

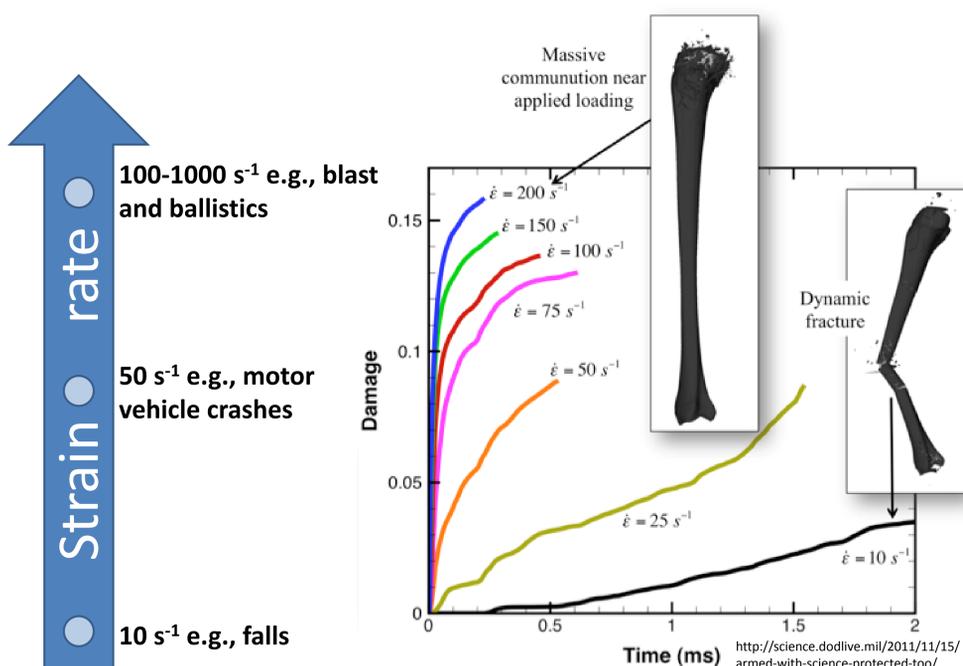
S&T Campaign: Analysis & Assessment

Military Injury Biomechanics

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Research Objective

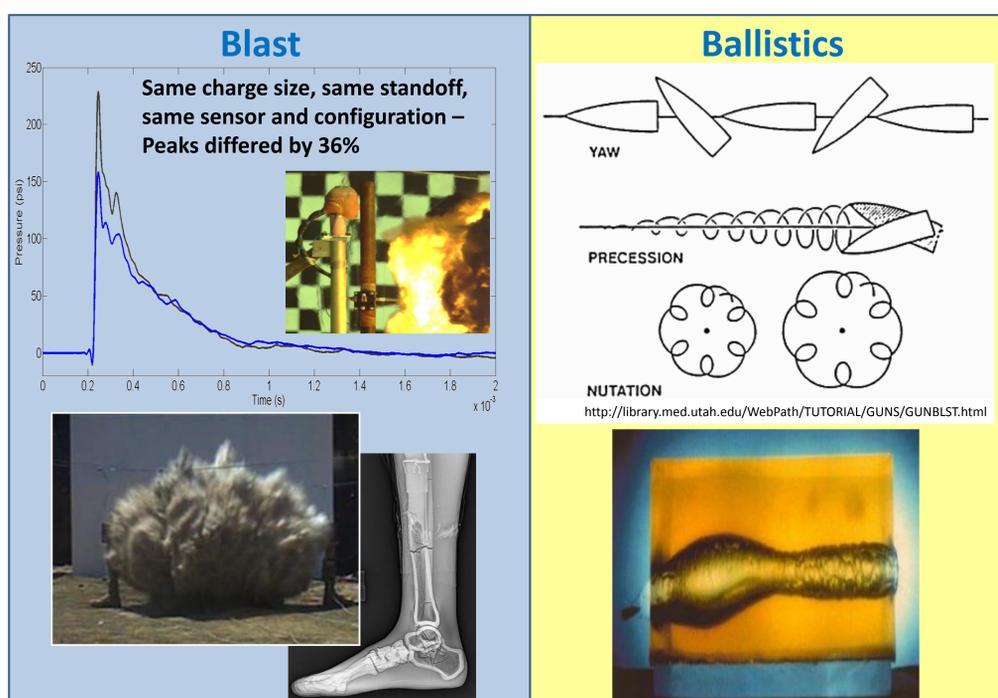
- Understand blast and ballistic injury mechanisms
- Develop physical and computational models for assessing personnel vulnerability and survivability



Biological tissue responses are rate sensitive. Although there has been significant research in injury biomechanics, much of it has come from research on motor vehicle accidents. Blast and ballistics, injury mechanisms that are certainly military-relevant, occur at much faster rates. However, there has been little research on the biological/mechanical responses within this regime.

Challenges

- Blast and ballistic events are high-rate, complex, variable, and often destructive making them difficult to reproduce and measure in a controlled, laboratory setting
- Some of the injuries from blast and ballistics are physiological making them difficult to assess with physical models



The figure demonstrates some of the variability, complexities, and destructive nature of blast and ballistic tests.

ARL Facilities and Capabilities Available to Support Collaborative Research

- Blast experimentation facilities that can detonate up to 50 lb HE or explosive munitions
- Ballistic experimentation facilities that can fire rifle rounds, pistol rounds, or projectiles from an air cannon
- Mechanical human models for assessing personnel vulnerability
- High-speed cameras and planar x-rays for imaging
- Instrumentation for measuring kinematics and dynamics of injury event, including accelerometers, angular rate sensors, load cells, strain gauges, and pressure transducers
- High-speed, multi-channel data acquisition system

Indoor Ballistic and Outdoor Blast Experimentation Facilities



Examples of mechanical surrogates used by our researchers



Complementary Expertise Sought in Collaboration

- Expertise in injury biomechanics across multiple scales, from nano to cellular to tissue
- Expertise in sensor technologies to develop systems that can capture and survive the extreme environments of blast and ballistics
- Expertise in materials to develop mechanical surrogates
- Expertise in modeling and simulation to develop mathematical models of human physiology and injury