# Wound Ballistics Modeling for Blast Loading, Blunt Force Impact, and Projectile Penetration

SAND2015-1261PE

## Research

**Goal: Develop a high-fidelity virtual simulation capability to investigate wound injury mechanics & assess armor designs for U.S. warfighter.**

- Allows investigation of wound injury to optimize armor design without the need for extensive field testing.

**Earlier Investments**

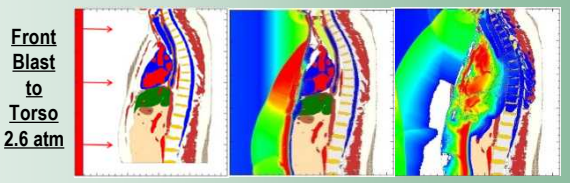
- Foundational 2007/2008 LDRD led to insight and applied Shock Wave Physics, Constitutive Material modeling, CTH and SSM computational capabilities
- Traumatic Brain Injury (TBI) simulation effort, funded by Office of Naval Research

**LDRD -** Modeling & Simulation (M&S) capability:

- M&S expertise on TBI to develop virtual anatomical models of the human head, neck, and torso
- Develop understanding of mechanics of wound injury mechanics
- Demonstrate assessment of protective body armor designs
- Identify personal armor qualities that optimize protective armor capability
- Provide blast environment data for helmet sensor development
- Demonstrate the advantages of performing injury simulations for the development of body armor.

## Development

**Development of torso model will enable CTH blast simulations**




Development of torso model to merge with existing head-neck model

Advanced EOS model to capture cavitation in soft tissue due to blast, ballistic projectile impact & penetration

M&S validation using injury data from various military and civilian sources

Refinements to soldier models to enable development of complete male and female human models

**Partnerships**

Office of Naval Research -- Force Protection,
UNM Health Sciences Center

## Mission Impact

**Improved warfighter protection systems - light body armor and blast sensor technology to protect personnel against blast, blunt impact, and ballistic missile penetration**

**Beneficiaries:**

- Military - Department of Defense, Department of Justice (Federal Bureau of Investigation)
- Civilian - Medical community, field triage, hospital surgery
  - Capability to diagnose and treat injuries, and save lives
  - Mitigate sports injuries

*Center of Excellence* for modeling wound mechanisms will enable optimized warfighter protection systems.

**Frontal Impact of notional Chest Armor by 9mm FMJ at 427 m/s**