

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

Executive Summary

- The Missile Defense Agency (MDA) continued to demonstrate an increased maturity of Command and Control, Battle Management, and Communications (C2BMC) Spiral 6.4 (S6.4) software during FY14.
 - Ground and flight testing demonstrated automated management of multiple AN/TPY-2 Forward-Based Mode (FBM) sensors. Ground testing further demonstrated tasking of the AN/TPY-2 radar in the presence of post-intercept debris.
 - C2BMC demonstrated the capability for Combatant Command (CCMD) sensor managers to direct AN/TPY-2 (FBM) radars to execute focused search plans or respond to precision cues.
 - C2BMC demonstrated timely and accurate forwarding of radar track data during numerous ground and flight tests.
- Ground and flight testing have identified numerous C2BMC S6.4 deficiencies in situational awareness and system-level interoperability. Furthermore, C2BMC S6.4 does not have an engagement management capability. The MDA is relying on C2BMC Spiral 8.2 (S8.2) (FY17-18) to address these deficiencies.
- During FY14, the MDA and Red Teams from the Threat Systems Management Office conducted three cyber assessments of future C2BMC software spirals using the newly created DOD Enterprise Cyber Range Environment (DECREE). In response, the MDA is examining solutions and procedures that can reduce the likelihood of occurrence or effect of cyber penetration.

System

- The C2BMC system is a CCMD interface to the Ballistic Missile Defense System (BMDS). More than 70 C2BMC workstations are fielded at U.S. Strategic, U.S. Northern, U.S. European, U.S. Pacific, and U.S. 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 CCMDs and other senior national leaders 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 from the Joint Tactical Information Distribution System Link 16 for theater/regional missile defense.
 - The C2BMC also provides upper echelon deliberate planning at the CCMD and component level. BMDS



elements (Aegis Ballistic Missile Defense [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.

- The C2BMC S6.4 suite provides command and control for the AN/TPY-2 FBM radar. The S6.4 Global Engagement Manager Suite provides updated sensor management, track processing, and reporting.
- Through the Global Communications Network, the C2BMC forwards AN/TPY-2 (FBM) and AN/SPY-1 tracks to GMD. Additionally, through the Joint Tactical Information Distribution System Link 16, it forwards AN/TPY-2 (FBM) tracks for THAAD and Patriot cueing and Aegis BMD engagement support.
- The C2BMC S8.2 is intended to improve and expand on S6.4 capabilities as the next step toward integrated sensor management and engagement coordination.

Mission

USSTRATCOM, USNORTHCOM, USEUCOM, USPACOM, and USCENTCOM use C2BMC to support ballistic missile

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defense engagements. More specifically, Combatant Commanders use C2BMC 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 C2BMC testing during FY14 in accordance with the DOT&E-approved Integrated Master Test Plan.
- C2BMC S6.4 Maintenance Release 2 (MR2) participated in the Flight Test Operational-01 (FTO-01) BMDS-level flight test in September 2013.
- The MDA executed Fast Phoenix in December 2013, a distributed ground test for USPACOM testing a new communications architecture between Aegis BMD ships using the Link Monitoring Management Tool and C2BMC S6.4 MR2. Fast Phoenix used both operational and hardware-in-the-loop (HWIL) assets and operational communications.
- C2BMC participated in Ground Test Integrated-04e (GTI-04e) Part 1a and GTI-04e Part 2, during which C2BMC S6.4 MR2 managed multiple AN/TPY-2 (FBM) radars.
 - Part 1a provided data for theater/regional interoperability assessments and focused on sensor debris mitigation (DM) functionality in defense of USEUCOM and USCENTCOM. The MDA conducted Phase I in April 2013 with DM disabled and Phase II in October 2013 with DM enabled.
 - Part 2 took place in March 2014 and focused on supporting the defense of USPACOM and USNORTHCOM. The test exercised several updates to C2BMC S6.4 MR2, including the tasking/managing of the Kyoga-Misaki AN/TPY-2 (FBM) radar, boost phase cueing by the AN/TPY-2 (FBM) radars, and updates to the focused search plans and threat enumerations. Part 2 also demonstrated interoperability with Aegis BMD in simulations for USCENTCOM.
- In June 2014, C2BMC S6.4 MR2 participated in Flight Test Ground-Based Interceptor-06b (FTG-06b). C2BMC provided situational awareness and forwarded track data from Aegis BMD and Link 16 data to the GMD Fire Control.
- C2BMC S6.4 MR2 participated in the Fast Exchange ground tests in both HWIL (June 2014) and fielded (August 2014) representations. C2BMC managed three AN/TPY-2 (FBM) radars in a cross-Area of Responsibility environment.
- During FY14, the MDA and Red Teams from the Threat Systems Management Office conducted three cyber assessments of future C2BMC software spirals using the newly created DECRE. The first assessment examined cyber effects that previous Red Teams were in a position to deliver on operational networks during an USEUCOM assessment. Each subsequent event added additional network elements and operational realism.

