

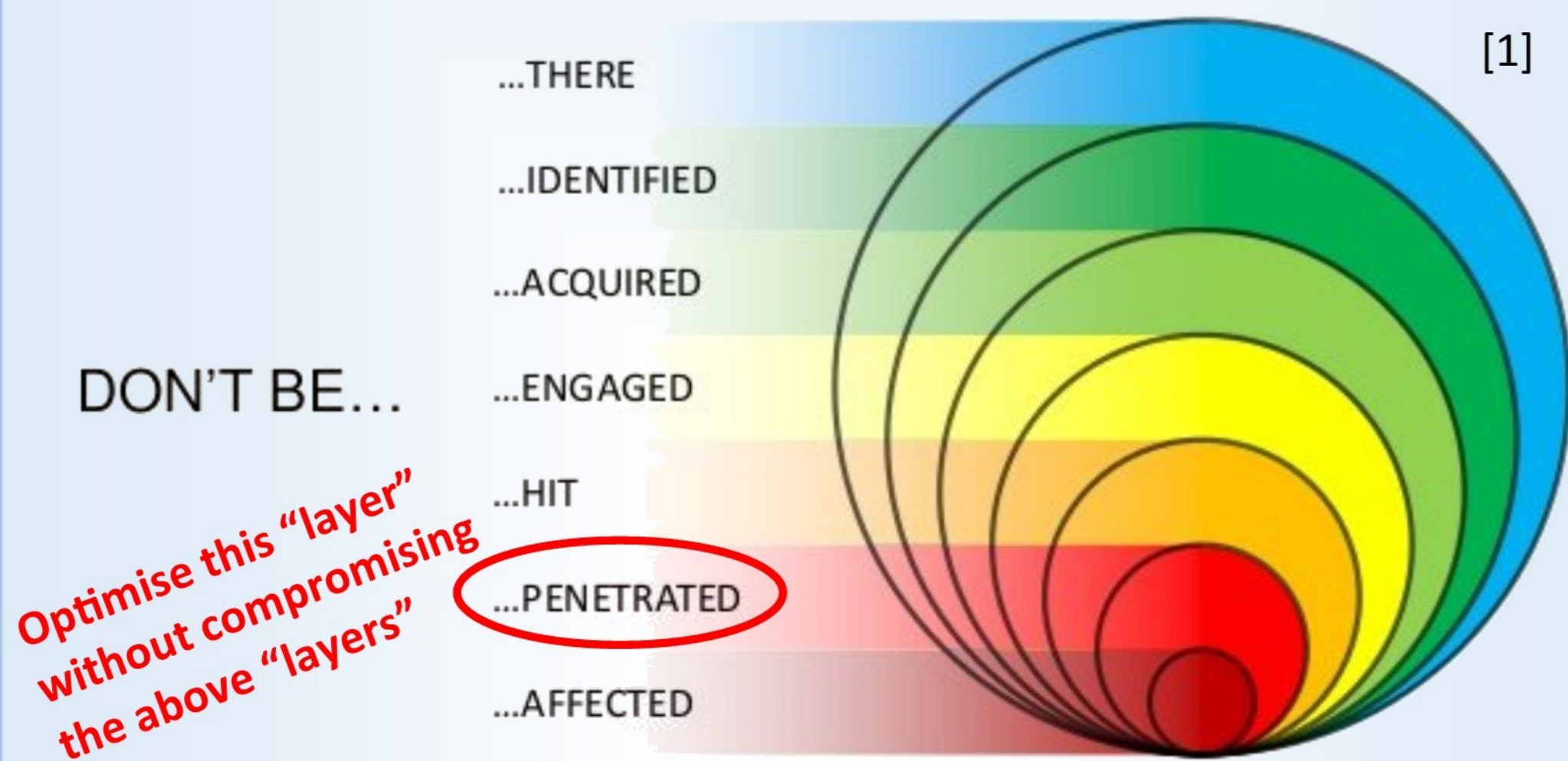


Novel ceramic armour for land vehicles: Identifying the chink in our knowledge

1st year PhD

Introduction

In modern warfare, land-based vehicles face a multitude of threats. Vehicle armour is required to protect against these threats (when necessary) whilst also offering maximum mobility; moving to avoid acquisition offers more protection than any armour. This makes lightweight armour solutions essential.



Complex armour systems may already be using near-optimal materials in their design. However, the ideal arrangement, layering and adhesion methods of these materials is not yet known. Further research in these subject areas may improve armour efficiency without increasing armour mass.

This research will largely focus on controlling the transmission of damaging shock waves through the ceramic-metal interlayer, aiming to maximise the structural support the metal offers the brittle ceramic.

