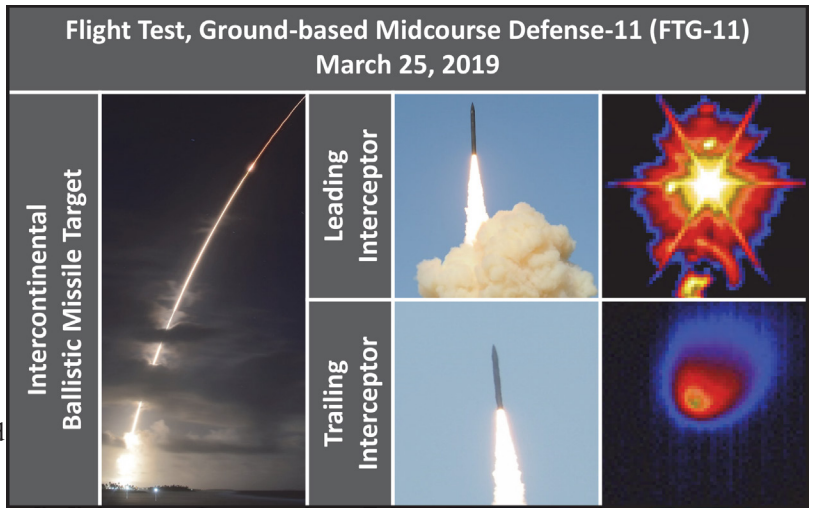
Ground-Based Midcourse Defense (GMD)

Executive Summary

- The Ground-based Midcourse Defense (GMD) element has demonstrated capability to defend the U.S. Homeland from a small number of intermediate-range ballistic missile (IRBM) or intercontinental ballistic missile (ICBM) threats with simple countermeasures when the Homeland Defense Ballistic Missile Defense System (BMDS) employs its full architecture of sensors and command and control.
- The Missile Defense Agency (MDA) conducted the first operational flight test of the GMD weapon system in March 2019, a two Ground-Based Interceptor (GBI) salvo engagement of a threat-representative ICBM target. The GMD weapon system performed as expected with the lead GBI intercepting the ICBM target, and the trailing GBI intercepting a designated object per the engagement fire control methodology. In addition, the MDA conducted four GMD ground tests and three GMD cybersecurity tests.
- The MDA made significant progress improving its GMD modeling and simulation capability. Continued progress is required to enable quantitative evaluation of GMD operational effectiveness. A quantitative assessment of GMD survivability requires more comprehensive threat-realistic operational cybersecurity testing.
- The USD(R&E) terminated the Redesigned Kill Vehicle (RKV) program and directed the MDA to issue a Request for Proposal to Industry for a Next Generation Interceptor. The MDA plans contract award(s) in mid-2020.



System

- The GMD interceptor system consists of:
  - GBIs
  - Ground System (GS), including Ground Fire Control nodes, Launch Management System, and In-Flight Interceptor Communication System Data Terminals
  - GMD Communications Network, including long-haul communications and network management (space-based, terrestrial, and submarine)

Mission

Commanders of U.S. Strategic Command and U.S. Northern Command (USNORTHCOM) employing U.S. Army Space and Missile Defense Command/Army Forces Strategic Command soldiers will use the GMD system to defend the U.S. Homeland against IRBM and ICBM attacks using GBIs to defeat threat missiles during the midcourse segment of flight.

Major Contractors

- GMD Prime: The Boeing Company, Network and Space Systems – Huntsville, Alabama
- Boost Vehicle: Northrop Grumman Corporation, Innovation Systems – Chandler, Arizona
- Kill Vehicle: Raytheon Company, Missile Systems – Tucson, Arizona
- Fire Control and Communications: Northrop Grumman Corporation, Information Systems – Huntsville, Alabama

