Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Overview of the First SHPB Experiments on Single Crystal Explosives CHRISTOPHER MEREDITH, DANIEL CASEM, US Army Rsch Lab - Aberdeen, CHENG LIU, BENJAMIN MORROW, CARL CADY, KYLE RAMOS, Los Alamos National Lab — Under plate impact experiments (uniaxial strain) single crystal explosives exhibit elastic-plastic mechanical behavior, however at quasi-static rates (uniaxial stress) they are brittle. We have conducted Split-Hopkinson Pressure Bar (SHPB) experiments to bridge the strain rate gap between the two extremes in an effort to tease out the effects of strain rate and pressure on the plasticity, and to probe the mechanisms of failure in single crystal RDX, PETN and HMX and PBX9501. Samples were compressed in different crystallographic orientations to promote different proposed deformation and fracture mechanisms, while utilizing in-situ synchrotron x-ray diffraction, phase contrast imaging, or high speed visible light imaging. Researchers have postulated that in sub-shock impacts, the mechanisms of stress dissipation an explosive possesses are very important to "hot spot" formation—which initiates the first chemical reactions within an energetic. This presentation will focus on the development of the mini- and micro-Kolsky bars utilized in order to maximize the strain rate within the samples, the initial results on the mechanical behavior and fracture mechanisms of these high explosives, and the challenges we have encountered and overcome.

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Date submitted: 15 Feb 2019 Electronic form version 1.4