Blast behaviour research could save British troops

March 10 2016

New research that sheds unprecedented light on the behaviour of blasts produced by landmines and Improvised Explosive Devices (IEDs) could aid the development of enhanced protection for UK soldiers on military, peace-keeping and humanitarian missions.

By focusing on explosives hidden in clay soils, the University of Sheffield project – funded by the Engineering and Physical Sciences Research Council (EPSRC) – has addressed a vital gap in knowledge about how buried explosives interact with their surrounding environment. This is a key factor in determining the pattern and extent of the pressure produced by an explosion.

Universities and Science Minister Jo Johnson said: "British scientific breakthroughs have saved the lives of millions and we will continue to invest in our scientists as they conduct such game-changing research. The potential for this research to provide better protection for British soldiers and humanitarian workers who risk their lives every day, underscores precisely why we continue to support UK science."

The project was part of a wider ongoing initiative – the Defence Science and Technology Laboratory's (Dstl's) programme to understand the effects of IEDs and land mines on armoured vehicles. As well as helping to inform future designs of armoured vehicles, the data produced by the project will aid risk assessment and route planning for operations in current and future combat zones.

Dr Sam Clarke, who led the EPSRC-funded project, says: "Detonations of explosives in shallow soils are extremely complex events that involve the interaction of the shock waves with the surrounding soil, air and water. The understanding we've generated about how clay soils affect the process is a key piece in the jigsaw, as it complements the extensive knowledge that's already been built up about explosions in sandy and gravelly soils, which are much less cohesive than clay soils."

Using the University of Sheffield's unique Explosives Arena, Dr Clarke and his team carried out around 250 test explosions using different soil samples and made 17 different pressure measurements during each test. The results were backed up and verified by numerical modelling developed and applied as part of an EPSRC CASE (Collaborative Award in Science and Engineering) Studentship.

The research has revealed how the blast produced by a landmine or IED would interact, for instance, with anti-mine body armour or an armoured plate fixed underneath a troop transport vehicle.

Hundreds of UK service personnel have been killed or injured by IEDs in recent years, while landmines in former warzones worldwide continue to cause thousands of deaths every year. In the face of dangers like these, there is a constant drive to keep improving the capabilities of vehicle armour, personal armour and protective footwear, and this can be aided by a clearer understanding about how explosions actually behave.

Dr Clarke comments: "The new data we've generated about the distribution of blast loading in clay soils will feed directly into Dstl's world-class work harnessing the latest science and technology to help protect UK troops and ensure they can operate even more effectively in future."