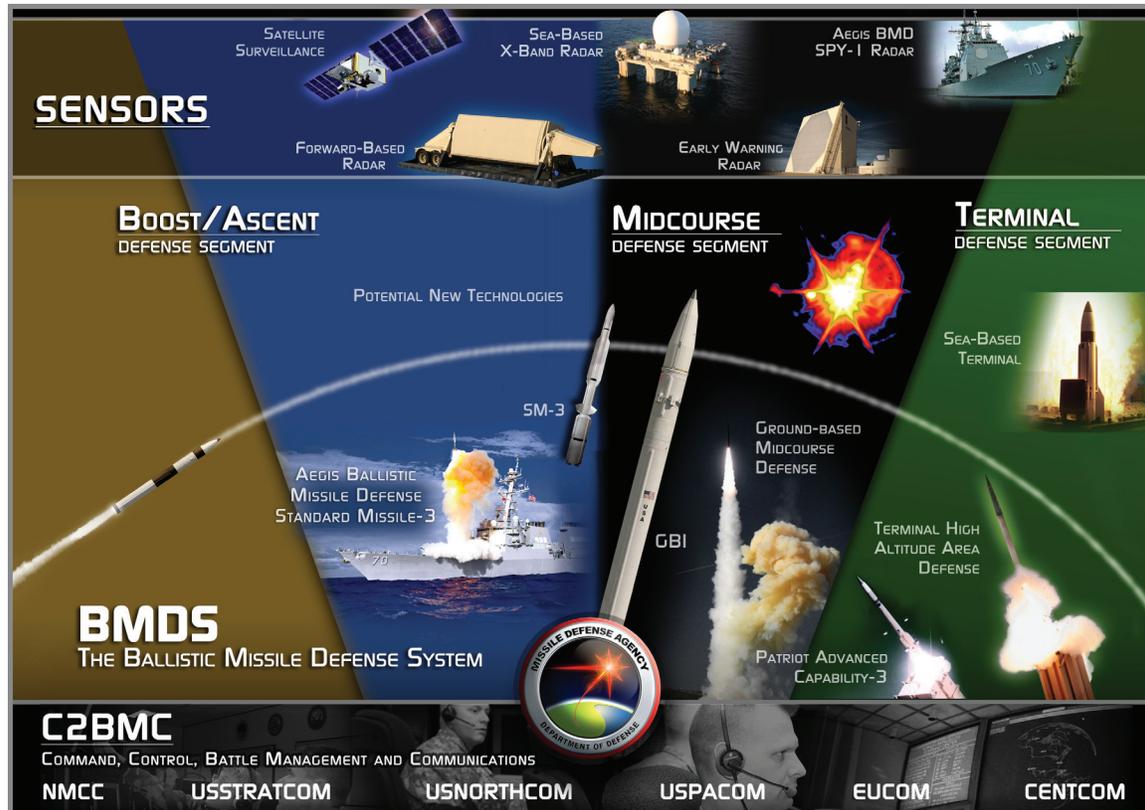


## Ballistic Missile Defense System (BMDS)



### Executive Summary

- In October 2012, the Missile Defense Agency (MDA) conducted the most complex ballistic missile defense flight test, combined developmental/operational Flight Test Integrated-01 (FTI-01), ever attempted in the history of the DoD. FTI-01 was the first flight test of a regional Ballistic Missile Defense System (BMDS) that included soldiers, sailors, and airmen from multiple Combatant Commands operating multiple sensors and missile defense systems to engage three ballistic and two cruise missile targets near simultaneously. Four of the five targets were successfully intercepted. Analysis is ongoing, but DOT&E will include the results in the 2012 BMDS report to Congress to be published in February 2013.
- Except for FTI-01, testing of the BMDS during the past fiscal year was limited to three ground tests, two Aegis BMD flight tests, one Terminal High-Altitude Area Defense (THAAD) flight test, and exercise Fast Eagle Increment 1 testing. The Ground-based Midcourse Defense (GMD) program did not accomplish any element flight testing.
- BMDS regional defensive capability was enhanced by completion of FTI-01, deployment of Phase 1 of the European Phased Adaptive Approach (EPAA), and the lessons learned during exercise Fast Eagle Increment 1.
- The MDA, in collaboration with the Operational Test community, continued to refine the content and quality of the BMDS Integrated Master Test Plan (IMTP) with emphasis on the verification, validation, and accreditation of the models and simulations supporting performance assessments.

