Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

The shock sensitivity of nitromethane/methanol mixtures BRIAN BARTRAM, DANA DATTELBAUM, STEVE SHEFFIELD, LEE GIBSON, Los Alamos National Lab — The dilution of liquid explosives has multiple effects on detonation properties including an increase in critical diameter, spatiotemporal lengthening of the chemical reaction zone, and the development of propagating wave instabilities. Earlier detonation studies of NM/methanol mixtures have shown several effects of increasing dilution, including: 1) a continual increase in the critical diameter, 2) lowering of the Chapman-Jouguet detonation pressure, and 3) slowing of the steady detonation velocity (Koldunov, et al. Comb. Expl. Shock Waves). Here, we present the results of a series of gas gun-driven plate-impact experiments to study the shock-to-detonation transition in NM/methanol mixtures. Embedded electromagnetic gauges were used to obtain in situ particle velocity wave profiles at multiple Lagrangian positions in the initiating explosive mixture. From the wave profiles obtained in each experiment, an unreacted Hugoniot locus, the initiation mechanism, and the overtake-time-to-detonation were obtained as a function of shock input condition for mixture concentrations from 100% NM to 50 wt%/50 wt% NM/methanol. Desensitization with dilution is less than expected. For example, little change in overtake time occurs in 80 wt%/20 wt% NM/methanol when compared with neat NM. Furthermore, the shock wave profiles from the gauges indicate that wave instabilities grow in as the overdriven detonation wave settles down following the shock-to-detonation transition.

Dana Dattelbaum
Los Alamos National Lab

Date submitted: 21 Feb 2013 Electronic form version 1.4