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CALCULATIONS IN SUPPORT OF THERMOBARIC EXPLOSIVE TESTS IN THE INDIAN HEAD BOMB PROOF CHAMBER

Charles Needham, John Schneider, Craig Watry

*Applied Research Associates
4300 San Mateo Blvd, Suite A220
Albuquerque, NM 87110*

The ARA afterburn model has been used to calculate the behavior of a number of explosives and mixes when detonated in the Bombproof Chamber at Indian Head, Maryland. All charges were bare, i.e., uncased. The charges ranged from near ideal explosives to aluminized explosives to mixtures with ammonium perchlorate and aluminum. The charges ranged in size from about 2 pounds to more than 35 pounds. Charge size effects were observed for aluminized explosives both experimentally and in the calculation results. Larger charges were observed to burn a larger percentage of the aluminum.

Although there was sufficient oxygen in the chamber to burn all of the aluminum, none of the charges completely burned the aluminum powder. Because the particulates are finite, they slip relative to the fluid. We found that the particulates were concentrated near the exterior of vortices that formed in the chamber, thus separating the particulates from the oxygen containing gasses. This high degree of non-uniform mixing is a key to the explanation of the observed restriction of aluminum burn.

A number of comparisons are made between experimental data and calculational results. The calculations clearly show the particulate motion, and help explain the incomplete aluminum burn. The aluminum burn model coupled to the hydrodynamic flow shows the increased aluminum burn with charge size.