### System

- The current BMDS architecture integrates ballistic missile defense capabilities against all ranges of threats.
- BMDS is a distributed system currently comprised of five elements (four shooter elements and one command and control element) and five sensor systems (four radar systems and one space-based system).

### Elements

- Aegis BMD (shooter)
- Command, Control, Battle Management, and Communications (C2BMC) (command and control)
- GMD (shooter)
- Patriot (shooter)
- THAAD (shooter)

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## Sensors

- Aegis BMD AN/SPY-1 Radar
- Cobra Dane Radar
- Upgraded Early Warning Radars
- AN/TPY-2 (Forward-Based Mode [FBM]) Radar
- Space Based Infrared System/Defense Support Program (SBIRS/DSP)
- These two sensor systems will support the BMDS when available:
  - Sea-Based X-Band Radar (primarily a test asset that can be operationally deployed as needed)
  - Precision Tracking Space System (a projected addition to the BMDS sensor systems)

## Mission

- The U.S. Strategic Command (USSTRATCOM) synchronizes operational-level global missile defense planning, operations support, and the development of missile defense effects for the DoD. When directed, it provides alternate missile defense execution.
- U.S. Northern Command (USNORTHCOM), U.S. Pacific Command (USPACOM), U.S. Central Command (USCENTCOM), and U.S. European Command (USEUCOM) will employ the assets of the BMDS to defend U.S. territory,

- deployed forces, friends, and allies against ballistic missile threats of all ranges and in all phases of flight. Initial capability permits defending U.S. territory against simple ballistic missile threats and defending deployed forces, friends, and allies from theater-level ballistic missile threats.
- USSTRATCOM, USNORTHCOM, USEUCOM, USCENTCOM, and USPACOM will use the C2BMC element of the BMDS to maintain situational awareness. USEUCOM, USCENTCOM, and USPACOM will also use the C2BMC to provide sensor management of theater AN/TPY-2 radars across the full mission engagement space.
- The Army employs Patriot to provide theater defense for deployed forces against short- and medium-range threats.

## Major Contractors

- The Boeing Company, Integrated Defense Systems, Missile Defense Systems – Huntsville, Alabama
- Lockheed Martin:
  - Missile and Fire Control – Dallas, Texas
  - Mission Systems and Sensors – Moorestown, New Jersey
  - Information Systems and Global Solutions – Gaithersburg, Maryland
- Raytheon Missile Systems – Tucson, Arizona

## Activity

- The MDA conducted FTI-01 in October 2012, which included near-simultaneous Aegis BMD and Patriot engagements of short-range ballistic missiles while defending against cruise missile attacks, and a THAAD first time engagement of a medium-range ballistic missile. SBIRS/DSP provided early warning and an AN/TPY-2 (FBM) radar provided acquisition cues via C2BMC. Soldiers performed command and control functions from the Air and Space Operations Center at Hickam AFB, Hawaii.
- In FY12, the MDA completed the Ground Test-04d (GT-04d) campaign, which consisted of Ground Test Integrated-04d Part 2 in October 2011 and Ground Test Distributed-04d (GTD-04d) Parts 2 and 3 in December 2011. These ground tests provided support to the MDA's European Phased Adaptive Approach (EPAA)-Phase 1 declaration against medium-range ballistic missiles and NATO's May 2012 declaration of an interim southern European missile defense capability.
- The MDA completed GTI-04 (Israel) in November 2011, which tested the interoperability of Israel's joint BMDS. It integrated the following U.S. and Israeli systems: C2BMC, Aegis BMD, AN/TPY-2 (FBM), SBIRS/DSP, THAAD, and a representation of the Israeli Arrow Weapons System.
- The MDA completed Ground Test Focused-04e (GTX-04e) in April 2012. This developmental ground test provided data to assess new functionality for Aegis BMD, GMD, and THAAD.
- The MDA completed the Fast Eagle Increment 1 hardware-in-the-loop testing in June 2012, a distributed test in August 2012, and follow-on hardware-in-the-loop testing in September 2012. These tests were designed to evaluate the capability of the AN/TPY-2 (FBM) and USCENTCOM C2BMC to augment the existing USCENTCOM BMDS capability.
- The MDA, in collaboration with the Operational Test community, made one update to the FY12 version of the BMDS IMTP that uses a critical factors analysis (referred to as Critical Engagement Conditions) and other important data needs (referred to as Empirical Measurement Events) to drive test design, planning, and execution. In July 2012, the MDA began a process of re-baselining the IMTP to better align it with BMDS modeling and simulation verification, validation, and accreditation data needs. The MDA conducted testing during FY12 in accordance with the DOT&E-approved IMTP.
- In FY11, the MDA established a Lethality Focus Group (LFG) in which the MDA, DOT&E, and the Operational Test community collaborate to identify lethality data gaps for all BMDS weapon elements. In FY12, the LFG generated a prioritized list of threat models needed to support lethality evaluations for planned flight and ground testing for Aegis BMD, GMD, Patriot, and THAAD, and has started developing a plan of action to address these data voids.
- During FY12, the MDA conducted numerous wargames and exercises that enhanced Combatant Command BMD readiness and increased confidence in the deployed elements of the BMDS. These events included: Air and Missile Defense Exercise (AMDEX), Joint Air and Missile Defense

