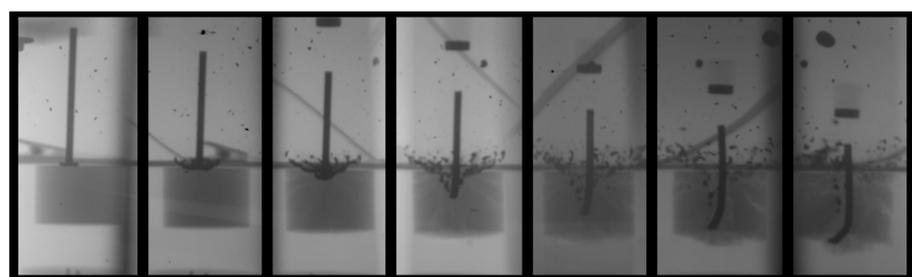


S&T Campaign: Sciences for Lethality and Protection
Kinetic Lethality
Effects on Target

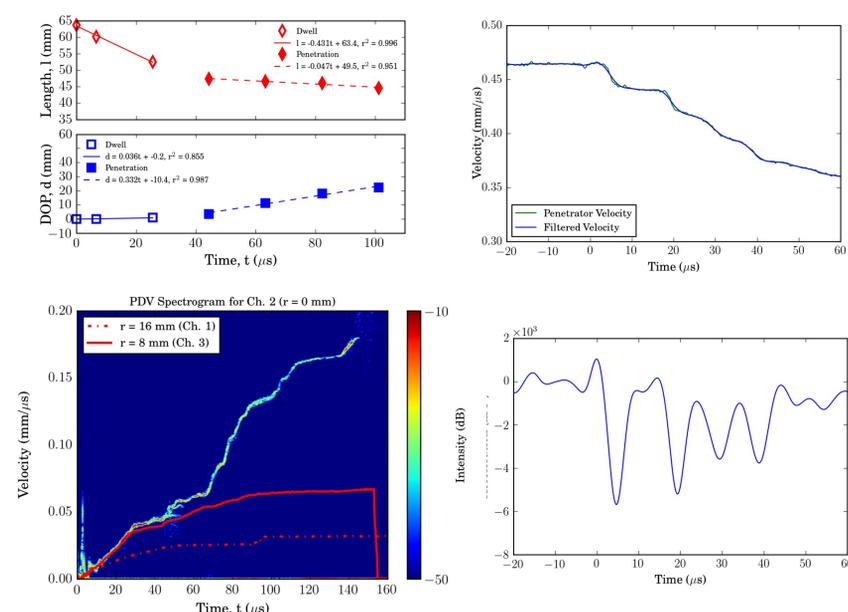
Brian Schuster
(410) 278-6733
brian.e.schuster.civ@mail.mil

Research Objective

- The objective of this research is to quantitatively examine penetrator and target interactions during a penetration event using advanced in-situ diagnostics.
- We work directly with material model developers to incorporate the critical deformation and failure mechanisms into large scale computational codes.



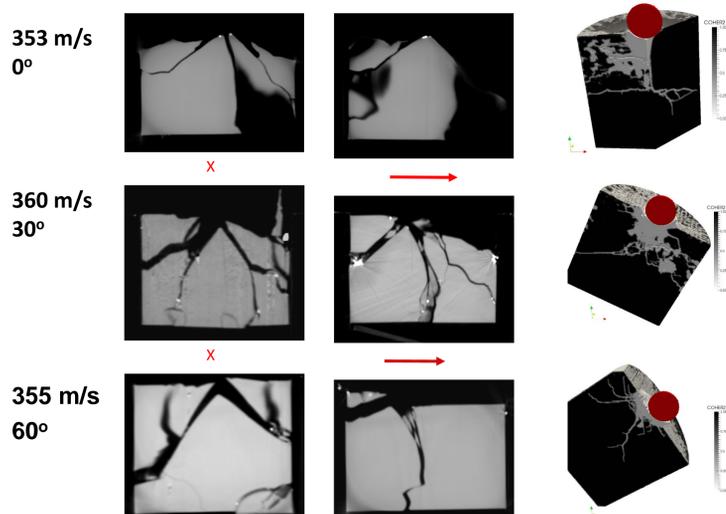
6.0 μ s 24.9 μ s 43.8 μ s 62.7 μ s 81.7 μ s 100.7 μ s 119.6 μ s



An example is shown for the impact of a tungsten load rod penetrator fired into boron carbide at 517 m/s.

Challenges

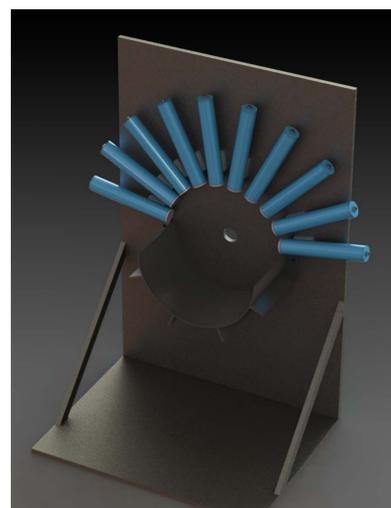
Fracture and failure dominate the response in the ballistic environment and it is difficult to capture using continuum methods.



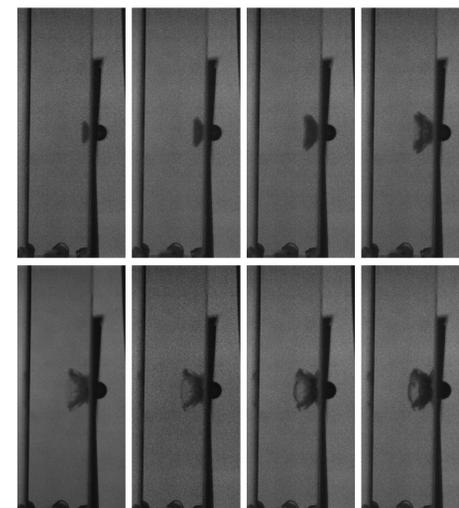
"Damaged" material in continuum codes is very different than what is found experimentally (From B. Aydelotte).

ARL Facilities and Capabilities Available to Support Collaborative Research

- EF309A:
 - Laboratory guns from 5.56 to 50 mm.
 - 100 to 2500 m/s
 - High-voltage In-Situ Diagnostic Radiography Apparatus (HIDRA)
 - Photonic Doppler Velocimetry (PDV)
 - High speed imaging >5Mfps
- Post-mortem characterization
 - SEM, EDS, EBSD,
 - XCT options at multiple length scales (w/B. Love, MMSD)



HIDRA



Failure in glass at 1.5Mfps (B. Aydelotte)

- BE Schuster et al., "Concurrent Velocimetry and Flash X-ray Characterization of Impact and Penetration in an Armor Ceramic," Procedia Engineering, 2015
- BB Aydelotte, BE Schuster, "Impact and Penetration of SiC: The Role of Rod Strength in the Transition from Dwell to Penetration," Procedia Engineering, 2015
- BB Aydelotte and BE Schuster, "A Computational Study of the ARL Glass Model and Its Predictions of Ballistic Penetration and Fracture Conoid Development," Proc. of the 28th International Symposium on Ballistics

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- We are interested in a wide range of different material systems including metals and ceramics for Lethality and Protection System applications.
- We would like to incorporate new diagnostic equipment to our experimental facilities.
- We are seeking collaborators that are interested in new methodologies for representing fracture and failure in computational codes at relevant strain rates and length scales.