

Oxford Physics Group Projects 2019 - 2020: Atomic Weapons Establishment (AWE)
GP_005

Project title	Design and characterisation of a disposable velocity measurement system for a gas gun launcher
Project type	Experimental
Company	AWE
Mentor	Dr James Ferguson
Local supervisor	TBC
Project description	<p>Gas guns are high velocity gas propelled launch systems that are commonly used in shock physics to generate defined loadings in materials of interest, they do this by impacting a target material with a projectile (flyer) [1]. In order to correctly analyse the recorded data it is important to accurately measure the velocity of the projectile before impact, typically this is several hundred metres a second. For the experiments that the HE Research team performs, the task is complicated by the fact that the projectiles used are often non-metallic and the targets are explosive. This means that the measurement system either needs to be deployed some distance prior to the impact point where the projectile may be altering velocity or be placed closer to the impact point but be treated as disposable (destroyed by the target detonating). The latter method is preferred but presents its own problems. For example, how accurate is the system, and more importantly how accurate is each iteration of the system? The project goal is to design a low cost velocity</p>

measurement system concept, and to build and characterise a demonstration model.

[1] Bourne N.K., A 50 mm bore gas gun for dynamic loading of materials and structures, *Meas Sci Technol*, 14(3):273-8, 2003

Objective – The objectives are as follows *Note these are not fixed and are open to amendment during initial discussions with the project team. It is anticipated that some level of simulation will be necessary.*

- Design and construct a system capable of accurately measuring the velocity of a 50 mm diameter x 100 mm length cylindrical projectile over a defined measurement volume (approx. 100 mm cube). The projectile will cross the volume on a fixed vector. Due to field of view constraints, any measurement system needs to be side on, additionally the projectile is non-metallic.
- The system should consist of a clearly defined 'disposable' portion e.g. measurement system which will link to a 'non-disposable' part e.g. recording system.
- The constructed system needs to be accurately characterised in order to do an error analysis. As the objective is for the system to be disposable, its reproducibility also needs to be considered.
- As part of the project the acquisition/construction of a defined motion system for moving a low velocity test projectile should be considered.
- The cost of the system needs to be considered and should form part of the end report.