FAR-FIELD PERFORMANCE CHARACTERISATION OF THE AUSTRALIAN ADVANCED BLAST SIMULATOR

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Abstract: The National Facility for Physical Blast Simulation (NFPBS) [1] is a state-of-the-art simulator situated at the University of Wollongong, NSW, Australia. Its purpose is to conduct experimental investigations into blast wave propagation, loading regimes, blast damage, and injury protection. The facility can replicate all the characteristics of a free-field explosive blast, including the generation of an entropy gradient and a 'true' negative phase with secondary shock. The NFPBS has a test section of 1.5 x 2 m, and it can accommodate various blast-test configurations such as full-reflection wall targets, diffraction model targets, behind-wall, and blast-ingress scenarios. The simulator is based on the 'Advanced Blast Simulator' (ABS) concept, which has been adopted by several universities and government laboratories in the US and Canada to research blast-effects.

The primary objective of this paper is to characterise the flow attributes and performance of the NFPBS. It presents pressure-impulse maps, x-t diagrams, and evolution of shock wave parameters along the length of the blast simulator. The authors also highlight the range of control available with this facility in tuning the positive and negative phases of a blast waveform to accurately generate a far-field blast environment suitable for high-precision and repeatable explosion testing of test specimens. The dual-mode driver capable of operating with either compressed gas or gaseous explosive modes, as well as a variety of waveform control methods, facilitate this capability. The authors correlate blast pressure-time histories generated with the ABS against the Kingery-Bulmash equations for free-field air blast. Numerical models based on Computational Fluid Dynamics (CFD) are employed to reveal valuable information on the ABS' internal flow environment and to conduct parametric studies to supplement experimental data as part of the performance characterisation study. The paper also provides some examples of studies of structural elements and blast barriers conducted with this facility.

Figure 1: NFPBS Advanced Blast Simulator (ABS)

[1] Remennikov, A., Parks, S., Ritzel, D. V., Uy, B. & Gan, E. C. J. (2018) *Commissioning of the Australian National Facility for Physical Blast Simulation*, in *International Symposium on Military Aspects of Blast and Shock (MABS 25)*