Protective Equipment

Vehicle Occupant Protection

The following efforts were conducted to lighten the vehicle structure and reduce the probability of injury during underbody blast events.

Composite lightweight structure for blast energy mitigation: In FY15, ARL collaborated with the industry and completed various areas of investigation for vehicle occupant protection. Lightweight composite panels were developed and live-fire tested. The panel was designed to absorb blast energy and provide protection simultaneously. The test results were compared with steel and aluminum based vehicle structure materials. The hybrid composite structure can potentially reduce the weight and enhance ballistic performance.

New generation Dyneema composite for ballistic protection: A complete evaluation of the new generation polyethylene composite (Dyneema HB212 and X245) was conducted. The V50 ballistic performance of Dyneema panel was obtained using .22 and .30 fragment-simulating projectiles. This evaluation provides a foundation for new initiative of scale-up for manufacture, and the future Army application in personnel and vehicle protection.

Electromagnetic blast sensors: An electromagnetic sensor that can detect electric and magnetic fields generated by the detonation of explosive was developed and evaluated at ARL. The sensor development can provide a much-needed sensing capability for countermeasure.

Dual-stage energy absorbing concept for vehicle occupant protection: A dual-stage energy absorbing concept was demonstrated for protecting vehicle occupants from underbody blast. The concept utilizes a novel shock-absorbing floor and seat mechanism to mitigate energy transmission to mounted Service Members. The protection scheme was integrated into a 30-ton surrogate ground vehicle structure and tested under elevated threat conditions. Test results proved the concept highly effective at reducing injury to the lower legs and spinal column of seated occupants at a high level of blast threat. The result confirms performance predictions obtained through computational modeling and simulated blast testing in a controlled laboratory environment.