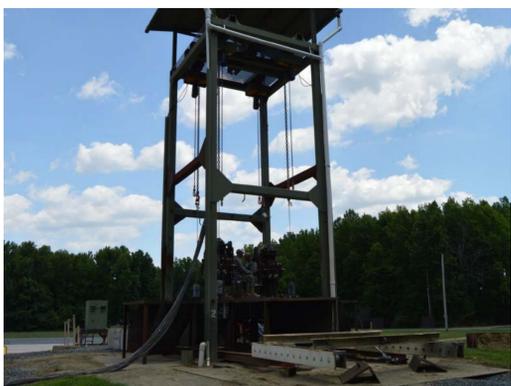


S&T Campaign: Sciences for Lethality and Protection  
*Kinetic Protection*  
*Soldier Protection*

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## Research Objective

- The Accelerative Loading Fixture (ALF) is designed to generate predictable and repeatable under-body blast (UBB) loading conditions to simulated vehicle occupants.
- Non-injurious Testing:
- Generate Biofidelity Response Corridors (BRCs) using Post Mortem Human Surrogates (PMHSs).
- Assess the effects of initial posture, personal protective equipment (PPE) burden, and loading conditions on ATD and PMHS responses.
- Injurious Testing:
- Explore injuries and mechanisms using PMHSs.
- Compare male and female injury outcomes.
- Link injuries and occupant kinematics to the effects of initial posture, PPE burden, and floor/seat loading.



The ALF at Bear Point test facility in APG, MD.



A Hybrid III ATD test (nominal posture and "no" PPE).

## Challenges

- Selecting test parameters to achieve desired floor/seat loading conditions.
- Mitigating the effects of explosive ejecta (detonation products and soil) to achieve kinematic tracking of the test specimen.
- Achieving severe floor and seat loading conditions without damaging the test fixture.
- Minimizing variability inherent to explosive testing.
- Testing under all weather and environmental conditions.
- Managing undesirable structural response.

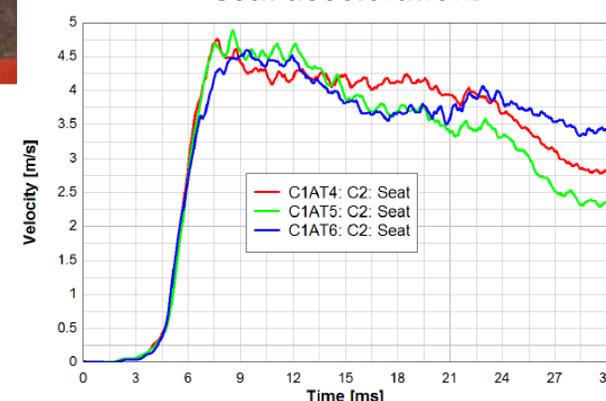
## ARL Facilities and Capabilities Available to Support Collaborative Research

- The ALF, with surrounding facilities at Fuse Range and EF-10, provides a unique biomechanics research and test capability for PMHS and ATD experiments.
- ALF capabilities include:
  - Explosively-driven seat/floor loading conditions that are representative of full vehicle UBB testing.
  - Seats adjust vertically and fore/aft to ensure consistent placement of the 5th - 95th percentile occupant feet.
  - Varying seat/floor loading conditions
  - Comprehensive structural instrumentation package (floor/seat accelerometers, foot-floor contact switches, seat belt load sensors, high-speed video, etc.).
- Existing collaborations with Aberdeen Test Center (ATC) and the Center for Injury Biomechanics (Virginia Tech, Ohio State University, and Wake Forest University).



Floor accelerometer types and their relative locations.

Test repeatability: Crew 2 vertical seat acceleration.



## Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- Modeling and simulation of buried explosive charges.
- Finite element analysis of explosively driven structures to predict damage and failure and to achieve specified acceleration profiles.
- Sensors and data acquisition for blast and shock loading.
- Analysis and signal processing for data taken from ATDs and PMHS.