Assessment

- The classified DOT&E February 2014 BMDS Annual Report, Appendix E, assesses the results from the FTO-01 mission and includes six key findings covering C2BMC participation and system-level performance, effectiveness, and suitability.
- Fast Phoenix demonstrated accurate and timely data sharing over Link 16 between Aegis BMD and C2BMC using the Link Monitoring Management Tool and C2BMC Air Defense Systems Integrator.
- During the GTI-04e Parts 1a and 2, C2BMC S6.4 MR2 received AN/TPY-2 (FBM) and Link 16 data and forwarded system tracks to Link 16. C2BMC provided situational awareness and demonstrated interoperability with theater BMDS elements. It controlled two AN/TPY-2 (FBM) radars for tasking by USEUCOM, USPACOM, USNORTHCOM, and USCENTCOM. Further, C2BMC demonstrated boost phase cue capabilities when managing two AN/TPY-2 radars for USPACOM. Testing uncovered problems with missile-threat acquisition using focused search plans designed for the new USPACOM radar and new threat characteristics. The MDA is investigating improvements to AN/TPY-2 radar search-plan designs and C2BMC sensor-tasking algorithms to address these problems.
- The C2BMC S6.4 MR2 performed nominally during the FTG-06b mission. It provided situational awareness and forwarded radar track information as designed. However, it did not receive the expected Sea-Based X-band radar-generated engagement hit assessment from the GMD fire control component. The MDA is investigating why this event did not occur.
- Fast Exchange demonstrated passing of pertinent, geographically-filtered sensor track data between BMDS elements in USEUCOM and USCENTCOM. Two C2BMC suites sent and received AN/TPY-2 (FBM) data over Link 16 involving the Aegis BMD, THAAD, and Space-Based Infrared System elements.
- The Red Team demonstrated a number of potential cyber vulnerabilities during the DECRE events. More importantly, MDA engineers were given access to all Red Team activities during the event execution. They benefited greatly from first-hand observations and the opportunity to query the Red Team regarding steps to preclude invasive activities. In response, the MDA is examining solutions and procedures that can reduce the likelihood of occurrence or effect of cyber penetration. Further, the MDA is actively planning additional cyber assessments using the DECRE environment.

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Recommendations

- Status of Previous Recommendations. The MDA addressed 9 of the previous 11 recommendations. The MDA continues to make progress on the outstanding FY06 recommendation to include cyber assessments during BMDS-centric C2BMC testing. A pathfinder exercise is planned during the Ground Test-06 campaign in FY15-16 with a more complete cyber

assessment during the Ground Test-07 campaign in FY17-18. The MDA is relying on C2BMC S8.2 (FY17-18) to address the remaining FY13 recommendation on C2BMC interoperability and engagement management deficiencies uncovered during numerous tests, including most recently FTO-01.

- FY14 Recommendations. None.

