P58 Statistical Variation of Airblast Parameters from Bare and Cased Explosive Cylinders

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Abstracts:

Decades of explosive experimentation have repeatedly shown that measurements of airblast pressures from explosive events are subject to considerable statistical variation. Even in carefully crafted situations where measured airblast pressures should be identical (e.g., measurements at symmetric positions, measurements from separate tests of identical explosive charges, etc.), measured airblast parameters often exhibit substantial variability. This poses the experimentalist with at least two technical challenges: 1) quantifiably stating the uncertainty to be associated with the measured airblast parameters, and 2) determining best practice for minimizing these uncertainties and their propagation into predictive algorithms. Unfortunately, the cost and destructive nature of explosive testing often renders it impossible to perform sufficient replicate experiments to quantify these uncertainties in a statistically confident manner. Often, the uncertainties derived from single shot explosive events, or even those with a few replicate experiments, are so uncomfortably large as to render them not useful for drawing conclusions or bounding the output of predictive models based on the measurements.

Over 180 experiments have been conducted on the AFRL blastpad, each generating 32 or more free-field airblast pressure measurements from bare and cased explosive charges. Included in this matrix of blastpad experiments are several instances where significant numbers of replicate experiments were conducted of explosive charges that were either identical, or very nearly so. In particular, three replicate experiments of cast pentolite cylinders, five replicate experiments of glued/segmented pentolite cylinders, three replicate experiments of bare cylinders of Composition B, and three replicate experiments of steel-cased Composition B cylinders were conducted on the AFRL blastpad to date. In each of these explosive configurations, the explosive mass was the same. In this paper, the statistical variation of the measured airblast parameters was studied for the individual groups of identical explosive configurations, and also for larger groups where the explosive configurations were “very similar” (e.g., for the “bare cylinders”, and the “cased cylinders”). Effort was made to quantify the mean airblast parameters, their confidence levels, and also to identify the physical sources most responsible for the statistical variation. The hope is that this information will assist airblast researchers and modelers in citing reasonable uncertainties for their experimental results and model outputs, and provide insight for how these uncertainties might be reduced in future efforts.

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