BLAST SIMULATION USING SHOCK-TUBE TECHNOLOGY

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Despite the strong capabilities and potential of computational modeling to investigate blast phenomenology and effects, experimental testing remains the ultimate means to identify vulnerabilities and validate protective designs for personnel or structures. Although a cost-effective alternative to field trials, conventional shock tubes do not in fact replicate the full blast profiles from explosive events unless carefully configured for blast simulation. Secondly, of course, there is a range of practical limitations such as the intensity of blasts that can be reproduced, size of target that can be tested, adverse wave dynamics, and venting noise.

A modular and versatile blast simulation apparatus is described based on a specialized conical shock tube capable of generating a wide range of adjustable blast-wave profiles using exchangeable drivers. The features exploit many 'lessons learned' from 40yrs of blast simulation technology in MABS which is reviewed along with important aspects of theory and wave dynamics in simulators. Variants of the proposed design could be used both at the smaller laboratory scale or large facility scale. The inherent advantage of the conical geometry is that the distinctive decay profile, negative phase, and secondary shock of spherical blasts can be simulated directly, although this carries the disadvantage that very high driver pressures are required. Therefore, special options are described for high-pressure gas and combustion drivers including use of gaseous and low-order explosives. For full-reflection targets such as panels blocking the tube end, CFD modelling is used to demonstrate the role of pre-set louvered venting to allow systematic control of loading impulse at nearly constant values of peak pressure.