GTI)-03 events in November 2007 and June 2008, respectively. It did adequately track targets of opportunity in the missile defense mode.
- **SBX:** SBX collected track and discrimination data on the Glory Trip-196, -197, and -194 inter-continental ballistic missile targets from April to August 2008, and participated in several ground test events, culminating in the system-level GTD-02 and GTI-03 events. SBX also participated in the Flight Test Other (FTX)-03 non-intercept sensors and target-only flight test.
- **UEWR:** UEWR-Beale participated in the FTX-03 flight test. The UEWRs (Beale and Fylingdales) also participated in several MDA system-level ground-test events, culminating in the system-level GTD-02 and GTI-03 events. UEWR Beale collected data on the Glory Trip-196, -197, and -194 inter-continental ballistic missile targets from April to August 2008.
- **AN/TPY-2 (FBM):** The AN/TPY-2 (FBM) radar observed the Glory Trip-197 inter-continental ballistic missile target as risk reduction for future flight tests in May 2008. The MDA then moved the radar to its test site in Juneau, Alaska, in support of FTX-03. The operational radar at Shariki also participated in several ground-test events, culminating in the November 2007 GTD-02 event, the June 2008 GTI-03 event, and extended operational periods as part of certification activities.
- **Aegis BMD:** Aegis BMD participated in multiple live-tracking exercises, ground tests, and real-world operations during FY08, including FTX-03 and the planned FTT-10. Its ground test participation culminated in the system-level GTD-02 and GTI-03 events.
- **SBIRS:** SBIRS participated in several ground tests culminating in the distributed ground test GTD-02 in November 2007 and the June 2008 hardware-in-the-loop GTI-03 test events.
- **BMDS Sensors:** The collection of BMDS sensors were used to collect precision track information on a failed U.S. satellite. The integrated track data was used by Aegis BMD to develop a fire control solution to direct a modified SM-3 interceptor to destroy the satellite prior to re-entry.
- The MDA used several single and multi-sensor satellite calibration exercises to gather data for verifying and validating models and simulations.

Assessment

- **Cobra Dane:** Performance estimates for Cobra Dane are limited to the ground test results and the targets of opportunity. These estimates rely on models and simulations that are not yet verified, validated, and accredited for use in assessing performance. This will require the MDA to fly another target through the Cobra Dane field of view. The MDA has agreed that this is necessary, but has not yet scheduled this test.
- **SBX:** SBX has yet to successfully support a live intercept mission. SBX successfully tracked the target in FTX-03, but did not collect important test data due to a target subsystem failure.
- **UEWRs:** UEWR-Beale successfully tracked the target in FTX-03, but did not collect important test data due to a target subsystem failure.
- **AN/TPY-2 (FBM):** The second AN/TYP-2 was successfully relocated to Juneau, Alaska, to participate in FTG-04. After the MDA restructured the flight test program, the AN/TYP-2 radar successfully tracked the target in FTX-03 and transmitted this data to C2BMC.
- **Aegis BMD:** Aegis BMD continues to evaluate its interoperability with the BMDS, and continues to support BMDS testing and real-world activities. Aegis BMD collected valuable BMDS mission support performance data during long-range surveillance and track exercises and real-world events. During FTX-03, Aegis BMD successfully tracked the target in FTX-03, but did not collect important test data due a target subsystem failure.
- **SBIRS:** SBIRS continues to improve the ability to support the BMDS with timely and accurate launch and predictive impact data.
- **Overall:** As each sensor finishes upgrades or development, it is demonstrating the ability to provide accurate and timely data to support successful BMDS intercepts.

Recommendations

- **Status of Previous Recommendations.** One of the previous nine recommendations remains valid.
- **FY08 Recommendation.**
 1. The MDA must extend its Post Flight Reconstruction methodology to this year's flight tests to support verified, validated, and accredited sensor models.