Improving the Evaluation of Behind-Armor Blunt Trauma

S&T Campaign: Assessment & Analysis
Military Injury Biomechanics

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Research Objective

- Improve the current methods used to evaluate behind-armor blunt trauma. Even when armor successfully stops a ballistic threat, the material deformation can still seriously injure or even kill.
- Design and develop surrogates and sensors required to facilitate evaluation.

Helmet successfully stopped a projectile, but was the deformation itself lethal?

Cylindrical Thoracic surrogate rig for ballistic evaluation.

Challenges

- What is appropriate backing material? Each has pros and cons (metal, clay, other).
- To back or not to back helmet/armor
  - Backed gives appropriate response
  - Unbacked eases data collection and allows for Digital Image Correlation and Laser Doppler Velocimetry
- How to improve surrogate models and materials to better correlate with observed injuries
- How to improve sensors to better withstand the impact event, better survive the environment, while still providing data at a high sampling rate**.**

Metal surrogate vs. clay backed surrogate?

ARL Facilities and Capabilities Available to Support Collaborative Research

- Ballistic and blast experimental facilities
- Digital image correlation cameras and software
- High-speed video cameras
- Digital X-ray timed to projectile flight
- Mobile CT scanner
- Material testing equipment

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- Improved surrogate thoracic rigs to increase repeatability and reliability of tests.
- Materials with better correlation to human tissue to better link impact event with observed injuries.
- Improved sensor technology to properly measure tissue level loading and deformation at the impact location
- Sensors with high rates, wide frequency responses, minimal phase shifts and linearity across the broad input range.

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