

Enabling Hybridized Manufacturing Process for Lightweight Body Armor

PROBLEM / OBJECTIVE

U.S. ceramic/composite body armor is battle-proven to be the most effective protection for the warfighter against a variety of threats, including fragmentation and a defined set of small arms bullets. However, the most consistent request from both program managers and user communities is the desire to deliver the same level of ceramic/composite ballistic protection at lighter weight.

The Army ManTech and Defense-Wide Manufacturing Science and Technology (DMS&T) program funded a project with the goal to enable new, high risk approaches in the process and manufacture of body armor materials to reduce weight.



Novel Integrated Ceramic/Composite Processes for Lighter Body Armor

ACCOMPLISHMENTS / PAYOFF

Process Improvement: Specific technologies which this program improved included:

- Process methods for boron carbide and silicon carbide blends that enabled higher ballistic mass efficiency
- New fiber architecture and manufacturing process that reduced non-penetrating back face deformation by over 20% (critical for ESAPI trauma requirements)
- First-of-a-kind high pressure fiber alignment techniques to optimize ballistic integrity of body armor plate backings
- New adhesive, bonding, sintering methodologies and first-of-kind automated composite ply backing assembly machine to enable semi-continuous processing of curved hot-pressed ceramic plates
- Enabled manufacturing readiness level (MRL) 8

Implementation and Technology Transfer:

The technology transitioned to PM Soldier Protection and Individual Equipment (SPIE) in September 2014 for use on the Soldier Protection Program (SPS). Technology transitioned to body armor contractors (BAE Systems and 3M/Ceradyne). This technology is being implemented on Army, Marines, Special Operations Forces, Navy, and Air Force body armor systems.

Expected Benefits and Warfighter Impact: Lighter Soldier protection will enhance Soldier mobility, endurance, and readiness – especially in extreme environments. Automated and semi-automated processes will enable more effective scale up and scale down of body armor plate manufacture, given the cyclic nature of body armor system procurement. Specific benefits of this ManTech investment include:

- Ballistic and backface deformation criteria of 6.3 psf areal density which represents a 10% weight reduction over current body armor systems.
- Reduced weight from 5.45 lbs to 4.5 lbs for each medium size body armor plate.

TIME LINE / MILESTONE

Start Date	September 2010
End Date	September 2014

FUNDING

U.S. Army ManTech	\$6.7M
DMS&T	\$3.7M

PARTICIPANTS

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