Sensors

Executive Summary

- In May 2007, the Missile Defense Agency (MDA) attempted the FTG-03 intercept flight test that would have used the Upgraded Early Warning Radar-Beale (UEWR-Beale) to provide a weapon task plan. However, the target vehicle failed prior to acquisition by the UEWR-Beale. Using the UEWR-Beale, FTG-03a (the retest) successfully completed in September 2007, meeting all test objectives.
- In FTX-02, the MDA launched a target from Vandenberg Air Force Base, primarily to allow the Sea-based X-band (SBX) Radar and Aegis Ballistic Missile Defense (Aegis BMD) to collect data to generate weapon task plans for simulated intercepts. SBX exhibited some anomalous behavior. The MDA adjusted software and performance parameters and used SBX to successfully collect test data during FTG-03a.
- No BMDS sensors have high fidelity performance models and simulations validated and accredited for use by the Joint Operational Test Agency.


Cobra Dane


SBX


UEWR

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.
- 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 Mission (formally called Forward-based X-band-Transportable (FBX-T) Radar): a Terminal 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 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.


AN/TPY-2


Aegis BMD


SBIRS/DSP

Mission

U.S. Strategic 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 C2BMC element
- Generate weapon task plans for ballistic missile defensive systems such as Aegis BMD and GMD

Activity

- Cobra Dane: Due to its location and field-of-view, Cobra Dane cannot participate in BMDS intercept flight test events. During the past year, it participated in several ground test events.
- SBX: SBX participated in the FTX-02 flight test. During this test, SBX exhibited some anomalous behavior. The MDA adjusted software and performance parameters and used SBX to collect test data during FTG-03a.

- UEWRs: The BMDS will use several UEWRs for radar detection, tracking, and classification. The MDA planned to use UEWR-Beale during FTG-03. However, the ballistic missile target for this event failed prior to entering the coverage volume of the radar, precluding the collection of any radar data. Using the UEWR-Beale, FTG-03a (the retest) successfully completed in September 2007, meeting all test objectives. The MDA successfully demonstrated UEWR-Fylingdales performance during GTI-02.
- AN/TPY-2 (FBM): The MDA moved the first AN/TPY-2 to its objective deployed location in Shariki, Japan, where it has undergone electromagnetic radiation surveys and executes daily performance monitoring and calibration. Before the move, the radar participated in GTD-01 with operational communications from the interim deployed location in Shariki, Japan. The second AN/TPY-2 is at Vandenberg Air Force Base, where it completed basic integration and testing. The MDA has installed the anti-tamper technology at the Vandenberg AFB radar and plans to complete verification by end of CY07. The MDA is preparing the radar to move to Juneau, Alaska, for FTG-04. It participated in three flight tests: Glory Trip-193, FTX-02, and FTG-03a (as an interceptor radar range sensor and was not part of the BMDS system under test.) The hardware-in-the-loop facility participated in the GTX-02a and GTI-02 system ground tests with more threat representative scenarios than in the GTD-01 campaign. The hardware-in-the-loop facility also participated in a few BMDS-level ground tests. In support of the FTG-04 flight test in FY08, the MDA negotiated and built a dedicated test site at Juneau, Alaska, which allows the AN/TPY-2 (FBM) radar to participate as a forward-based sensor and pass track data on a target launched from Kodiak, Alaska.
- Aegis BMD: Aegis BMD participated in multiple live tracking exercises, ground tests, and real-world operations during FY06. These events exercised the long-range surveillance and track capability of the Aegis BMD radar and demonstrated interoperability with the BMDS.
- SBIRS: During FY07, SBIRS participated in four ground tests and seven flight tests. These tests exercised the SBIRS-C2BMC active interface. This interface, which the Air Force declared operational in February 2007, enables C2BMC to receive early warning data directly from SBIRS instead of going through a GMD communications network. The software baseline release 7-1 underwent an operational trial period and may be declared the new operational baseline in late FY07.

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 validated and accredited for use in operational evaluations. This will require the MDA to fly another target through the Cobra Dane field of view.
- SBX: SBX has yet to support a live intercept as the primary sensor. The MDA adjusted software and performance parameters prior to FTG-03a. Subsequently, SBX performed well in a data collection mode during FTG-03a. The MDA must complete its analysis of SBX performance before finalizing the SBX role in the BMDS.
- UEWRs: The UEWR-Beale successfully tracked the target during FTG-03a. It provided the data required to generate the weapon task plan for the interceptor launched from Vandenberg Air Force Base. In FY07, the MDA declared UEWR-Fylingdales as an early capability delivery radar, but not as part of the BMDS operational baseline. The MDA will assess the radar's suitability for inclusion in the BMDS after GTD-02.
- AN/TPY-2 (FBM): The first AN/TPY-2 was primarily occupied with set-up at the objective site. Glory Trip-193, FTX-02, and FTG-03a allowed the second AN/TPY-2 to demonstrate some new capabilities and more advanced tasking from both C2BMC and the External Sensors Laboratory, although these tests did not represent operational test geometries. Additionally, in July 2007, U.S. Pacific Command used results from a warfighter capability demonstration of the AN/TPY-2, positioned in its operational location at Shariki, Japan, to declare the radar Partially Mission Capable. AN/TPY-2 and C2BMC are both preparing for major software upgrades starting next year. The MDA will need to accomplish additional testing to demonstrate the new capabilities.
- 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. Aegis BMD has yet to participate in a BMDS flight test that uses AN/SPY-1 radar data in real-time to develop a GMD weapon task plan.
- SBIRS: SBIRS has demonstrated 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 intercepts for the BMDS.

Recommendations

- Status of Previous Recommendations. Three of the six FY06 DOT&E recommendations remain valid. The MDA does not plan to fly another target through the Cobra Dane radar field of view to verify the software fixes that resulted from FT 04-5 before FY10 (FY06). The MDA has not yet used SBX or Aegis BMD as the primary sensor to provide the radar intercept data during a flight test that culminated in an actual target intercept using a GMD interceptor (FY06). Before deploying the second AN/TPY-2 radar, the MDA should use it as the primary sensor generating the radar intercept data during a flight test that culminates in an actual target intercept using a GMD interceptor (FY06).
- FY07 Recommendations. None.