DEVELOPMENT OF A SOURCE MODEL FOR ALUMINIZED EXPLOSIVES

Dr Eric J. Rinehart
DTRA/TDTP
1680 Texas St. SE
Kirtland AFB, NM, 87117

Jeffrey M. Thomsen
Applied Research Associates
P.O. Box 5388
Albuquerque, NM 87185

ABSTRACT

The Defense Threat Reduction Agency (DTRA) has been investigating the performance of highly aluminized high explosive sources for use inside confined areas. The sources, known as thermobarics, are in reality a single event, fuel-air explosive. That is, the high explosive both disperses and then ignites a highly energized fuel in one step. This is much different that the usual dispersal, mixing and then ignition of a mixed source. The single event requires maintenance of the ignited source during mixing and dispersal. Increased energy output is expected due to high weight percentages of aluminum powder designed into the formulations. Mixing is enhanced by detonation in a confined target structure.

Because of the late release of energy and the high rarefaction propagation velocities in the initial explosion, increases in peak pressures are not expected. Increases of impulse are expected, as are increases in temperatures and heat fluxes and fluences. Lethality models depend upon both peak pressures and total impulses (when temperatures are not included); therefore measures-of effectiveness are not clear at this time.

To develop a test series to be used in this investigation, a computational source model was developed for use in hydrocodes. Initial detonation was modeled using the LLNL JWL Equation-of-State. Following the initial detonation state, the energy of aluminum burning within explosive detonation products was treated using modified JWL models developed for water-bubble expansion. Late time burning of aluminum in air and carbonaceous explosive binder in available oxidizers was finally considered.

Several static tests have been detonated to provide a basic set of data for comparison with the calculations. Both unconfined and confined, open air and underground experiments have been performed. Data have been compared with the calculated pretest predictions. Initial peaks and early time impulses were well modeled. Later-time reflections and implications of case break-up on pressures are not modeled as well and additional investigations are ongoing.