

Apache Block III (AB3) Upgrade

Executive Summary

- The Army conducted the Apache Block III (AB3) IOT&E at the National Training Center in Fort Irwin, California, March through April 2012. The test included training, force-on-force missions, live fire of all weapon systems, and threat penetration testing of AB3 computer networks. The IOT&E was preceded by four years of developmental testing that included analysis, modeling and simulation, component qualification testing, testing in extreme environments, system-level flight testing, weapons qualifications, and live fire testing.
- The Army completed LFT&E of AB3 flight critical and force protection components followed by vulnerability analyses to evaluate aircraft ballistic survivability.
- In August 2012, DOT&E submitted a Combined Initial Operational Test and Evaluation and Live Fire Test and Evaluation report to Congress evaluating:
 - AB3 as operationally effective. It has improved flight performance compared to legacy Apache Block II (AB2) aircraft. When aided by real-time unmanned aircraft system (UAS) video containing actionable intelligence, AB3 teams demonstrated target acquisition ranges, Hellfire missile engagement ranges, and mission success rates greater than the legacy AB2 aircraft.
 - AB3 as operationally suitable. The aircraft exceeded reliability thresholds with statistical confidence and met all current maintainability requirements. Overall, flight safety is enhanced by the aircraft's ability to operate with increased power margins.
 - AB3 as at least as survivable as legacy AB2 aircraft. New AB3 subsystems met survivability requirements and demonstrated ballistic tolerance similar to legacy AB2 aircraft.



- Level 4 receives and displays UAS data/video feed and enables the aircrew to control the flight path of the UAS and the payload
- Improved Radar Electronic Unit to provide radio frequency interferometer passive ranging, extended fire control radar range, and maritime targeting capability
- Improved aircraft performance with 701D engines, composite main rotor blades, weight reduction through processor and avionic upgrades, and an improved rotor drive system
- Enhanced survivability with integrated aircraft survivability equipment and additional crew and avionic armoring
- Enhanced communication capability, which includes satellite communication, Link 16 datalink, and an integrated communication suite to meet global air traffic management requirements
- Improved reliability and maintainability using embedded system-level diagnostics, improved electronic technical manuals, and reduced obsolescence

System

- The AB3 is a modernized version of the AH-64D Attack Helicopter with which the Army intends to sustain the Apache fleet through the year 2040. The Army intends to organize the AB3 in Attack/Reconnaissance Battalions assigned to the Combat Aviation Brigades. Each Battalion will have 24 aircraft.
- The Army acquisition objective is to procure 690 AB3 aircraft: 634 remanufactured and 56 new build aircraft. Remanufactured and new build AB3 aircraft are built on the same assembly line in Mesa, Arizona, and are essentially the same aircraft.
- The AB3 aircraft capability improvements include:
 - Levels 2 through 4 UAS control by the AB3 aircrew
 - Level 2 receives and displays UAS data/video feed
 - Level 3 receives and displays UAS data/video feed and enables the aircrew to control the UAS payload (sensor)

Mission

The Attack/Reconnaissance Battalions assigned to the Combat Aviation Brigade will employ the AB3 to conduct the following types of missions:

- Attack
- Movement to contact
- Reconnaissance
- Security

Major Contractors

- Aircraft: The Boeing Company Integrated Defense Systems – Mesa, Arizona
- Sensors and UAS datalink: Longbow Limited – Orlando, Florida, and Baltimore, Maryland

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Activity

- The Army conducted the AB3 IOT&E in accordance with the DOT&E-approved test plan from March 16, 2012, through April 13, 2012, at the National Training Center in Fort Irwin, California. The IOT&E consisted of force-on-force missions with a dedicated opposing force; live fire of all weapon systems; and threat penetration testing of AB3 computer networks.
- Prior to the IOT&E, the test unit completed three weeks of classroom, simulator, and flight training at the Boeing facility in Mesa, Arizona. Legacy AB2 aircraft and aircrews conducted home-station training prior to deploying to the National Training Center.
- During IOT&E, five AB3 aircraft flew 367 flight hours. The five AB3 aircraft and five legacy AB2 aircraft conducted 28 force-on-force missions under varying conditions. The conditions were selected using Design of Experiments methodology with four factors: aircraft type (AB3 or AB2), mission type (reconnaissance or attack), UAS support (with or without), and light level (day or night). A single Gray Eagle UAS with associated flight crew and personnel provided mission support to the IOT&E from Edwards AFB, California.
- The Army conducted ballistic testing of production-representative AB3-improved drive system components and composite main rotor blades (CMRBs) from May through July 2011 at Aberdeen Proving Ground, Maryland.
- The Army conducted ballistic shots against 20 crew armor panels on December 7, 2010, to verify performance against the key performance parameter force protection threat.
- At the conclusion of ballistic testing, the Army completed a system-level vulnerability analysis using a modeling and simulation suite that models target-threat interaction for direct fire and small projectiles on air and ground systems.
- The Air Force approved the Mission Design Series request to designate the AB3 as the AH-64E on September 6, 2012.
- In August 2012, DOT&E submitted a Combined Initial Operational Test and Evaluation and Live Fire Test and Evaluation report to Congress.
- The USD(AT&L) conducted a Defense Acquisition Board on August 16, 2012. The key decisions include the following.
 - Approve full-rate production for the Apache Block IIIA (AB3A) Remanufacture program.
 - Authorize the procurement of up to 12 low-rate initial production aircraft in FY13 for the Apache Block IIIB (AB3B) New Build program.
 - The Army will fully fund the AB3A Remanufacture program to the Director of Cost Assessment and Program Evaluation-approved independent cost estimate.
 - Upon approval of the AB3A Remanufacture Acquisition Program Baseline, the AB3A Remanufacture and AB3B New Build programs will be designated as Acquisition Category 1C programs.

