# Command and Control, Battle Management, and Communications (C2BMC) System

Executive Summary

- The Missile Defense Agency (MDA) continued to demonstrate the increased capability of Command and Control, Battle Management, and Communications (C2BMC) Spiral 6.4 software during FY13. Ground and flight testing demonstrated automated management of multiple AN/TPY-2 Forward-Based Mode (FBM) sensors, as well as limited battle management capabilities allowing Combatant Command sensor managers to direct AN/TPY-2 (FBM) radars to execute focused search plans or respond to precision cues.
- C2BMC also demonstrated timely and accurate radar track forwarding during numerous ground and flight tests.
- C2BMC remains the key situational awareness tool used by the Combatant Commanders and National Command Authority to stay abreast of both homeland and regional ballistic missile defense operations.

System

- C2BMC is a Combatant Command's interface to the fully integrated Ballistic Missile Defense System (BMDS).
- More than 70 C2BMC workstations are fielded at U.S. Strategic, Northern, European, Pacific, and Central Commands (USSTRATCOM, USNORTHCOM, USEUCOM, USPACOM, and USCENTCOM); numerous Army Air and Missile Defense Commands; Air and Space Operations Centers; and other supporting warfighter organizations.
  - The current C2BMC provides Combatant Commands and the National Command Authority with situational awareness on BMDS status, system coverage, and ballistic missile tracks by displaying selective data from the Global Communications Network for strategic/national missile defense and the Joint Tactical Information Distribution System for tactical/regional missile defense.
  - C2BMC also provides upper echelon deliberate planning at the Combatant Command and component level, permitting a federation of planners across the BMDS. BMDS elements (Aegis BMD, Ground-based Midcourse Defense [GMD], Patriot, and Terminal High-Altitude Area Defense [THAAD]) use their own command and control battle management systems, and mission planning tools for stand-alone engagements.
  - C2BMC S6.4 Combatant Command suite provides command and control for one AN/TPY-2 (FBM) radar. The S6.4 Global Engagement Manager Suite provides command and control for multiple radars, as well as updated sensor management, track processing, and reporting.
- Through the Global Communications Network, C2BMC provides track forwarding of AN/TPY-2 (FBM) and
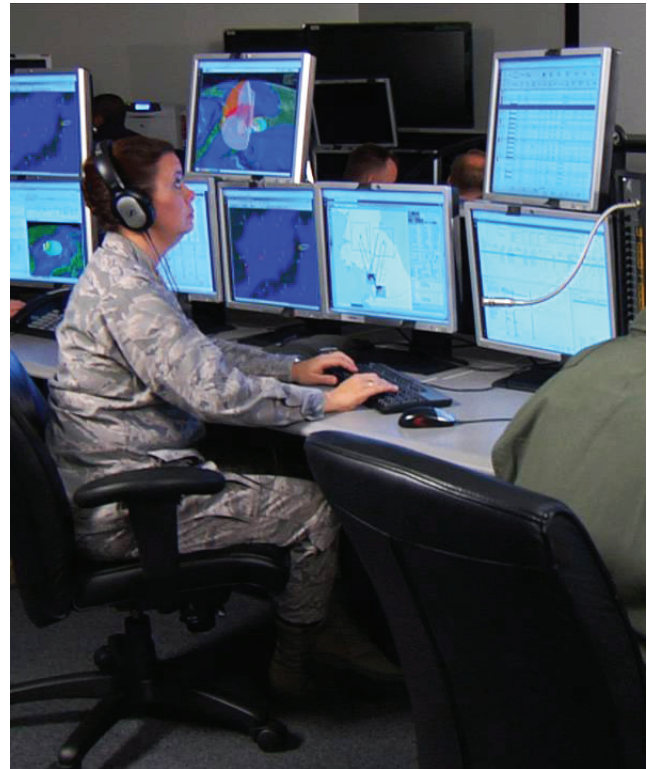
AN/SPY-1 tracks to GMD. Additionally, through the Joint Tactical Information Distribution System, it provides track forwarding of AN/TPY-2 (FBM) tracks for THAAD and Patriot cueing and Aegis BMD engagement support.
- C2BMC S8.2 is intended to improve and expand the initial S6.4 capabilities as the next step toward integrated sensor management.

Mission

U.S. Strategic, Northern, European, Central, and Pacific Commands currently use C2BMC to support ballistic missile defense engagements. Commanders use C2BMC specifically for:
- Deliberate and dynamic planning
- Situational awareness
- Track management
- AN/TPY-2 (FBM) sensor management and control
- Engagement monitoring
- Data exchange between C2BMC and BMDS elements
- Network management

Major Contractor

Lockheed Martin Corporation, Information Systems and Global Solutions – Gaithersburg, Maryland

