

# **Design and Development of a Laboratory based Mechanism for Testing of Blast Mitigation Material Systems**

## ***Abstract***

Explosions are lethal and special personal protection equipment (PPE) are required to ensure safety while working in situations where explosions are anticipated such as terrorist attacks, military warfare, de-mining and bomb disposal. However these PPEs are as heavy as 26 kg and it is difficult to work while wearing them. Therefore research is required to develop new lightweight materials that can mitigate the effect of explosions. Explosions kill humans through shock wave, splinters and impact against walls and heavy objects.

Development of lightweight material systems for blast mitigation applications requires regular experimentation. As blast experiments are expensive and hazardous, alternative experimental methods need to be explored. This thesis is an exploration towards a laboratory based testing method for assessing the performance of materials against blast loading. It is an attempt towards development of a testing method that may help avoid field blast tests, or at least reduce the frequency of field testing. The testing methodology under consideration includes simultaneous impact of PU foam projectiles and Fragment Simulating Projectiles (FSPs) onto a target panel. The foam impact provides a shock loading similar to blast loading and FSP impact simulates the impact due to splinters.

This PhD research is a comprehensive approach towards development of a laboratory based mechanism for testing of blast mitigation material systems from scratch. This research work includes design and fabrication of a single stage air gun for propelling the projectiles, fabrication and calibration of a ballistic chronograph to measure the projectile speed, characterization of PU foam used for impact experiments, development of various testing fixtures, and demonstration of the laboratory based testing methodology.