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Exercise, Austere Challenge, Terminal Fury/Global Lightning, EUCOM AMDEX, Keen Edge, Ulchi Freedom Guardian, Vigilant Shield/Global Thunder, BMDS Wargame, Planning Exercise, Joint Tactical Air Picture, National Missile Defense Conference, Nimble Titan, Joint Deployable Integrated Air and Missile Defense, Integrated Air and Missile Defense Center Senior Level Seminar, Huntsville Wargame, and the Missile Defense Advisory Committee Wargame.

- To support operational testing beginning in FY13, the MDA completed major infrastructure improvement and modernization efforts at the Reagan Test Site (RTS) and on Wake Island. At RTS these include: development of Mission Operations Centers; upgrade of power, water, and fuel infrastructure to support THAAD, Patriot, and AN/TPY-2 radar sites in various locations on the Kwajalein Atoll; development of housing and dining facilities for Soldiers who will man the THAAD and Patriot batteries; a climate-controlled storage facility; improvement and modernization of housing for flight test personnel; and installation of communications infrastructure to support mission data and voice communications. On Wake Island these include: refurbishment of the 50k Rail Launcher; improvement and upgrade of the backup power systems; and repair and improvement of the existing communications infrastructure.

## Assessment

- Many of the models and simulations used in the ground tests are still not accredited for performance assessment, thereby limiting quantitative assessments based on their results. Re-baselining the IMTP to better align it with BMDS modeling and simulation will support required verification, validation, and accreditation.
- The BMDS defensive capability against theater threats increased during the last fiscal year. The deployment of an AN/TPY-2 (FBM) radar to Turkey and an Aegis BMD ship to the Mediterranean Sea provided an interim defensive capability in the southeastern Europe theater, which was demonstrated through ground testing (although these ground tests have not been accredited for performance assessment). Similar ground testing provided evidence for an initial defensive capability for the Israeli and Middle Eastern theaters as well. During FTI-01, sensors and weapon

systems worked together successfully to engage four of the five targets launched during the test scenario contributing to this assessment. Only Aegis BMD was unsuccessful while engaging a short-range ballistic missile. DOT&E anticipates continued increases in this capability over time.

- BMDS interoperability increased during the last fiscal year to support the additional defensive capabilities in the European, Israeli, and Middle Eastern theaters. Ground testing (GT-04 campaign and Fast Eagle Increment 1) uncovered some interoperability and command and control deficiencies that affected track processing, situational awareness, and battle management. The MDA is currently investigating these deficiencies.
- The BMDS capability against strategic threats has not increased because the GMD program continues to resolve deficiencies with its Capability Enhancement II (CE-II) Exo-atmospheric Kill Vehicle (EKV). As a result, the GMD program did not conduct a flight test in FY12.
- The designated Service members actively participated in system-level BMDS testing, as well as element-level testing. They perform operational roles at individual element levels through major Combatant Command levels using operational tactics, techniques, and procedures.
- Although the LFG has developed a plan of action to address BMDS lethality data voids, the MDA has made little progress in retiring lethality data needs.

## Recommendations

- Status of Previous Recommendations. Although the MDA has made progress on previous recommendations, the FY08 recommendation regarding the BMDS lethality program and the FY09 recommendation regarding IMTP execution are still valid. The FY11 recommendation regarding flight testing to verify root causes and Failure Review Board results for Aegis BMD and GMD flight tests failures has been partially met for the Aegis BMD program, and is still being addressed for the GMD program.
- FY12 Recommendation.
  1. The MDA should continue addressing the interoperability and command and control deficiencies uncovered during the GT-04 test campaign and FTI-01. Resolution of these deficiencies should be demonstrated through ground and/or flight testing.

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