Aegis Ballistic Missile Defense (Aegis BMD)

Executive Summary

- Aegis Ballistic Missile Defense (BMD) intercepted both short- and medium-range targets during FY08 tests. The short-range engagements included a two-target engagement and a single-target engagement. All short-range targets were non-separating. Aegis BMD also conducted a single engagement using a medium-range separating target.
- Based on combined developmental and operational testing from FY06 to FY08, Commander Operational Test and Evaluation Force (COTF) declared the Aegis BMD 3.6 system to be operationally effective and operationally suitable. Additionally, COTF recommended transition of 18 ship sets and up to 90 SM-3 Block IA missiles from the Missile Defense Agency (MDA) to the Navy. The MDA transferred the Aegis BMD 3.6 system to the Navy in October 2008.
- Aegis BMD demonstrated the Aegis BMD 3.6.1 sea-based terminal capability in one of the FY08 intercept tests.
- Aegis BMD demonstrated long-range surveillance and track (LRS&T) capability to support the Ground-based Midcourse Defense (GMD) mission and the ability to send and receive a cue to and from the Terminal High-Altitude Area Defense (THAAD) system during exercises in FY08.
- Continuing involvement of operational testers and warfighters in flight tests has proven valuable in planning and conducting operationally-realistic tests and in exposing operational design and training issues.

System

- Aegis BMD is a highly-mobile, sea-based missile defense system that employs the multi-mission shipboard Aegis Weapon System, with new radar and missile capabilities to engage ballistic missile threats.
  - Computer program modifications to the AN/SPY-1 radar allow LRS&T of long-range ballistic missiles.
  - A modified Aegis vertical launcher system stores and fires the new, larger Standard Missile-3 (SM-3) Block IA.
  - The SM-3 Block IA design delivers a maneuverable kinetic warhead to an intercept point in the upper atmosphere or in space.
- Aegis BMD is capable of autonomous missile defense operations and can accept external cues and tracks over tactical data links.

- Aegis BMD can cue other BMDS sensors through tactical data links.
- A near-term sea-based terminal ballistic missile defense capability is provided with a modified SM-2 Block IV missile.

Mission

The Navy can accomplish three missions using Aegis BMD:

- Provide forward-deployed radar capabilities to enhance defense against long-range ballistic missile threats
- Provide all short- to long-range ballistic missile threat data to the Command, Control, Battle Management, and Communications (C2BMC) system for dissemination to U.S. Strategic Command and U.S. Pacific Command to ensure situational awareness
- Defend deployed forces and allies from short- and medium-range theater ballistic missiles

Prime Contractors

- CSC
- Lockheed Martin
- Raytheon

Activity

- In FY08, the Aegis BMD program continued to demonstrate engagement and LRS&T capabilities. The program completed the combined Developmental Test/Operational Test (DT/OT) phase of testing that supported the transition of the Aegis BMD 3.6 system to the Navy in October 2008.

- The Aegis BMD program completed three successful intercept flight tests in FY08: Flight Test Standard Missile-13 (FTM-13), Japanese FTM-1 (JFTM-1), and FTM-14.
  - An Aegis BMD cruiser successfully conducted a near-simultaneous engagement of two short-range unitary ballistic missile targets using a two-missile salvo of SM-3 Block IA interceptors during FTM-13 in November 2007.
  - A Japanese Aegis BMD destroyer successfully conducted an engagement of a medium-range separating target with an SM-3 Block IA interceptor during JFTM-1 in December 2007.
  - An Aegis BMD cruiser successfully conducted an engagement of a short-range target in the terminal phase of flight using a salvo of two modified SM-2 Block IV interceptors during FTM-14 in June 2008.
- Aegis BMD successfully conducted a shoot-down of a failed U.S. Government satellite using modified system software and a modified SM-3 interceptor in February 2008.
- COTF conducted a maintenance demonstration exercise in March 2008. The purpose of the exercise was to verify that maintainability, maintenance training, documentation, and logistic supportability are adequate to support fleet operational requirements. The test was conducted by COTF as part of their evaluation of the Aegis BMD 3.6 System.
- Aegis BMD participated in several flight and ground tests to assess Aegis BMD functionality and interoperability with the BMDS during FY08.
  - Performance Assessment 07 (PA07) in September/October 2007 used software representations of Aegis BMD, GMD, AN/TPY-2 Forward-Based Mode (FBM) radar, C2BMC, and Space-Based Infrared System (SBIRS)/Defense Support Program (DSP) to explore interoperability and functionality in a digital simulation event.
  - Ground Test Distributed-02 (GTD-02) in November 2007 demonstrated BMDS operational functionality, connectivity, and interoperability. Two Aegis BMD ships used dockside simulators and simulators at two Naval Surface Warfare Center locations.
  - Ground Test Other-03a (GTX-03a) in February 2008 used hardware-in-the-loop simulations to test the interactions among Aegis BMD, THAAD, Patriot, and other sensors and command and control interfaces. Aegis BMD demonstrated a capability to launch using an AN/TPY-2 (FBM) cue as part of the exercise.
  - Flight Test THAAD-09 (FTT-09) in June 2008 demonstrated the ability of Aegis BMD to receive a cue from THAAD over operational communication links. An Aegis BMD cruiser conducted a simulated engagement of a medium-range ballistic missile target after receipt of the THAAD cue.
  - Aegis BMD detected and tracked an intercontinental ballistic missile target during the Air Force test Glory Trip-197 in May 2008.
  - Ground Test Integrated-03 (GTI-03) in June 2008 used hardware-in-the-loop systems to test the interactions among Aegis BMD, GMD, THAAD, and C2BMC nodes, demonstrating BMDS functionality, connectivity, and interoperability in the Missile Defense System Exerciser architecture.
  - Aegis BMD participated with the AN/TPY-2 (FBM), SBX, and UEWR-Beale sensors in a sensors and target-only flight test, FTX-03, in July 2008.

