# DEVELOPMENT OF A CELLULAR DRIVER FOR TAILORING BLAST WAVEFORMS

T. Josey[1], L. Donahue[2], D. Ritzel[3] and T. Sawyer[1]

*[1]Defence Research and Development Canada – Suffield Research Centre, Box 4000, Stn Main, Medicine Hat, Alberta, T1A 8K6, Canada; [2]Lloyd's Register Applied Technology Group, 400-1888 Brunswick St, Halifax, Nova Scotia, B3J 3J8, Canada; [3]Dyn-FX Consulting, 19 Laird Ave North, Amherstburg, Ontario, N9V 2T5, Canada*

**Key words :** Blast, Simulator, Shock, Modelling, Cellular Driver

Blast simulators and shock tubes are often used in place of free-field blast trials to reduce costs, increase repeatability and reduce the required resources. Complementary numerical simulation work is often performed to provide insight into the design, gain a further understanding of the experimental observations and to visualize and predict the shock loading conditions of the explosive threat. A new blast-simulator concept is being developed for use in the DRDC Suffield Research Centre blast induced traumatic brain injury (bTBI) program. The design uses a tight packing of small 'cellular' Drivers rather than a standard single Driver cavity having a large diaphragm. Each Driver cell has an adjustable cavity length and a special fairing to smoothly expand the flow beyond the diaphragm. The bank of cells fit together to fill the cross-sectional area of the test section. The new design allows wide-ranging control of the blast waveform parameters such as the positive-phase duration, decay coefficient, and negative phase. Furthermore, much higher Driver pressures can be achieved for the same diaphragm thickness that would be used for a traditional design. Apart from the better control of the blast-wave properties, the cellular approach provides a number of advantages including ease of manufacturing large simulators using standard small-size commercial pressure tubing; also, blast-wave conditions can be closely replicated between wide-ranging simulator sizes using the same technique. Numerical simulations using the Chinook CFD code were performed to help design the tube-fairing geometry to minimize transverse waves and to assess effects of different Driver gases and the global tube-bundle geometry on the waveform. Three-dimensional simulations were performed and presented to analyze the effect of the specific cellular matrix dimensions/driver states on the downstream waveform.