THE CHARACTERIZATION OF A NEW EXPLOSIVE USING SMOKE-TRAIL PHOTO-DIAGNOSTICS

MCMILLIN,D.J.; DEWEY,J.M.

Smoke-trail photo-diagnostic techniques were used to measure the overall airblast environment in the free-field and Mach-stem regions of the blast wave produced by a 22.67 ton charge of a relatively new explosive, QM1OOR, detonated 57.33 ft above the ground surface, (MIDDLE KEY 4). For this experiment, the smoke launcher which has been extensively used to produce the smoke trails for photo-diagnostic studies of large surface-burst explosions, was redesigned in order to produce smoke trails at heights up to 100 ft in order to visualize the particle motion in the free-air region of this large-scale height-of-burst experiment. The refractive images of the shock fronts, and the displacement of the smoke trails by the blast waves were recorded using high-speed photography. The photographic records were analyzed to provide the trajectory of the triple point, and the trajectories of both the spherical free-air shock front above the triple point and the Mach stem below. The positions of the reflected shock above the triple point, and of the contact surface, were also recorded. The motion of the air in the blast flow behind the shock fronts, made visible by the smoke trails, was measured and used with the piston-path random-choice method (Dewey and McMillin, 1987) to numerically reconstruct the time-resolved free-air and Mach stem blast waves. The reconstructed flows were compared to a large body of similar data for TNT in order to compute energy yields and other characteristics of the new explosive relative to a TNT standard. The relative energy yields calculated using the free-air and the Mach stem data were not identical. A number of other interesting features of the explosion recorded by the high-speed photography, such as reversed flows above and below the contact surface, will also be described.