NUMERICAL RECONSTRUCTION OF THE FLOW FIELD IN EXPERIMENTALLY OBSERVED MACH STEM BLAST WAVES

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The piston path-random choice method (PP-RCM) has been used to successfully reconstruct the flow fields in experimentally observed Mach stem blast waves produced by air burst explosions. Measurements have been made of the Mach stem blast waves produced by air burst explosions ranging from less than 1 g to 554 To, at various height of burst. The measurement techniques include high speed photography of the refractive images of shock fronts and particle tracers, and gauge measurements of the time histories of pressure and density at a limited number of positions. The work describes here uses a numerical technique together with the results of the experimental measurements to reconstruct all the physical properties of the flow field in the Mach stem blast waves. The PP-RCM was chosen as the numerical technique because it has been used by other workers to reconstruct the 1D flow in surface blast waves. The question to be addressed was whether a Mach stem blast wave could be simulated by a 1D flow, either cylindrically or spherically symmetrical. The technique was evaluated using the results from DIRECT COURSE, a 554 TO ANFO at a HOB of 51 m, equivalent to a height of 0.58 m for a 1 kg charge. The closest complete particle tracer trajectory was used as the initial piston path. The resulting flow field was calculated by RCM and compared with the observed shock front and particle tracer trajectories. Minor adjustments were made to the piston path until the reconstructed flow field matched these trajectories to within 1%. The best simulation was found using spherical symmetry and the simulation gave excellent agreement with pressure and density time histories measured by other workers, even when extrapolated beyond the observed shock and particle trajectories. The piston paths which
produce Mach stem flow fields for a range of HOB are now being determined.