

Active Protection Systems (APS) Program

Executive Summary

- In FY17, in support of the European Deterrence Initiative, the Army initiated an expedited installation and characterization of three Active Protection Systems (APS): the Rafael Trophy APS for the Army Abrams M1A2 and Marine Corps M1A1 tanks, the Artis Iron Curtain APS for the Stryker family of vehicles, and the Elbit Iron Fist – Light Decoupled APS for the Bradley family of vehicles.
- The selected APS technologies are non-developmental items intended to improve the survivability of ground combat vehicles against anti-tank guided missiles, rocket-propelled grenades (RPGs), and recoilless rifle threats by using a kinetic “hard kill” mechanism to intercept and disrupt/defeat the incoming threat.
- The Army tested the APS in two phases. Phase I assessed technology maturity, performance, and integration. Phase II supported the urgent materiel release (UMR).

Trophy APS

- In FY19, the Army completed Phase II of the Trophy APS testing. DOT&E will summarize the demonstrated performance in a combined OT&E/LFT&E report in 2QFY20 to support the UMR.
- Based on the demonstrated performance, the Army issued a directed requirement to procure and install Trophy APS systems on Abrams for a total of four Armored Brigade Combat Teams, by the end of FY20.

Iron Fist – Light Decoupled APS

- In FY18, the Army completed Phase I Iron Fist APS testing on the Bradley. This test supported the Army Requirements Oversight Council (AROC) meeting on November 30, 2018, where the Army decided to move forward with the Phase II Iron Fist – Light Decoupled APS program. Phase II testing is currently scheduled for FY21.

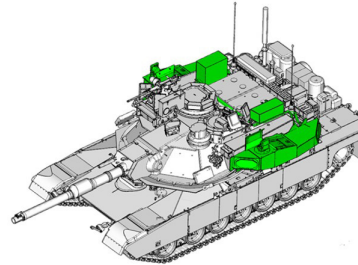
Stryker APS

- In FY18, the Army completed Phase I Iron Curtain APS testing on the Stryker. In FY19, the Army pursued and tested two additional Stryker APS solutions: Advanced Modular Armor Protection – Active Defense System by UBT/Rheinmetall and the Trophy Light system by DRS/Rafael. The Army has not selected any of these solutions due to the demonstrated performance and the systems maturity.

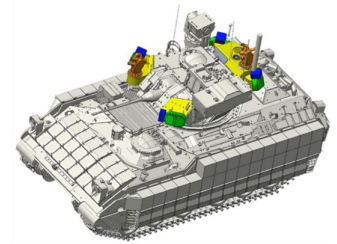
System

Trophy APS

- The Trophy APS includes search radars to detect, identify, and track incoming threats, and a set of kinetic projectiles intended to destroy the threat or cause its early detonation. The Abrams base armor is expected to absorb post-engagement threat residuals (threat by-products generated after the collision). The Trophy APS adds approximately 8,600 pounds to the platform. The Army



Abrams with Trophy APS



Bradley with Iron Fist APS

has integrated the Trophy system into the tank’s situational awareness system.

Iron Fist – Light Decoupled APS

- The Iron Fist – Light Decoupled APS includes radars and optics to detect, identify, and track incoming threats, and a set of explosive projectiles intended to destroy or divert the threat. The system adds approximately 1,543 pounds to the platform. The fielded Bradley A3 does not generate sufficient power to operate the APS, while the Bradley A4 power components, currently under development, can support this APS solution.

Stryker APS

- The Army evaluated three different solutions for Stryker APS: Iron Curtain, Advanced Modular Armor Protection – Active Defense System, and the Trophy Medium Variant system. Each vendor had unique technical solutions with different countermeasure mechanisms. The Army did not select any of the three systems evaluated.

Mission

- Army and Marine units intend to use Trophy APS-equipped Abrams main battle tanks to disrupt/destroy certain classes of enemy fire while safely maneuvering across the full range of military operations.
- Army units intend to use Bradley vehicles equipped with the Iron Fist APS to provide protected transport of soldiers, to provide over-watching fires to support dismounted infantry and suppress an enemy, and to disrupt/destroy enemy military forces and control land areas.
- Army commanders intend to use Stryker vehicles equipped with APS (if a suitable solution is found) to disrupt/destroy enemy military forces, to control land areas including populations and resources, and to conduct combat operations to protect U.S. national interests while increasing protection to the vehicle and its crew.

