# BLAST-INDUCED MOTION: DIFFERENT HYDRODYNAMICS DOMINATES FOR SHORT-DURATION BLAST

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

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

**Key words:** blast, motion, injury, experiments, modelling

Continuing from exploratory experimental research reported at the previous MABS-24, computational studies have confirmed there is a dramatic shift of behavior in the blast-induced motion of spheres as the sphere size approaches the same order-of-magnitude as the blast wavelength which is a common circumstance for IED attacks against vehicles and personnel. The previous MABS paper described the preliminary and unexpected result that subsequent to a relatively low 'kick-off' velocity imparted by the diffraction of the shock front, spheres were actually decelerated in the after-flow when the sphere diameter was even 1/20$^{th}$ that of the blast wavelength. The unusual behavior is due to the combined effect of the initial shock-front diffraction and the gradients in the freestream flow leaving vortices embedded in the afterbody region of the spheres. This observation of what is effectively a 'negative' drag coefficient is in fact opposite to that for smaller spheres and dust particles exposed to the typical step-function shockwave of standard shock tubes for which greatly enhanced drag is reported. The current results have implications for problems such as blast-induced traumatic brain injury (bTBI) where many studies had concluded that severe acceleration from blast was the likely biomechanical cause for the injury.