Activity

- The MDA conducted testing in accordance with the DOT&E-approved Integrated Master Test Plan.
- In October 2018, the Army conducted a cybersecurity Cooperative Vulnerability and Penetration Assessment test on selected components of GMD GS 7A software and hardware. In July 2019, the Army conducted a related Cooperative Vulnerability and Penetration Assessment on a GBI silo. In July 2019, the Army conducted a cybersecurity Adversarial Assessment on GMD GS 7A. All three of these tests were executed at the direction of the MDA.
- In FY19, the MDA conducted four ground tests where GMD was a major participant:
  - A series of two ground tests in December 2018 and March 2019 used hardware and software representations of the Homeland Defense BMDS to assess Capability

Increment 5 functionality. A follow-on ground test in May 2019 included operational assets and Service operators on console.
  - In August 2019, hardware-in-the-loop ground testing requested by USNORTHCOM assessed sensor performance, GMD fire control engagement planning and execution, and Exo-atmospheric Kill Vehicle (EKV) performance.
- The MDA conducted the first operational flight test of the GMD weapon system in March 2019. Flight Test, GMD Weapon System-11 (FTG-11) was a two GBI salvo engagement of a threat-representative ICBM target based on data from the Sea-Based X-band radar; the AN/TPY-2 Forward-Based Mode radar; Command and Control, Battle Management, and Communications (C2BMC) element; BMDS Overhead Persistent Infrared Architecture; and the Space-Based Infrared System. The GBI salvo consisted of a Capability Enhancement-II (CE-II) Block 1 EKV on top of a Configuration 2 booster followed by a CE II EKV on top of a Configuration 1 booster. The MDA also exercised its Post Intercept Assessment methodology based on multiple sensor data and physics-based analytical tools.
- In FY19, the MDA conducted two GBI subscale light-gas gun lethality tests against an ICBM target.
- GMD continues to evolve:
  - In October 2018, the MDA postponed the RKV Critical Design Review. With technical design challenges still unresolved, the USD(R&E) in May 2019 directed a stop-work order on the program and initiated a study on alternative approaches to the RKV. In August 2019, the USD(R&E) terminated the RKV program and directed the MDA to issue a Request for Proposal to Industry for a Next Generation Interceptor. The MDA plans contract award(s) in mid-2020.
  - The MDA fielded GMD GS 7A.0.2 Phase 1 software in March 2019. This build delivered enhanced cueing of the Sea-Based X-band radar, an operator-selectable defended-area zone, and an updated user interface.
  - In July 2019, the MDA fielded GBI Configuration 1 booster software version 6.1 and CE-I EKV software version 23.1. These updates provided capability improvements to EKV tracking and discrimination, and addressed concerns related to in-flight status reporting.

Assessment

- GMD continues to demonstrate the capability to defend the U.S. Homeland for a small number of IRBM or ICBM threats with simple countermeasures when the U.S. Homeland Defense BMDS employs its full architecture sensors and command and control.
- Cybersecurity and ground test data, and resulting assessments, are classified; see the DOT&E "FY19 Assessment of the BMDS," to be published in February 2020.
  - Ground testing in FY19 supported USNORTHCOM operational acceptance of Increment 5 capabilities, including Target Object Map improvements and their effects on EKV performance. FY19 ground testing also evaluated the interoperability of operational BMDS assets, the effects of using backup and alternate failover communications, and a USNORTHCOM feasibility assessment for GBI employment.
- In FTG-11, the lead GBI intercepted the ICBM target. The trailing GBI intercepted an object per the engagement fire control methodology. The GMD weapon system performed as expected. The MDA exercised its developing Robust Post Interceptor Assessment methodology based on multiple sensor data and physics-based analytical tools, which showed promise but requires further development. For additional technical details and lethality results, see the classified DOT&E "FY19 Assessment of the BMDS," to be published in February 2020.
- The MDA made significant progress improving its GMD modeling and simulation capability in FY19. For the first time, the BMDS Operational Test Agency Team independently accredited several GMD models for use in ground testing. However, continued progress is required to enable quantitative evaluation of GMD operational effectiveness.
- A quantitative GMD survivability assessment requires more comprehensive threat-realistic operational cybersecurity testing.

Recommendations

The MDA should:

1. Continue to develop independently accredited modeling and simulation to enable quantitative evaluation of GMD operational effectiveness.
2. Conduct more comprehensive threat-realistic operational cybersecurity testing to enable quantitative evaluation of GMD survivability.