Abstract Submitted
for the SHOCK15 Meeting of
The American Physical Society

Detonation shock dynamics with an acceleration relation for nitromethane and TATB[1] DAMIAN SWIFT, RICHARD KRAUS, Lawrence Livermore National Laboratory, ROBERTA MULFORD, Los Alamos National Laboratory, STEPHEN WHITE, AWE Aldermaston — The propagation of curved detonation waves has been treated phenomenologically through models of the speed D of a detonation wave as a function of its curvature K, in the Whitham-Bdzil-Lambourn model, also known as detonation shock dynamics. D(K) relations, and the edge angle with adjacent material, have been deduced from the steady shape of detonation waves in long rods and slabs of explosive. Nonlinear D(K) relations have proven necessary to interpret data from charges of different diameter, and even then the D(K) relation may not transfer between diameters. This is an indication that the D(K) relation oversimplifies the kinematics. It is also possible to interpret wave-shape data in terms of an acceleration relation, as used in Brun's Jouguet relaxe model. One form of acceleration behavior is to couple an asymptotic D(K) relation with a time-dependent relaxation toward it from the instantaneous, local speed. This approach is also capable of modeling overdriving of a detonation by a booster. Using archival data for the TATB-based explosive EDC35 and for nitromethane, we found that a simple linear asymptotic D(K) relation with a constant relaxation rate was able to reproduce the experimental wave-shapes better, with fewer parameters, than a nonlinear instantaneous D(K) relation.

[1]This work was performed in part under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Damian Swift
Lawrence Livermore National Laboratory

Date submitted: 30 Jan 2015 Electronic form version 1.4