BLAST WAVES FROM NON-SPHERICAL FUEL-AIR EXPLOSIONS

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The potential applications of Fuel-Air Explosives (FAE) include minefiled breaching, destruction of weaker targets such as buildings and other unprotected structures, and clearing for landing strips and other parts. For many of these applications long non-spherical FAE charges may be most effective. In order to characterize the blast waves resulting from detonation of such FAE charges, the blast waves were monitored in a series of FAE field tests on the DRES range. In these tests the FAE charges consisted of cylindrical plastic bags filled with explosive gas mixtures of acetylene, methane or propane in air. The sizes of the charges ranged from about 5 m3 to 100 m3, with bag diameters from 0.9 m to 3.7 m and bag length to diameter ratios from 3 to 10. Detonation was initiated at one end of the bag at up to ten positions along an axis perpendicular to the bag axis out to a distance of about 100 bag radii. In the near field (from the edge of the bag out of 5 bag radii) the pressure was monitored on the ground an 1.5 m off the ground.

At distances from the bag larger than three bag lengths the air blast parameters (peak overpressure, positive impulse and positive duration) all scale according to the "cube-root" energy scaling law based on the chemical energy released in the explosion. In fact, the blast parameters are in good agreement with those obtained from a TNT surface burst with the corresponding energy release, indicating that at these distances the explosion is equivalent to a concentrated hemi-spherical explosion. In the near field and inside the bag where the explosion phenomena are approximately two-dimensional, the results are compared with the predictions obtained using a flux-corrected transport (FCT) 2-D finite difference computer code.

Finally, based on the corresponding of analytic and numerical results with experiment for a range of FAE detonation parameters and charge sizes, scaling laws which can be used to estimate the near and far field blast waves from other FAE charges are proposed.