BLAST-INDUCED PRESSURE FIELDS BENEATH A MILITARY HELMET

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ABSTRACT

The pressure field surrounding a head with a helmet subjected to a blast wave typical of injurious but non-lethal threats was investigated by coordinated experiments and numerical simulations. Experiments were conducted with C4 explosive charges ranging from 0.75 kg to 5 kg, and two anthropomorphic test mannequins (Hybrid III) located 3 m from the explosive. Experimental diagnostics included pressure sensors mounted at selected locations around each mannequin's head and in the free-field. Numerical modeling was done using a two-step approach. First, the blast and ground reflection were computed using a multi-component, reacting flow model. Second, the results were used to specify the boundary conditions for a three-dimensional unsteady simulation of the head-helmet complex subjected to a blast wave. Experiments and simulation results were verified and found to be consistent with one another. Results showed that the highest pressures developed when the mannequin faced 45º from the explosive charge. Pressure waves that entered the gap between the helmet and head focused on the side of the head away from the blast. The helmet also was shown to provide protection against primary blast injury both in computations and experiments.