Assessment

- In FY08, Aegis BMD flight testing continued to demonstrate the capability to engage short-range unitary and medium-range simple separating ballistic missile targets.
- COTF completed evaluation of the Aegis BMD 3.6 system in support of transition to the Navy in FY08. The Commander declared the system to be operationally effective and operationally suitable. Additionally, COTF recommended transition of 18 ship sets and up to 90 SM-3 Block IA missiles from the MDA to the Navy.
- SM-3 Block IA interceptors equipped with a fully capable divert system on the kinetic warhead were flown in the latter stages of DT/OT testing; however, flight tests to date have not yet exercised the full range of divert system pulse modes. Also, the full range of pulse modes of the third-stage rocket motor on the SM-3 have not been tested in a live intercept event.
- FTM-14 demonstrated the capability to intercept a short-range ballistic missile target in the terminal phase of flight with a modified SM-2 Block IV interceptor. Live intercept testing of this capability is limited, and additional testing is needed to better evaluate the effectiveness of the Aegis BMD 3.6.1 near term sea-based terminal capability.
- Test events during DT/OT demonstrated the utility of the unitary version of the Aegis Readiness Assessment Vehicle (ARAV-A) target as an affordable target for tracking and intercept tests for some mission scenarios.
- The Aegis BMD program continues to assess its interoperability with the BMDS. In FY08, the Aegis BMD flight test program incorporated other BMDS elements and components. FTM-14 and JFTM-1 provided opportunities to send and receive cues between Aegis BMD and THAAD. Aegis BMD participation during an FY08 Glory Trip event and others in past years has provided valuable data toward assessing Aegis BMD LRS&T capability in support of GMD. However, to date, GMD has not utilized Aegis BMD track data in the real-time construction of a GMD weapon task plan during a live intercept test event.
- The Aegis BMD program continues to include operational realism in its flight test program, as demonstrated during the DT/OT test phase. Aegis BMD benefits from the active participation of the operational test and warfighter communities, as their recommendations are incorporated in system design modifications; tactics, techniques, and procedures; fleet training; and follow-on flight missions.
- During FTX-03, Aegis BMD successfully supported the LRS&T mission by tracking a live target with an Aegis BMD configured Destroyer in an operationally-representative test support position. Aegis BMD track data was sent to GMD.

Post mission analysis confirmed Aegis BMD's ability to support cueing of SBX by GFC and formation of a weapons task plan for a Launch on Aegis BMD scenario.

Recommendations

- Status of Previous Recommendations. The program addressed the single recommendation from FY07.
- FY08 Recommendations.
  1. The MDA should conduct an analysis using verified and validated modeling and simulation across its engagement envelope and threat set to determine the extent to which the second pulse of the SM-3 Block IA kinetic warhead divert system would be invoked. The MDA should use this analysis to determine what, if any, additional flight testing is required.
  2. The MDA should conduct an analysis of the third-stage rocket motor zero-pulse mode using verified and validated modeling and simulation to assess its capability since this mode would be difficult to safely demonstrate in a flight test due to the requirement to fly the target nearly directly over the SM-3 launching ship endangering both the ship and its crew.
  3. The program should conduct further end-to-end testing of the Aegis BMD 3.6.1 sea-based terminal capability to allow for a more thorough assessment of its operational effectiveness.
  4. The program should continue to test and refine the interoperability of the Aegis BMD system with the AN/TPY-2 radar operating in both forward-based and theater modes.
  5. Aegis BMD should demonstrate in an intercept flight test, a launch on remote engagement using an external sensor cue.
  6. The MDA should explore the viability of expanding the use of separating versions of the ARAV for engagement scenarios in operationally realistic testing.