Activity

- The MDA conducted testing during FY13 in accordance with the DOT&E-approved Integrated Master Test Plan.
- In October 2012, C2BMC S6.4 managed an AN/TPY-2 (FBM) radar from which it forwarded acquisition cues to Aegis BMD and THAAD during the MDA's combined developmental/ operational Flight Test Integrated-01 (FTI- 01).
- In November 2012, C2BMC participated in Ground Test Integrated-04e Part 1 (GTI-04e Part 1), an MDA combined developmental/operational ground test that focused on the defense of USEUCOM and USCENTCOM. The purpose of GTI-04e Part 1 was to assess the new mission functionality of the BMDS operational architecture consisting of Aegis BMD, THAAD, Patriot, AN/ TPY-2 (FBM), and C2BMC. In particular, the warfighters used C2BMC S6.4 to receive AN/TPY-2 (FBM) radar tracks and Link 16 data and forward system tracks. C2BMC S6.4 had no new functionality (software or hardware) during this test event.
- C2BMC S6.4 managed a single AN/TPY-2 (FBM) radar during the Fast Eagle II Increment 2 ground test in February 2013 that used both deployed and hardware-in-the-loop (HWIL) representations of BMDS weapon assets focusing on the defense of USCENTCOM.
- In February 2013, C2BMC participated in Flight Test Standard Missile-20 (FTM-20). It provided tracks generated by the Space Tracking and Surveillance System and processed by the External Sensors Laboratory and the C2BMC Experimental Laboratory to an Aegis BMD 4.0.2 ship. The ship used these data to successfully intercept a target with an SM-3 Block IA interceptor.
- In April 2013, the MDA started GTI-04e Part 1a integration testing. For this test event, C2BMC S6.4 was upgraded with Maintenance Release 1 and 2 (MR1 and MR2) with a focus on debris mitigation.
- In July 2013, the MDA conducted Flight Test GBI-07 (FTG- 07) in which C2BMC S6.4 forwarded tracks from Aegis BMD to the GMD Fire Control software.
- The MDA conducted Flight Test Operational (FTO-01) in September 2013 to demonstrate an integrated and layered upper-tier regional/theater BMDS defense. During the test, C2BMC S6.4 MR2 managed one deployed AN/TPY-2 (FBM) radar, including demonstrating MR2's debris mitigation functionality, and passed tracks of two medium-range targets between that radar and an Aegis BMD ship. C2BMC also received and responded properly to J-series messages from Aegis BMD and THAAD.
- The MDA conducted an HWIL test called Fast Aim in August 2013. The MDA used an HWIL representation of C2BMC S6.4 MR2 to forward track data from Aegis BMD, report data from an AN/TPY-2 (FBM) radar, and receive data from the Sea-Based X-band radar for simulated intercontinental ballistic missile threats to a portion of the U.S. Homeland.

Assessment

- C2BMC S6.4/Global Engagement Manager allows for automated management of multiple AN/TPY-2 (FBM) sensors located in one area of responsibility. It also provides greater automation of sensor management functions and improved track processing and reporting while requiring less operator involvement as compared to S6.2 software.
- C2BMC has limited battle management capabilities allowing Combatant Command sensor managers to direct AN/TPY-2 (FBM) radars to execute focused search plans or respond to a precision cue. S6.4 demonstrated command and control of a single AN/TPY-2 (FBM) radar in ground and flight tests. S6.4 demonstrated command and control of two AN/TPY-2 (FBM) radars in both an HWIL and distributed test environment, but not in a flight test using deployed assets.
- The C2BMC engagement planner provides performance analysis of the composition and location of U.S. and allied BMD assets but does not currently provide a system-level capability to coordinate engagement decisions. Such a capability is planned for S8.4.
- The MDA tested C2BMC S6.4 interactions with theater elements throughout the GTI-04e Parts 1, 1a, and Fast Eagle II Increment 2 ground test campaigns in FY13. In addition to providing situational awareness, C2BMC S6.4 (and in the case of GTI-04e Part 1a, S6.4 MR2) demonstrated interoperability with theater BMDS elements and command and control of up to two AN/TPY-2 (FBM) radars contributing to the defensive capability for the USEUCOM and USCENTCOM theaters.
- During the GTI-04e Parts 1, 1a, and Fast Eagle II Increment 2 campaigns, C2BMC generally performed nominally receiving AN/TPY-2 (FBM) and Link 16 data and forwarding system tracks to Link 16.
- C2BMC did experience some minor latency issues during stressing test cases with large numbers of threats. These latencies ultimately did not adversely affect the outcome for the test cases run during GTI-04e Part 1.
- The MDA and BMDS Operational Test Agency team identified S6.4 interoperability and command and control deficiencies during GTI-04e Part 1 that affected track processing, situational awareness, and battle management. Some of these problems are exacerbated by increasing the density of blue forces in any given theater. The MDA is currently testing solutions to these deficiencies.
- C2BMC selected and reported AN/TPY-2-based system tracks to Link 16 for all major objects from all threats in support of radar cueing in FTI-01.
- C2BMC demonstrated the ability to cue multiple weapon elements in addition to the management and forwarding of cues from the AN/TPY-2 (FBM) supporting FTI-01. It also forwarded track data to Aegis BMD, THAAD, and Patriot.
- During FTO-01, C2BMC demonstrated the ability to manage a deployed AN/TPY-2 (FBM) radar while forwarding track data from multiple targets between the radar and an Aegis BMD

ship. C2BMC also received and responded properly to J-series messages from Aegis BMD and THAAD.
- During the Fast Aim HWIL test, C2BMC demonstrated its role in the strategic defense of the U.S. Homeland by forwarding simulated intercontinental ballistic missile tracks between the multiple sensors and the GMD fire control.

Recommendations

- Status of Previous Recommendations. The MDA addressed eight of the previous nine recommendations. The FY12 recommendation has been combined with the FY13 recommendation. The MDA continues to make progress on the one outstanding FY06 recommendation to include assessments of Information Assurance during BMDS-centric C2BMC testing.
- FY13 Recommendations. The MDA should:
  1. Perform additional flight testing with multiple AN/TPY-2 (FBM) radars in a single Area of Regard or theater to assess C2BMC's ability to correctly task and coordinate track data from multiple radars.
  2. Continue to address the C2BMC interoperability and command and control deficiencies uncovered during the GTI-04e Part 1, Fast Eagle II Increment 2, and FTI-01 campaigns. Resolution of these deficiencies should be demonstrated through ground and/or flight testing.