

Advanced Protection from Objective Threats (APOT)

PROBLEM / OBJECTIVE

A fundamental Army combat vehicle challenge is improving protection from ballistic and blast threats while reducing weight and controlling cost. Advanced structure and armor solutions for combat vehicles require multiple complex assembly procedures and expensive advanced armor materials with long lead-times.

The Army Manufacturing Technology (ManTech) program has invested in advanced technologies to address manufacturing readiness of new armor materials and structures. This approach positions the industrial base to deliver underbody blast, kinetic energy, and multi-threat armor solutions.

ACCOMPLISHMENTS / PAYOFF

Process Improvement: Specific technologies which this program demonstrated included:

- Hot press and pressure assisted sintering processes for silicon-carbide high-performance armor ceramic.
- First-of-a-kind full scale processing for single piece forged or formed underbody structures.
- Composite armor manufacturing using hybridized 3D through-thickness reinforced (TTR) woven processes.
- Application and maturation of a BAE proprietary High Energy Buried Arc Welding (HEBAW) process for lower hull structural designs which demonstrated objective level underbody protection and better quality than traditional welding processes.
- New alloys for enhanced underbody protection which can now be formed, forged and welded.
- Enabled manufacturing readiness level (MRL) 8

Implementation and Technology Transfer:

The APOT ManTech project provided the results of the aluminum hull and TTR armor manufacturing capability to the TRADOC Maneuver Center of Excellence (MCoE) to inform ground combat vehicle requirements. MCoE wrote underbody blast protection requirements based on results demonstrated in this effort. The APOT project transitioned HEBA welded structure designs to the Armored Multi-purpose Vehicle (AMPV) program, whose lower hull utilizes structural features developed from this effort. The APOT project also transitioned

TTR applique armor to PM Stryker for testing, qualification and potential implementation.



Ballistic Hull and Turret System

Armor Tiles

Expected Benefits and Warfighter Impact:

Lighter weight armor protection systems for ground vehicles have the potential to increase mobility, endurance, and mission flexibility and reduce operating costs. Specific benefits of this ManTech investment include:

- Validated underbody manufacturing options to improve underbody blast protection for combat vehicles.
- Single piece underbody hulls and UB protection kits for Objective protection at less than \$30/lb.
- Non-traditional approaches for underbody design and manufacturing capability for AMPV and the Next Generation Combat Vehicle (NGCV).
- Reduced cost by 30% for 3D weave & ceramic armor tile enabling affordable higher-performing solutions.

TIME LINE / MILESTONE

Start Date	September 2012
End Date	April 2017

FUNDING

U.S. Army ManTech	\$25.9M
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PARTICIPANTS

U.S. Army RDECOM Army Research Lab (ARL)
 Constellium - Ravenswood, WV
 TEAM - Woonsocket, Rhode Island
 BAE - York, Pennsylvania
 Alcoa - Cleveland, Ohio
 SFSA - Chicago, Illinois
 CoorsTek - Vista, California
 ATI - Lexington, Kentucky