Ground-Based Midcourse Defense (GMD)

Executive Summary

- Ground-based Midcourse Defense (GMD) has demonstrated a partial capability to defend the U.S. Homeland from small numbers of simple intermediate or intercontinental ballistic missile threats launched from North Korea or Iran.
- The performance of GMD during flight tests in FY13 prevented any improvement in the assessment of GMD capability. The Missile Defense Agency (MDA) successfully flew a redesigned Capability Enhancement-II (CE-II) Exoatmospheric Kill Vehicle (EKV) in a planned non-intercept flight test; however, the MDA experienced a failure with a CE-I EKV in an unrelated intercept flight test. The flight test failures that have occurred during the past three years raise questions regarding the robustness of the EKV's design.
- The MDA continues to make progress on the return-to-intercept for the CE-II EKV, but will need to successfully conclude its investigation of the CE-I EKV failure before returning the CE-I EKV to intercept flight testing.

System

GMD is a Ballistic Missile Defense System element that counters intermediate-range and intercontinental ballistic missile threats to the U.S. Homeland. The GMD "system" includes:

- COBRA DANE Upgrade Radar at Eareckson Air Station (Shemya Island), Alaska
- Upgraded Early Warning Radars at Beale AFB, California; Royal Air Force Fylingdales, United Kingdom; and Thule Air Base, Greenland
- Ground-based Interceptor (GBI) missiles at Fort Greely, Alaska, and Vandenberg AFB, California
- GMD ground system including GMD Fire Control (GFC) nodes at Schriever AFB, Colorado, and Fort Greely, Alaska; Command Launch Equipment at Vandenberg AFB, California, and Fort Greely, Alaska; and In-Flight Interceptor Communication System Data Terminals at Vandenberg AFB, California, Fort Greely, Alaska, and Shemya Island, Alaska
- GMD secure data and voice communication system including long-haul communications using the Defense Satellite Communication System, commercial satellite communications, and fiber-optic cable (both terrestrial and submarine)
- External interfaces that connect to Aegis BMD; North American Aerospace Defense – U.S. Northern Command Command Center and Command and Control, Battle Management, and Communications at Peterson AFB, Colorado; Space Based Infrared System/Defense Support Program at Buckley AFB, Colorado; and AN/TPY-2 (Forward-Based Mode [FBM]) radar at Shariki Air Base, Japan
- Sea-Based X-band radar, which is a sea-based mobile sensor platform used primarily as a test asset, but which can be operationally deployed as needed

Mission

Military operators for the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command (the Army service component to U.S. Strategic Command) will use the GMD system to defend the U.S. Homeland against intermediate-range and intercontinental ballistic missile attacks using its weapon, the GBI, to defeat threat missiles during the midcourse segment of flight.

Major Contractors

- The Boeing Company, Integrated Defense Systems, Missile Defense Systems – Huntsville, Alabama
- Orbital Sciences Corporation – Chandler, Arizona
- Raytheon Missile Systems – Tucson, Arizona
- Northrop Grumman Information Systems – Huntsville, Alabama

Activity

- The MDA conducted an interceptor-only flight test of a GBI equipped with a CE-II EKV in January 2013. The MDA planned this test, GMD Control Test Vehicle-01 (GM CTV-01), as part of its return-to-intercept effort in response to the failed intercept attempt, Flight Test GBI-06a (FTG-06a), in December 2010.
  - A Failure Review Board, which the MDA had convened subsequent to FTG-06a, attributed the failure to a faulty design of a CE-II EKV component.
  - The MDA redesigned the EKV component, and in GM CTV-01, tested a GBI equipped with a CE-II EKV that incorporated the component redesign. The MDA collected data in this interceptor flight test on the EKV flight environment and EKV performance in the flight environment.
  - The MDA assessed the data collected in GM CTV-01 and is preparing to conduct an intercept flight test, FTG-06b, in March 2014 as a redo of FTG-06a using a GBI equipped with the redesigned CE-II EKV component.
- The MDA conducted an intercept flight test of a GBI equipped with a CE-I EKV against an intermediate-range ballistic missile (IRBM) target in July 2013. The MDA planned this test, FTG-07, to demonstrate CE-I EKV performance under more challenging threat engagement conditions than had been demonstrated in previous intercept flight tests with CE-I EKVs.
  - The MDA launched an IRBM target from the U.S. Army's Reagan Test Site on Kwajalein Atoll, Republic of the Marshall Islands. The BMDS sensors detected and tracked the target.
  - The GFC planned an engagement, and a warfighter manning the GFC launched a GBI from Vandenberg AFB, California, to intercept the target. The GBI, however, failed to intercept. The MDA convened a Failure Review Board that investigated the failure and reported its initial results in August 2013.
- The MDA conducted a hardware-in-the-loop test called Fast Aim in August 2013. The MDA used hardware and software representations of GFC; Space-Based Infrared System; Command and Control, Battle Management, and Communications; the AN/TPY-2 (FBM) radar; the Aegis BMD radar in its Long Range Surveillance and Track mode; and the Sea-Based X-band radar to investigate additional BMD capability against intercontinental ballistic missile threats.
- The MDA conducted testing in accordance with the DOT&E-approved Integrated Master Test Plan.

Assessment

- In GM CTV-01, the GBI boost vehicle and the CE-II EKV with the redesigned component performed adequately and mostly as expected.
  - The MDA noted several unexpected results that did not negatively affect test execution or data collection. The MDA is analyzing these unexpected results to determine if any of them pose a risk to GBI operational or test performance.
  - The CE-II EKV fly-out in GM CTV-01 was, as planned, developmental in nature in order to stress specific aspects of EKV performance and to acquire data in specific environments. CE-II EKV performance in the more operationally-representative intercept flight environment of the failed test, FTG-06a, remains to be demonstrated.
  - The MDA plans FTG-06b to be a redo of FTG-06a, which should enable assessment of CE-II EKV performance, including target intercept, in that same flight environment.
- In FTG-07, the CE-I EKV failed to separate from the GBI boost vehicle and, consequently, was unable to complete all further inflight actions including intercept of the IRBM target. This was the first failure to intercept for a GBI equipped with a CE-I EKV.
  - The three prior tests, FTG-02, FTG-03a, and FTG-05, all resulted in target intercepts albeit in less challenging engagement conditions than presented in FTG-07, which had a longer time of flight and a faster closing velocity than the previous CE-I-equipped GBI flight tests.
  - The MDA convened a Failure Review Board and reported its initial results in August 2013. The board is expected to publish its final report by the end of calendar year 2013.
- The MDA is currently analyzing the data that it acquired in the August 2013 Fast Aim test.
- The flight test failures that have occurred during the past three years raise questions regarding the robustness of the EKV's design.

Recommendations

- Status of Previous Recommendations. The MDA has started, but not completed, the FY11 recommendation to repeat the FTG-06a mission to verify (1) failure root causes, (2) Failure Review Board results, and (3) permanent fixes for the deficiencies found during the flight test. They have identified root cause issues, implemented solutions, and successfully completed the first (CTV-01) of a planned two-flight test series designed to demonstrate the fixes. The MDA has scheduled the second flight test in the series, FTG-06b.
- FY13 Recommendations. The MDA should:
  1. Conduct a redo of the FTG-07 test with a GBI equipped with a CE-I EKV in order to accomplish the test objectives of FTG-07.
  2. Consider whether to re-design the EKV using a rigorous systems engineering process to assure its design is robust against failure.