CONFINED HETEROGENEOUS BLAST

F. Zhang[1], A. Yoshinaka[1], J. Anderson[1], R. Ripley[2]

[1] *Defence R&D Canada - Suffield*
PO Box 4000, Station Main, Medicine Hat, Alberta T1A 8K6 Canada
[2] *Martec Limited*
1888 Brunswick Street, Suite 400. Halifax, Nova Scotia B3J 3J8 Canada

A thermobaric explosive (TBX) comprises a condensed explosive mixed with reactive metal particles. The TBX explosion process is created by primary detonation of the explosive followed by a heterogeneous blast wave coherent with the momentum flux and the late-time energy release of the metal particles. The fundamental performance of such a heterogeneous blast wave under confined conditions has been studied using three simple-geometry, non-responding steel structures including a two-wall straight street, a closed chamber and a two chamber system with various venting ratios between them. The straight street is composed of two 5 cm thick, 3.7 m high by 6.1 m long steel walls in parallel under various street widths. Each wall has been equipped with 36 gauge mounts that can be used for pressure and temperature measurements. The explosion chamber, 26 m^3 in volume and 3 m in diameter, is both vacuum-sealed and designed to sustain a 1500 psi hydrostatic pressure. It is equipped with 12 gauge mounts and 7 circular windows 10 cm in diameter. The two-chamber system consists of the above 26 m^3 explosion chamber connected to a 23 m^3 venting chamber (3 m I.D.) via an orifice plate. The venting chamber is equipped with 25 gauge mounts, three pairs of 45 cm x 15 cm windows on either sides and a window 15 cm in diameter looking through the end wall downstream of the orifice. The venting orifice plate is interchangeable for various hole diameters up to 1.22 m corresponding to a venting area of 1.169 m^2. The experiments were conducted using various TBX charges and baseline C-4 charges with masses ranging from 1 kg to 7.7 kg. The diagnostics included pressure transducers, pyrometric sensors and high-speed digital video cameras. Multiphase CFD calculations were also performed to extend the range of the experimental parameters in order to gain both a fundamental understanding and to find how these parameters correlate in confined explosion conditions.