NUMERICAL SIMULATIONS OF THE EFFECT OF BLAST CONFINEMENT ON PERSONNEL VULNERABILITY

Jean-Philippe Dionne[1], Eric Li[3], Jeffrey Levine[1], Matthew Ceh[2], Charlene Fawcett[2]
Aris Makris[1]

[1] *Allen-Vanguard Corporation (Med-Eng Systems)*
2400 St. Laurent Blvd., Ottawa, Ontario, K1G 6C4 Canada
[2]*Defence Research and Development Canada – Suffield*
PO Box 4000 Stn Main, Medicine Hat, Alberta, T1A 8K6, Canada
[3]*Martec Limited*
1888 Brunswick Street, Suite 400, Halifax, Nova Scotia, B3J 3J8, Canada

ABSTRACT

There is a growing concern about the increased potential for blast injuries resulting from the interaction of blast waves with rigid obstacles and structures in the vicinity of the explosive charges, due to the high occurrences of Improvised Explosive Devices (IEDs) detonated in urban areas. As such, an experimental investigation carried out at DRDC Suffield, making use of instrumented Hybrid III mannequins and Blast Test Devices (BTDs), has clearly demonstrated the increased blast threat and corresponding injury potential as predicted from head acceleration and chest overpressure measurements, with increased confinement level: free-field, wall, corner, corridor.

In the current study, the blast experiments carried out at DRDC Suffield study have been numerically simulated, to gain a deeper understanding of the underlying physical mechanisms involved when personnel are subjected to complex blast due to the presence of confining structures. Chinook, a specialized blast computational fluid dynamics (CFD) tool from Martec Limited, has been used to provide estimates of pressure profiles and other thermodynamic variables at various locations in the confined blast flow field. While no mannequins were modeled due to the complexity of their response to blast, BTDs were included in the simulations, for direct comparison with the experimental results.

The results from this numerical study, in addition to providing more insight into the phenomena observed experimentally, have allowed the investigation of other parameters such as the effect of standoff between the explosive charge and the reflecting surfaces, and the effect of varying the location of the individual with respect to the charge and walls. These results demonstrate the increased blast threat arising from the presence of reflecting surfaces in the vicinity of the explosives on the individuals subjected to them.