Enhanced Prediction of Skeletal Injury Risk Due to Under-Body Blast (UBB)

S&T Campaign: Sciences for Lethality and Protection
Kinetic Protection
Soldier Protection

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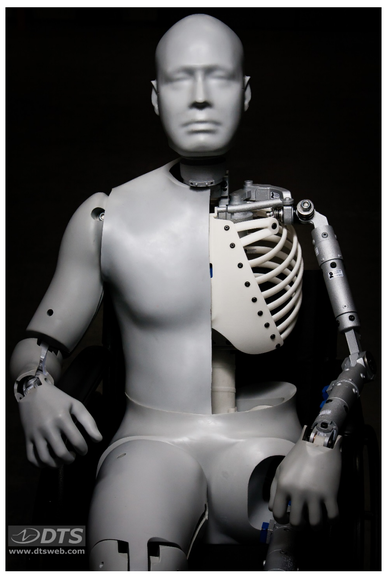
Research Objective

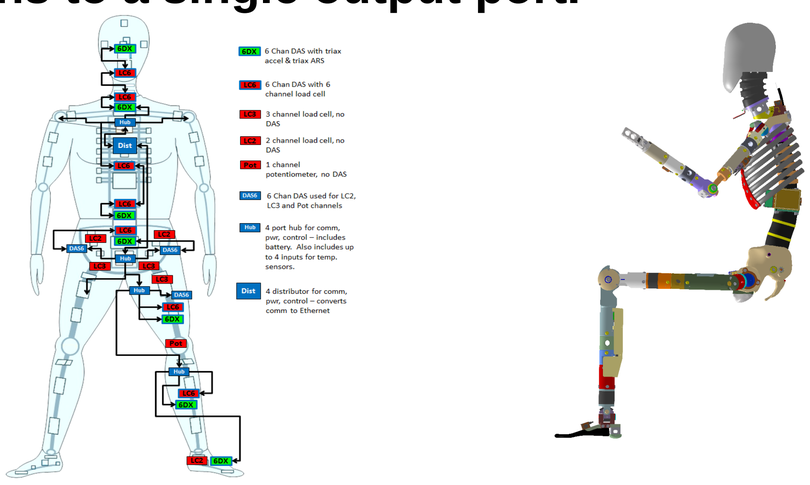
- **The Warrior Injury Assessment Manikin (WIAMan) project is developing a new, scientifically valid capability to assess the probability of skeletal injury to occupants of ground vehicles subjected to the effects of an under-body blast (UBB) event such as a Live-Fire test.**
- **The project will produce new biomechanics knowledge and an anthropomorphic test device (ATD) designed to have human-like response to vertical, high-energy, high-acceleration conditions. The capability will be demonstrated at TRL 6.**

3D model of the WIAMan ATD concept



Challenges

- **Novel biomechanical testing is required to measure human response to vertical loading conditions and define the mechanisms for injuries associated with UBB.**
- **The WIAMan ATD must be robust and repeatable and provide the ability to measure and record data that can be correlated to human injury risk.**
- **Materials and structures that provide human-like compliance while meeting strength-of-design needs.**
- **Finite element analysis models that can guide ATD design and protection technology development.**
- **Unique embedded data acquisition systems, with a total of 146 data channels, located in multiple body regions to a single output port.**



Embedded data acquisition system (left) and WIAMan prototype (right)

ARL Facilities and Capabilities Available to Support Collaborative Research

- **The Accelerative Loading Fixture (ALF) located at Aberdeen Proving Ground is a unique capability for producing biomechanical data for UBB conditions.**
- **A team of world-class biomechanics researchers and experimental facilities.**
- **Live-Fire Test & Evaluation injury analysis methodologies**
- **Best practices for the use of the Hybrid III ATD including new methods for injury assessment based on WIAMan biomechanics testing.**
- **Finite element analysis modeling of advanced ATDs.**
- **Biomechanics data suitable for development and validation of physics-based models of humans.**
- **Design and testing of advanced ATDs.**

Controlled testing of an under-body blast (UBB) event

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- **Technologies for non-metallic materials that can enable human-like response in ATD structures subjected to severe loading.**
- **Biomechanics data and test methods for the UBB environment.**
- **Multi-dimensional structural optimization using finite element analysis.**
- **Data acquisition systems, sensors, and signal processing for use in a blast-driven environment.**
- **Physics-based modeling of the human body under UBB conditions.**
- **ATD technologies for severe loading environments.**

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