Major Contractors

- DRS/Rafael – St. Louis, Missouri
- GD-OTS/Elbit Land Systems Ramat Hasharon – Haifa, Israel
- UBT/Rheinmetall – Troy, Michigan
- Artis – Herndon, Virginia

Activity

- The Army used a two-phased approach to characterize the performance of the APS solutions in support of the UMR:
 - Phase I consisted of limited characterization testing intended to determine fundamental capabilities and limitations of the APS and feasibility of installing APS systems on the host platforms.
 - Phase II focused on testing production-representative APS as installed on operationally representative systems under realistic combat conditions.

Trophy APS

- In September 2017, the Army completed Phase I testing. Phase I testing also included 10 Marine Corps Abrams tests with moving vehicle and inert threats.
- In September 2019, the Army completed Phase II testing, which included:
 - Operational testing at Fort Bliss, Texas, from November 28 through December 14, 2018. An armored platoon outfitted with Trophy APS-equipped M1A2 SEPv2 tanks successfully conducted maneuver and gunnery test events. The test unit completed Trophy APS familiarization training, a force-on-force maneuver event against an opposing force, and tank qualification gunnery. The final test event consisted of four effectiveness shots utilizing inert RPG threats to assess how well Trophy APS retained system calibration following maneuver and gunnery.
 - The Army and Marine Corps completed 62 live fire tests including some operationally stressing conditions (e.g., background clutter, rain, concrete walls) to adequately evaluate the APS performance. Live fire testing included inert unguided threats fired against either a fully functional Abrams SEPv2 or Marine M1A1 tanks equipped with Trophy, and live rocket and missile threats fired against a ballistic hull and turret tank shell powered by a generator.
 - The Army completed one live fire test against a fully functional Abrams SEPv2 tank to assess a potential for cascading, system-level damage effects post intercept.
 - The Army conducted Trophy APS Phase II testing at Redstone Test Center, Aberdeen Test Center, Yuma Test Center, and Fort Bliss in accordance with DOT&E-approved test plans.
- The Army is planning a Phase III test series to examine Trophy APS as installed on Abrams SEPv3 vehicles.

Iron Fist – Light Decoupled APS

- In August 2018, the Army completed Phase I testing, which included live fire and user excursion tests. The contractor (Elbit) conducted follow-on testing in Israel to implement and retest changes to the system design needed for the AROC decision to enter Phase II. Phase II planning will be conducted in FY20.

Stryker APS

- From December 2018 to April 2019, the Army tested two alternate APS solutions intended to characterize the maturity and feasibility of these systems as installed on a Stryker vehicle.

Assessment

Trophy APS

- During Phase I, Trophy APS countered most of the threats tested in basic range conditions and threat engagements. The Army relied heavily on the contractors to set up the Trophy APS due to the limited knowledge of the foreign system.
- The evaluation of Phase II live fire testing is ongoing. The Army trained the test personnel to use the system without help from the contractor. The Army is maturing the existing vulnerability modeling and simulation tools to complement the system assessment.
- The evaluation of Phase II operational testing is ongoing. Limited testing was conducted to assess installation time, transportation issues, and technical manual validation. There was no real-time casualty assessment (RTCA) or simulator support for Trophy APS testing. This hindered the test unit's ability to develop or assess crew and platoon tactics, techniques, and procedures associated with Trophy APS employment in a force-on-force environment. The Army has no plans to develop RTCA. The Army is developing Training Aids, Devices, Simulators, and Simulations for Trophy APS.
- Phase II live fire and operational testing was designed to support the fielding of one brigade of pre-positioned stocks to the European Command.
- DOT&E will detail the performance of the Trophy APS-equipped Abrams tank in a combined OT&E/LFT&E report in 2QFY20 to support the UMR.

Iron Fist – Light Decoupled APS

- Phase I demonstrated an inconsistent capability of the Iron Fist APS to intercept threats largely due to counterammunition dudding and power failures to the launcher. The Army has been working with the vendor to address and implement some prospective solutions to mitigate these shortfalls. The Army will verify these fixes in Phase II scheduled for 1QFY21. A demo of the Phase II system will be conducted at the vendor's test facility in December 2019.

Stryker APS

- Testing showed neither system was immediately suitable for Stryker. Currently, the Army has not selected any of the tested solutions due to system maturity.

Recommendations

The Army should:

1. Ensure Trophy Phase III testing is designed to examine areas identified as a concern in Phase II.
2. Continue to develop and advance the appropriate modeling and simulation tools needed to support the test planning and evaluation of systems equipped with APS.
3. Include test events designed to assess logistical considerations for maintenance and counterammunition resupply.
4. Conduct additional testing to further assess installation and transportability considerations.