Objectives

- Identify novel methods of joining ceramics to metal backing plates
- Investigate and evaluate the underpinning science of the currently under-researched interlayer between the ceramic and metal
- Create predictive models to estimate the effectiveness of the proposed solutions

1. dstl (2015) 'CDE enduring challenge competition' [PowerPoint presentation], available at: https://www.slideshare.net/MOD_CDE/13-january-2015-enduring-challenge (Accessed: 15th September 2020)

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Methodology

Literature review

- Current armour systems
- Shock waves and their effects on armour
- Analyse the feasibility of potential solutions

Computational modelling

- Create tools to predict armour failure
- Test various geometries, material thicknesses and material combinations

Lab-based experiments

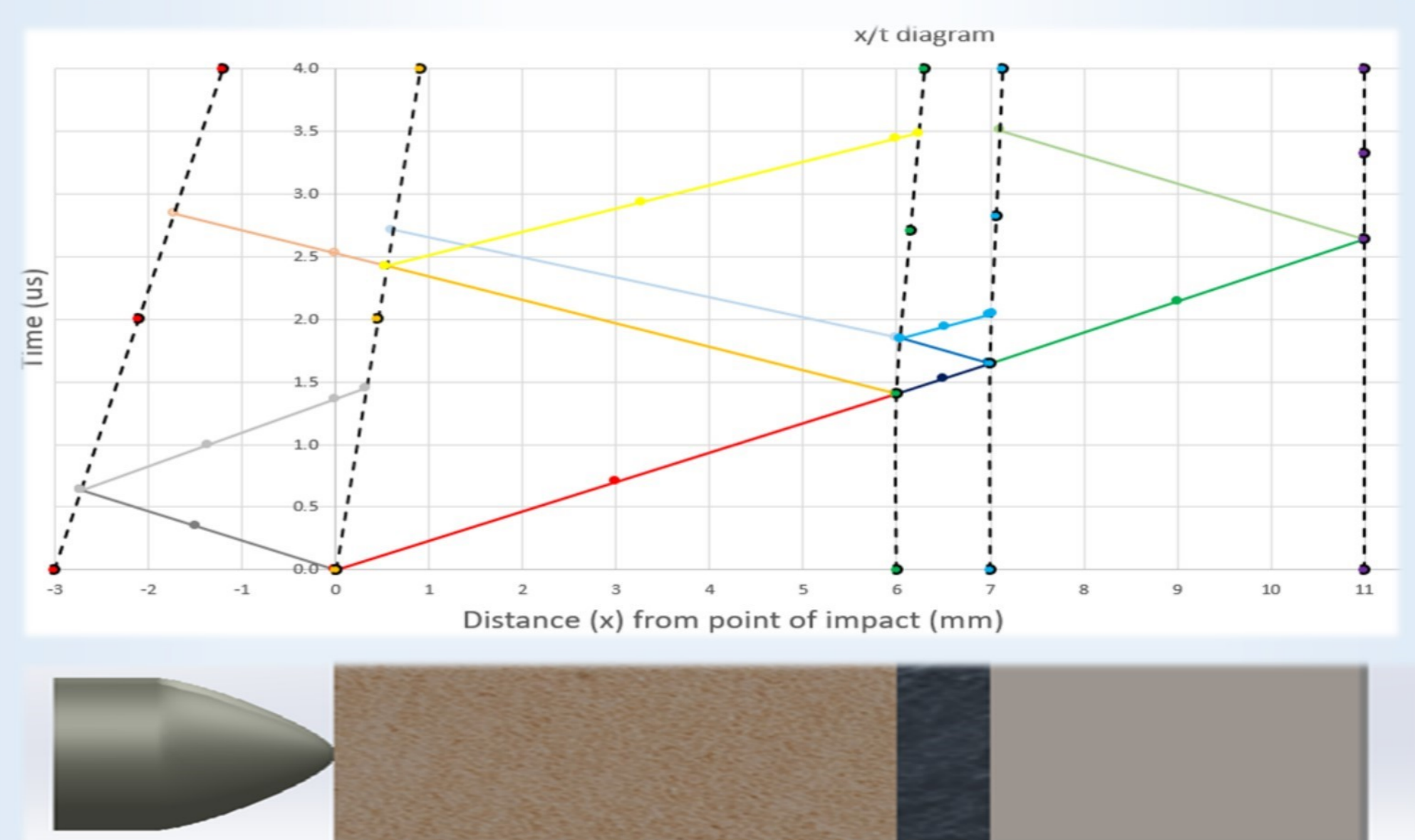
- Identify and utilise suitable manufacturing methods for proposed armour solutions
- Test solutions using high-velocity gas guns

Data analysis

- Validate/improve computational models
- Compare against current armour systems

Results

A spreadsheet outputting an accurate displacement-time diagram from specified materials and layer thicknesses has been created, allowing prediction of armour failure. This assists in the validation of models, which can in turn identify the most viable solutions to carry forwards to the more expensive physical testing.



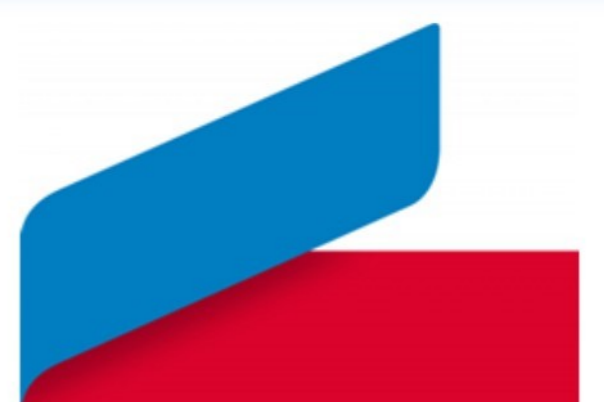
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