Assessment

- The AB3 is operationally effective. It has improved flight performance compared to legacy AB2 aircraft, and when aided by real-time UAS video containing actionable intelligence, AB3 teams demonstrated target acquisition ranges, Hellfire engagement ranges, and greater mission success rates than legacy AB2 aircraft teams.
- AB3 crews were consistently able to establish a datalink with Gray Eagle to receive UAS video. Crews had some difficulty establishing and maintaining control of the Gray Eagle sensor.
- There is a pilot confidence concern with the AB3 transmission design. It has a single tail rotor output pinion that provides power for the tail rotor, hydraulic pump, and electric generator. A failure of this one pinion could be catastrophic for the aircrew, as this would result in the simultaneous loss of the tail rotor, electric generator, and hydraulic power.
- AB3 is operationally suitable. The helicopter exceeded its reliability thresholds with statistical confidence and met all current maintainability requirements. The redesigned AB3 helmet offers improved comfort and performance compared to the legacy helmet. Overall, flight safety is enhanced by AB3's increased power margins relative to legacy AB2 aircraft.
- The AB3 is at least as survivable as the legacy AB2 aircraft. New AB3 subsystems met survivability requirements and demonstrated ballistic tolerance similar to legacy AB2 aircraft.
- Infrared countermeasures provide protection against most man-portable rocket system threats, but the Army should improve the laser and radar warning systems. Consistent with other DOT&E evaluations, the APR-39A(V)4 radar warning receiver was not effective during IOT&E. Radar warning receiver false alarms were so pervasive during the IOT&E that the pilots ignored or turned off all countermeasure warning systems.
- The AB3 is vulnerable to computer network attack. An Army threat computer network operations team conducted limited penetration testing of AB3 computer networks. The threat team considered three attack vectors to gain access to the AB3 networked systems: the Blue Force Tracker, the Aviation Mission Planning System, and aircraft maintenance ports. Threat team activities were limited to computer network scanning (passive and active) while the AB3 aircraft were on the ground, so as not to affect flight operations. The team was successful in gaining access to AB3 systems.
- The CMRB has very low vulnerability to most small arms threats. However, during another test, a larger threat impacted the blade spar and removed a substantial portion of the spar's cross-sectional area. The blade completed 30 minutes of operation, despite a loss of structural stiffness. While spinning, the centrifugal forces kept the blade straight, but as the blade rotation slowed after the shot, the blade folded downward at the damage location. It is uncertain if the observed damage would have resulted in catastrophic blade failure within 30 minutes under actual flight conditions, or if

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equivalent damage located at another spar location would have resulted in the same outcome.

Recommendations

- Status of Previous Recommendations. The Army continues to address all DOT&E recommendations from previous testing. Many of the recommendations, including the Fire Control Radar performance anomalies and the AB3 aviator helmet fit and visibility display, were addressed and changed prior to the IOT&E.
- FY12 Recommendations. The Army should:
 1. Continue to refine tactics, techniques, and procedures for teaming with UASs. Determine the root cause for datalink dropouts and improve the stability of the tactical command datalink for control of UAS sensors.
 2. Consider incorporating improvements to current threat warning systems as they are developed. Upgrade radar and laser warning systems and provide for adjustable controls for each warning system.
 3. Address pilot's confidence concerns with regard to the transmission design. Conduct physics of failure analysis to provide an independent analysis of the probability of failure of the new tail rotor pinion design. Investigate the feasibility of alternate transmission designs that provide automatic redundant hydraulic and electrical power in the event of loss of power to the tail rotor.
 4. Address the Information Assurance vulnerabilities identified.
 5. Perform a structural analysis of the CMRB to better understand the load carrying capabilities of the blade that was damaged during ballistic testing.

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