Joint Air-to-Ground Missile (JAGM)

Executive Summary

- As of September 28, 2017, the Army has completed 2 successful ground launches and 20 successful Integrated Test and Evaluation shots launched from an Apache aircraft, 4 of which included live warheads. The program intends to fire 48 Engineering Manufacturing and Development (EMD) missiles in support of Milestone C in FY19. Ten of the missile shots will occur during the planned Limited User Test in January 2018.
- Eighteen of 20 EMD missiles hit their intended targets. One warhead did not function. Failure analysis is underway to determine the root cause.
- Testing has revealed that targeting systems on the Apache aircraft generate large target location and target velocity errors that will affect the Joint Air-to-Ground Missile (JAGM) performance.
- The system completed the first of two planned cybersecurity assessments. The contractor identified a Category I vulnerability during test preparation: a trained and knowledgeable cyber analyst could gain access to the missile guidance software.

System

- The JAGM combines the capabilities of the HELLFIRE II and Longbow HELLFIRE missiles into a single missile. The major contractor combined two sensor technologies – semi-active laser (SAL) and millimeter wave (MMW) radar – into a single seeker and guidance system and mated it to the HELLFIRE Romeo warhead, motor, and flight control systems.
- The dual seeker, in addition to providing independent SAL and MMW targeting, offers two combined modes using both the laser and MMW seekers to maintain desired performance in degraded environments and against threat countermeasures.

- The HELLFIRE Romeo warhead Integrated Blast and Fragmentation Sleeve (IBFS) detonates with a programmable delay fuse and a Height-of-Burst (HOB) feature. This updated warhead blast provides a capability to engage armored vehicles while the IBFS and HOB feature engage personnel in the open. The programmable delay allows time for the warhead to penetrate deep into a building, bunker, or lightly armored vehicle before detonating to incapacitate the personnel and destroy the equipment inside.

Mission

Army and Marine Corps commanders intend to employ JAGM from rotary-wing and unmanned aircraft to engage enemy combatants in stationary and moving armored and unarmored vehicles, within complex building and bunker structures, in small boats, and in the open.

Major Contractor

Lockheed Martin Corporation, Missiles and Fire Control Division – Grand Prairie, Texas

Activity

- The Army conducted two ground-launched risk reduction shots in October 2016. Both hit their target. The second shot repeated an earlier risk reduction shot that missed the target following extended exposure to cold temperatures.
- The Army conducted two successful aircraft-launched risk reduction shots in December 2016 and January 2017. One missile was launched by an AH-64D over water against a small boat target and the other was launched by an AH-64E against a T-72 tank.
- The Army conducted a cybersecurity Cooperative Vulnerability and Penetration Assessment of the JAGM guidance section in April 2017.

- The Army conducted 2 ground-launched safety-of-flight shots in April 2017 and 20 Integrated Test and Evaluation shots from Apache through September 28, 2017, using EMD phase production missiles.
- Safety-of-flight and integrated test shots included four live fire shots against a brick-over-block wall with a high temperature thermally soaked warhead, a 2S1 self-propelled howitzer, a T-72 with explosive reactive armor, and an armored personnel carrier.
- Live fire testing in FY17 has also included component tests, behind armor debris, arena, and rolled homogenous armor testing to characterize warhead lethality and to compare its

performance to the legacy AGM-114-R HELLFIRE missiles. Fuse and dynamic penetration testing is planned for February to April 2018.

- The program intends to fire 48 EMD missiles in support of Milestone C in FY19. Ten of the missile shots will occur during the planned Limited User Test in January 2018.
- The Army conducted all testing in accordance with the DOT&E-approved test plan.

Assessment

- The program is proceeding according to schedule toward Milestone C. As of September 28, 2017, the Army has completed 20 successful missile launches from an AH-64E Apache aircraft at Yuma Proving Ground, Arizona. Eighteen of these missiles hit their intended targets under carefully controlled developmental flight test conditions. Missile geometries and modes were selected from among those in the most favorable part of the performance envelope. EMD and risk reduction testing has demonstrated that the Apache's Modernized Target Acquisition Designation Sight and Fire Control Radar occasionally generate erroneous target velocities that are passed to the missile without cueing the gunner of the errors.
- One EMD missile missed the intended target, hitting the ground well outside the burst radius of the warhead. A second EMD missile hit near the bottom of the vehicle track and road wheels. Post-test investigation will adjudicate whether this missile hit or missed the intended target.

- Eighteen missile launches from an AH-64E hit the intended target, one of the four launches that included a live warhead failed to detonate. Failure analysis is currently underway to determine the root cause.
- Preliminary results of component and other warhead characterization tests indicate JAGM warhead lethality is equivalent to the legacy HELLFIRE system.
- The initial cybersecurity testing of the JAGM guidance section in April 2017 revealed a Category I vulnerability: a trained and knowledgeable cyber analyst could gain access to the missile guidance software.
- Development of Apache software to recognize the JAGM missile and enable all its operational modes is under way with an early version to be available just before Milestone C. Until that software is available, Apache aircrews must launch the JAGM missile using non-standard procedures and an engineering test page in the cockpit.

Recommendations

- Status of Previous Recommendations. This is the first annual report for this program.
- FY17 Recommendation.
  1. The Apache Program Office should work with the JAGM Program Office to identify the source of spurious sensor targeting data and eliminate or mitigate targeting errors.