

M109 Family of Vehicles (FoV) Paladin Integrated Management (PIM)

Executive Summary

- The Army continued multiple phases of the M109 Family of Vehicles (FoV) Paladin Integrated Management (PIM) LFT&E program at Aberdeen Proving Ground, Maryland, to include testing of the underbody IED protection kit, Automatic Fire Extinguishing Systems (AFES), ballistic protection of modified armored areas, and system response to simulated damaged sub-systems. In FY15, the Army:
 - Validated modifications to the Self Propelled Howitzer's (SPH) Threshold 1 (T1) and Threshold 2 (T2) armor systems, including those made to address vulnerable areas identified in early testing. Most of the modified armored areas provide protection against requirement threats.
 - Integrated and tested changes to the crew compartment AFES in the Carrier, Ammunition Tracked (CAT). These measures mitigated the AFES deficiency identified in earlier, FY14 testing.
 - Verified that the SPH has the potential to provide underbody IED protection against the requirement threat and the objective level threat when equipped with the underbody blast kit. At this time, the Army does not intend to equip the SPH or CAT vehicles with the underbody kit.
- The Army did not address the deficiencies identified in fire survivability testing of the SPH crew compartment AFES and should take measures to reduce vulnerability to fires in the SPH crew compartment.
- The Army began full-up system-level testing of the SPH and CAT resupply vehicle in 1QFY16.

System

- The M109 FoV PIM consists of two vehicles: the SPH and CAT resupply vehicle.
 - The M109A7 SPH is a tracked, self-propelled 155 mm howitzer designed to improve sustainability over the legacy M109A6 howitzer fleet. The full-rate production howitzers will have a modified M109A6 turret with a high-voltage electrical system and a modified Bradley Fighting Vehicle chassis, power train, and suspension. The M109A7 does not include any upgrades to the cannon. A crew of four Soldiers operates the SPH and can use it to engage targets at ranges of 22 kilometers using standard projectiles and 30 kilometers using rocket-assisted projectiles.
 - The M992A3 CAT supplies the SPH with ammunition. The full-rate production ammunition carriers will have a chassis similar to the SPH. The ammunition carriers are designed to carry 12,000 pounds or 98 rounds of ammunition in various configurations. A crew of four Soldiers operates the CAT.



- The Army will equip the SPH and CAT with two armor configurations to meet two threshold requirements for force protection and survivability – Threshold 1 (T1) and Threshold 2 (T2).
 - The base T1 armor configuration is integral to the SPH and CAT. The T2 configuration is intended to meet protection requirements beyond the T1 threshold with add-on armor kits.
 - The Army plans to employ PIM vehicles in the T1 configuration during normal operations and will equip the SPH and CAT with T2 add-on armor kits during combat operations.
- The Army designed an underbody kit to determine the potential protection an SPH and CAT could provide against IEDs similar to those encountered in Iraq and Afghanistan. The Army purchased five underbelly kits for test purposes. At this time, the Army does not intend to equip the SPH or CAT with the underbody kit.
- The Army intends to employ the M109 FoV as part of a Fires Battalion in the Armored Brigade Combat Team and Artillery Fires Brigades, with the capability to support any Brigade Combat Team.
- The Army plans to field up to 557 sets of the M109 FoV with full-rate production planned for FY17.

Mission

Commanders employ field artillery units equipped with the M109 FoV to destroy, defeat, or disrupt the enemy by providing integrated, massed, and precision indirect fire effects in support of maneuver units conducting unified land operations.

Major Contractor

BAE Systems – York, Pennsylvania

FY15 ARMY PROGRAMS

Activity

- In FY15, the Army continued LFT&E of the M109 FoV PIM at Aberdeen Proving Ground, Maryland, to include the following:
 - Exploitation testing on the SPH 5A to validate armor modifications. The Army validated modifications to the SPH's T1 and T2 armor systems, including those made to address vulnerable areas identified in early testing.
 - Fire survivability testing. AFES testing in FY14 identified system deficiencies with the crew compartment AFES in both the SPH and CAT. To improve survivability, the Army made changes to the crew compartment AFES in the CAT vehicle. The Army integrated and challenged these changes in test. However, the Army did not address the deficiencies identified in fire survivability testing of the SPH crew compartment AFES.
 - Underbody blast testing against the "SPH 5A", a high-fidelity SPH prototype. The testing included two events with and without an objective-level underbody blast kit.
 - Controlled damage experimentation on selected subsystem (such as the high voltage electrical system) to determine the consequences of various types of damage.
- The Army conducted all testing in accordance with DOT&E-approved test plans.
- The Army began full-up system-level testing of the M109 SPH and CAT resupply vehicle in 1QFY16.

Assessment

- Over the course of the LFT&E program, the Program Office has taken considerable action to correct deficiencies identified in early testing and to validate associated fixes.

- During armor exploitation testing, most of the modified armored areas demonstrated that they provide protection against Key Performance Parameter threats.
- Changes to the crew compartment AFES in the CAT mitigate the deficiency identified in early testing and reduce the CAT's vulnerability to fires.
- The crew compartment AFES in the SPH was designed to only protect a localized area in the compartment and therefore remains deficient. The system should be redesigned to improve SPH survivability to fires.
- The Army verified that the base SPH has the potential to provide underbody IED protection against the requirement blast threat and the objective level threat when equipped with the underbody blast kit. Additional underbody blast testing of the SPH and CAT is required to quantify the benefit of equipping both platforms with the kit.

Recommendations

- Status of Previous Recommendations. In FY14, DOT&E recommended the Army correct deficiencies identified in fire survivability testing. In FY15, the Army made design changes to mitigate the deficiencies in the CAT's crew compartment AFES and validated those changes in test. The Army did not incorporate changes to address the deficiencies in the SPH's crew compartment AFES.
- FY15 Recommendation.
 1. The Army should correct the deficiencies in the SPH's crew compartment AFES and validate those fixes in test.