

AIR BLAST TUNNEL TESTING AND ANALYSIS FOR ASSESSMENT OF STRUCTURAL RESPONSE TO BLAST

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Abstract:

AWE is required to provide evidence as to the performance of various systems in a range of environments. Historically this has primarily been achieved through experimentation, however, there are now reduced opportunities to undertake large-scale, expensive trials. Furthermore, an abstraction of the environment and system of interest often has to be deployed during testing due to the hazards and/or impracticability associated with fielding a fully representative trial. Therefore, greater emphasis is now placed on an integrated testing and modelling approach to obtain the requisite evidence to support system assessments.

One example of this methodology will be discussed involving the structural response of a sub-system to blast loading. The process followed to obtain the appropriate evidence in this case will be described, with particular focus on a critical trial and the modelling activities undertaken to support it. The trial was conducted utilising the Air Blast Tunnel (ABT) – a unique facility for generating large-scale long duration blast waves. A variety of diagnostics were deployed to characterise the blast loading and monitor the response of moveable components housed within a structural unit subjected to the blast.

Finite Element Analysis (FEA), hydrocode analysis and engineering calculations undertaken prior to, and during the development of, the trial were used to identify suitable explosive driver configurations, inform the design of trial apparatus and trial setup and determine the specification and deployment of trial diagnostics. The technical challenges associated with the trial included achieving the correct blast loading, obtaining a free-free environment and gracefully decelerating the unit following exposure to the blast.

An overview of the trial and supporting analysis activities will be given together with examples of how the challenges identified above were overcome and the technologies and technical solutions employed to meet the trial's key objectives.