Ground-Based Midcourse Defense (GMD)

Executive Summary

- The Missile Defense Agency (MDA) intercepted a threat representative target for the second time with an interceptor launched from an operationally-configured silo using data from a deployed radar.
- The MDA increased the operational realism of its flight tests employing both assets and warfighters in a more operationally realistic manner.
- Robust integrated ground testing continues to provide valuable insight into system behavior and capability.
- Available flight test data, consistent with or indicative of system maturity, impedes evaluation of effectiveness, relability, suitability, and survivability, and is a factor limiting validation of models and simulations.
- Ground test events and digital simulations are critical to performance assessment. Lack of accredited models and simulations continues to be a problem that limits confidence in results from these events.

System

Ground-based Midcourse Defense (GMD) is the principal element used by the Ballistic Missile Defense System (BMDS) for the homeland defense mission. The current distributed GMD configuration consists of the following systems:

- Cobra Dane Upgrade Radar at Eareckson Air Station (Shemya Island), Alaska
- Upgraded Early Warning Radars (UEWR) at Beale Air Force Base, California, and Fylingdales, United Kingdom
- Ground-based Interceptor (GBI) missiles at Fort Greely, Alaska, and Vandenberg Air Force Base, California
- GMD Fire Control (GFC) / Communications at the Missile Defense Integration and Operations Center, Schriever Air Force Base, Colorado; and Fort Greely, Alaska. The GFC includes In-Flight Interceptor Communications System (IFICS) Data Terminals (IDTs) at Vandenberg Air Force Base, Colorado, Fort Greely, Alaska, and Shemya Island, Alaska.
- External interfaces include Aegis BMD; Cheyenne Mountain Directorate, Colorado; Command, Control, Battle Management, and Communications (C2BMC), Peterson Air Force Base, Colorado; Space-Based Infrared System (SBIRS), Buckley Air Force Base, Colorado; and AN/TPY-2 radar (formerly called the Forward-based X-band Transportable radar, or FBX-T), Shariki Air Base, Japan

Mission

U.S. Strategic Command operators will use the GMD system to defend U.S. territory, deployed forces, friends, and allies against threat ballistic missiles (intercontinental and intermediate range missiles).

Activity

- The GMD program is in the development phase. The MDA testing included:
  - Flight Test Other-2 (FTX-02) occurred in March 2007 and was a long-range target launched from Vandenberg Air Force Base, California. The target flew across radar viewing volumes of the Sea-based X-band (SBX) radar and two Aegis BMD SPY-1 radars to characterize radar and BMDS performance.
  - Flight Test Ground-based Interceptor-3 (FTG-03) occurred in May 2007 and was an intercept attempt that was declared a “no-test” when the target failed to reach the defended area. The interceptor was not launched.
  - FTG-03a occurred on September 28, 2007, as a repeat of the FTG-03 “no test” in May 2007. The MDA launched a target from Kodiak Launch Complex, Alaska. Using radar data from the Beale UEWR, the MDA intercepted the target using a GBI launched from Vandenberg Air Force Base.
  - Five GMD-centric and BMDS-centric ground tests and one fully digital end-to-end BMDS simulation to support characterization of GMD performance within the BMDS.

- SBX underwent sea trials and journeyed round trip from Hawaii to the vicinity of the Alaskan Aleutian Island chain.
- The MDA scheduled a new flight test, FTG-03a, to repeat FTG-03. This delayed FTG-04 to FY08. Subsequent to the FTG-03 "no-test," the MDA delayed ground tests including Ground Test Distributed-02 (GTD-02), which the MDA delayed to FY08.
- The MDA fielded new sensors, more interceptors, and upgraded software into the GMD architecture.
  - Sensors: The MDA fielded the AN/TPY-2 radar at Shariki Air Base in Japan and the UEWR at Fylingdales, United Kingdom.
  - Interceptors: The MDA emplaced 10 additional interceptors at Fort Greely, Alaska, and one additional at Vandenberg Air Force Base, California, bringing the total number of operational interceptors to 24.
  - Software: The MDA upgraded the GFC software from version 4B.1.2.3 to version 6A.1.6 in FY07.
- The MDA delayed fielding of a second AN/TPY-2 and the SBX pending further development and testing. The MDA utilized the SBX for FTX-02 (target only) and FTG-03a though it did not participate in directing the FTG-03a engagment.
- Warfighters participated in MDA flight and ground tests and conducted their own exercises, wargames, demonstrations, and training.

Assessment

- Ground and flight tests enabled characterization of GMD performance within the BMDS, but limited flight test data and limited accreditation of ground tests and digital simulations prevented performance evaluation. The limited flight test data reflects the current maturity and developmental nature of the system. The limited accreditation reflects the inability of model development and accreditation based on test results to keep pace with development and fielding.
  - FTX-02 demonstrated capable SBX performance and potential, but also uncovered some unanticipated, undesirable performance. The MDA analyzed these test results and is modifying the radar software.
  - FTG-03a demonstrated an end-to-end test of the system for a single engagement sequence group, target hit, and warfighter execution within a limited threat representative scenario. Several aspects of the engagement were representative of an unsophisticated threat, such as lacking specific target suite dynamic features and intercept geometry. Several other aspects were realistic of a particular engagement, but relatively unchallenging, such as closing velocity and fly out range.
  - As a result of the target failure during FTG-03, the MDA executed only one of two planned intercept flight tests indicative of the complexity of developing and testing the GMD. The slow pace of intercept flight testing impeded verification and validation of ground test models and digital simulations.
  - Ground tests demonstrated system behavior and supported warfighter exercise of tactics, techniques, and procedures. These tests also uncovered unanticipated, undesirable system performance features that the MDA addressed, is addressing, or plans to address.
  - Ground tests supported system characterization, but not performance evaluation due to limited validation, lack of transparency into model accreditations, and absence of accreditation by an independent agency.
- Effectiveness and suitability were limited consistent with the maturity of the fielded system. The MDA fielded capability continually, component-by-component and software build-by-software build, commensurate with the MDA spiral development plan.
- Intercept tests FTG-03 and FTG-03a incorporated operational realism consistent with the maturity of the fielded system:
  - Used production GBI and production kill vehicle
  - Used deployed sensors for engagement planning and execution.
  - Exercised a single engagement sequence group in end-to-end system test with multiple sensors providing the GFC with tracks of the threat
  - Warfighters operated the GFC, all other command and control nodes, and the Beale UEWR, the primary intercept sensor
- Warfighters demonstrated increased control and facility with the system through participation in MDA flight and ground tests, and warfighter exercises, wargames, demonstrations, and training.

Recommendations

- Status of Previous Recommendations. There were no recommendations in FY06. Two of the seven FY05 DOT&E recommendations remain unfulfilled. The MDA has begun to put processes into place and develop an evaluation-based test strategy (FY05). Through contract modifications and user forums, the MDA continues to work to maximize data collection to determine the GMD systems operational reliability, availability, and maintainability, but needs to develop and implement systematic data collection, analysis, and reporting procedures for all BMDS elements (FY05).
- FY07 Recommendations.
  1. Model and simulation development needs to keep pace with the developmental program so that verification, validation, and accreditation occur prior to ground test events or digital simulation events that are intended to support performance assessment.
  2. The GMD-specific lethality simulation needs to be re-examined in light of test data emerging from MDA target lethality testing since its last accreditation for Initial Defensive Operations in FY04.