



US DEPARTMENT OF DEFENSE

# BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

## Injury Models

### Modeling of Head Protection System

Blast load transfer and mitigation for helmets or their foam pads is currently not well understood. The pads between the helmet and head can absorb energy, and the gap that the pad creates between the helmet and head helps prevent or delay contact between the helmet shell and the head during blast. Researchers at USARL are conducting coupled head/suspension/helmet modeling to gain insight on the load transfer to the head and potential injury mechanisms. A material model for composites made of Ultra High Molecular Weight Polyethylene (UHMWPE) was developed to study ballistic loading of the head. Flat plate ballistic limit and back face deformation and delamination characteristics were measured and used in model parameter development. The last two measures are critical in evaluating behind-helmet blunt trauma, an injury that results when the deformed helmet contacts the head. Additionally, a helmet and head model was exercised to investigate the role of pads in the load transfer to the brain, and a computational model for blast loading of head and helmet was developed. A set of material parameters was identified from the parametric/sensitivity analysis of the ballistic experiments. Further material tests can assist in establishing the estimated parameters and in improving the computational model. This investigation will help assess the role of protective equipment in mitigating ballistic load transfer to the head, and will lead to improved blast protection strategies.