THE EFFECTS OF VENTING ON PARTIALLY CONFINED THERMOBARIC DETONATIONS

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A series of parametric calculations have been completed for the detonation of cylindrical pipe bombs with thermobaric fills in multi-room structures. Parameters that were varied included: the size of the charge, the loading density (explosive mass to room volume), the shape of the room and the vent area to the atmosphere.

The detonations of two aluminized explosives were calculated in a variety of closed geometric rooms. Comparisons of the aluminum burn rates and total aluminum burned were made as a function time for each of the calculations. The aluminum burn is a strongly non-linear function. As aluminum burns, the temperature of the gas increases, this, in turn, increases the rate of aluminum heating and causes earlier ignition of more aluminum. We observed that nearby walls, and therefore higher reflected shock pressures, significantly enhanced the aluminum burn.

The calculations indicate a strong dependency on the vent area. A relatively small vent area (0.3% of the wall area) gives results very near those of a completely sealed structure. An increase to a vent area of ~1.5% of the wall area of the structure reduces the aluminum burned by 20%. This is caused by the cooling of the fireball gasses and the reduction in heating rate of the aluminum.

Comparisons are made with several experimental overpressure waveforms which confirm the accuracy of the computational model. The experimental data comes from testing of thermobaric filled pipe bombs in a vented structure with doors and windows which can be opened or closed.