



Development of Sustainable PPE for Higher Threat Clearance Operations by Humanitarian Organisations

Project Background

- Current PPE is designed to protect users against the blast effects of 240g TNT (at 60cm) .
- However, both current and future threats are likely to contain much larger charges.
- It is currently unknown how current PPE will perform/interact with these larger threats.

Overall Objectives

1. Understand the current level of blast protection attributed to current demining vests.
2. **Investigate the ambiguities of IMAS 10:30**
3. Define survivability and determine whether PPE and PPE standards should be improved.
4. Identify and test alternative soft armour material.

Ambiguities in IMAS 10:30

- The below experimental work was designed to test blast protection as per the following requirement set out in IMAS 10:30.
"PPE shall also be capable of protecting the chest, abdomen and groin area against the blast effects of 240gm of TNT at 60 cm from the closest part of the body,"
- For the experiment, the states of certain variables had to be decided - but what were they and could they effect the results?

(1) Environmental Factors

- Blast overpressures are lower at high altitudes.
- Soil type, terrain topography and trees can also cause blast to reflect and amplify.

(2) Shape of Charge

- The shape of the charge will effect the shock wave propagation.
- Spherical charges create spherical shock waves and cylindrical charges create areas of amplified and dampened pressures.

(3) Confinement vs No Confinement

- Confined charges create higher peak overpressures.
- For the same mass of explosive, confinement can increase the damage to structures.

(4) Distance of Person

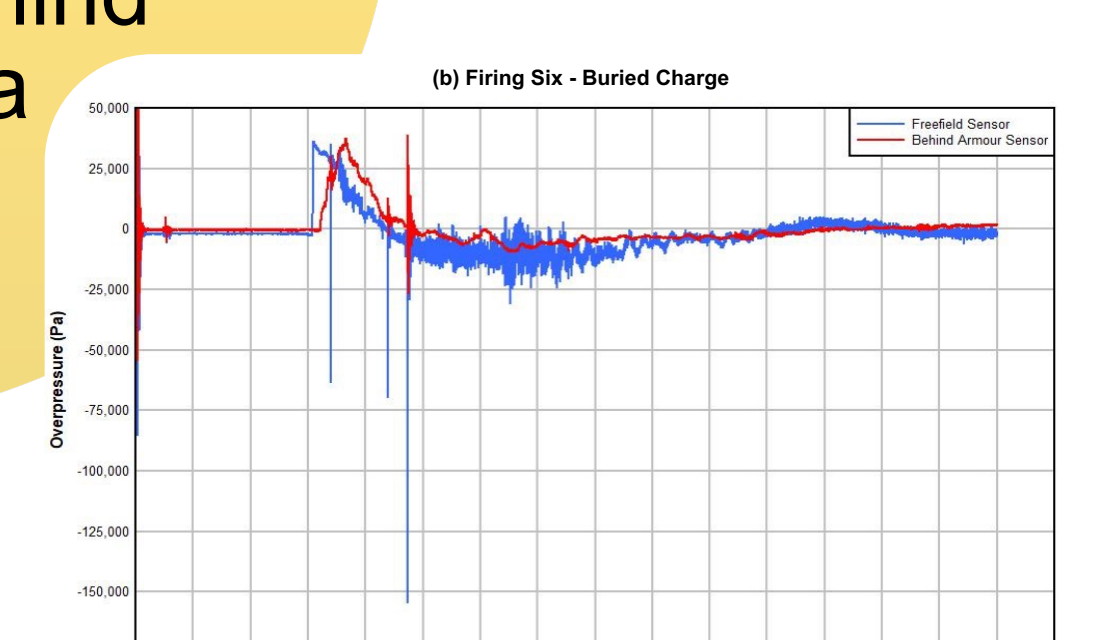
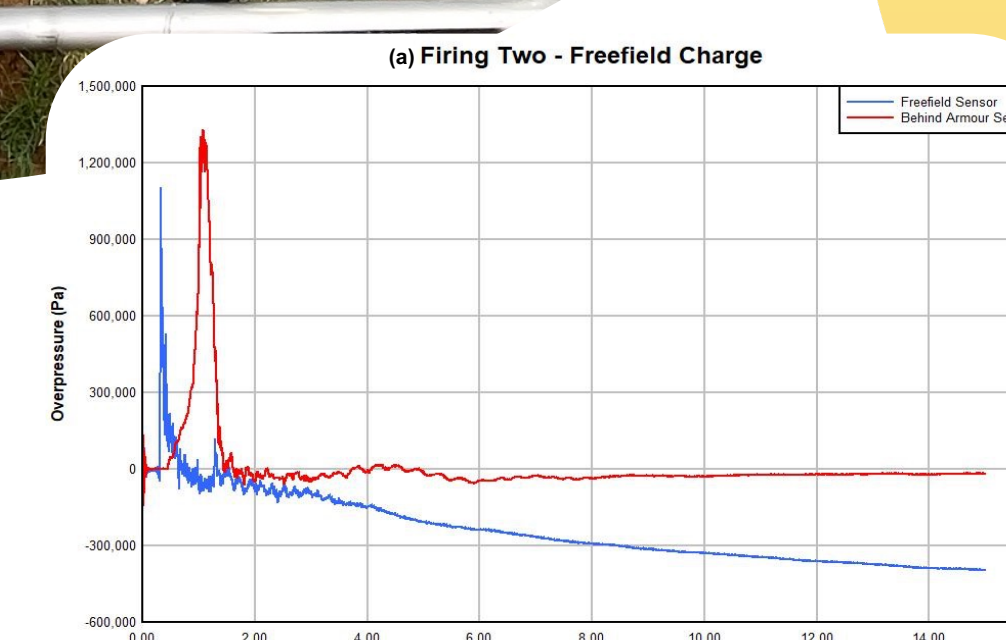
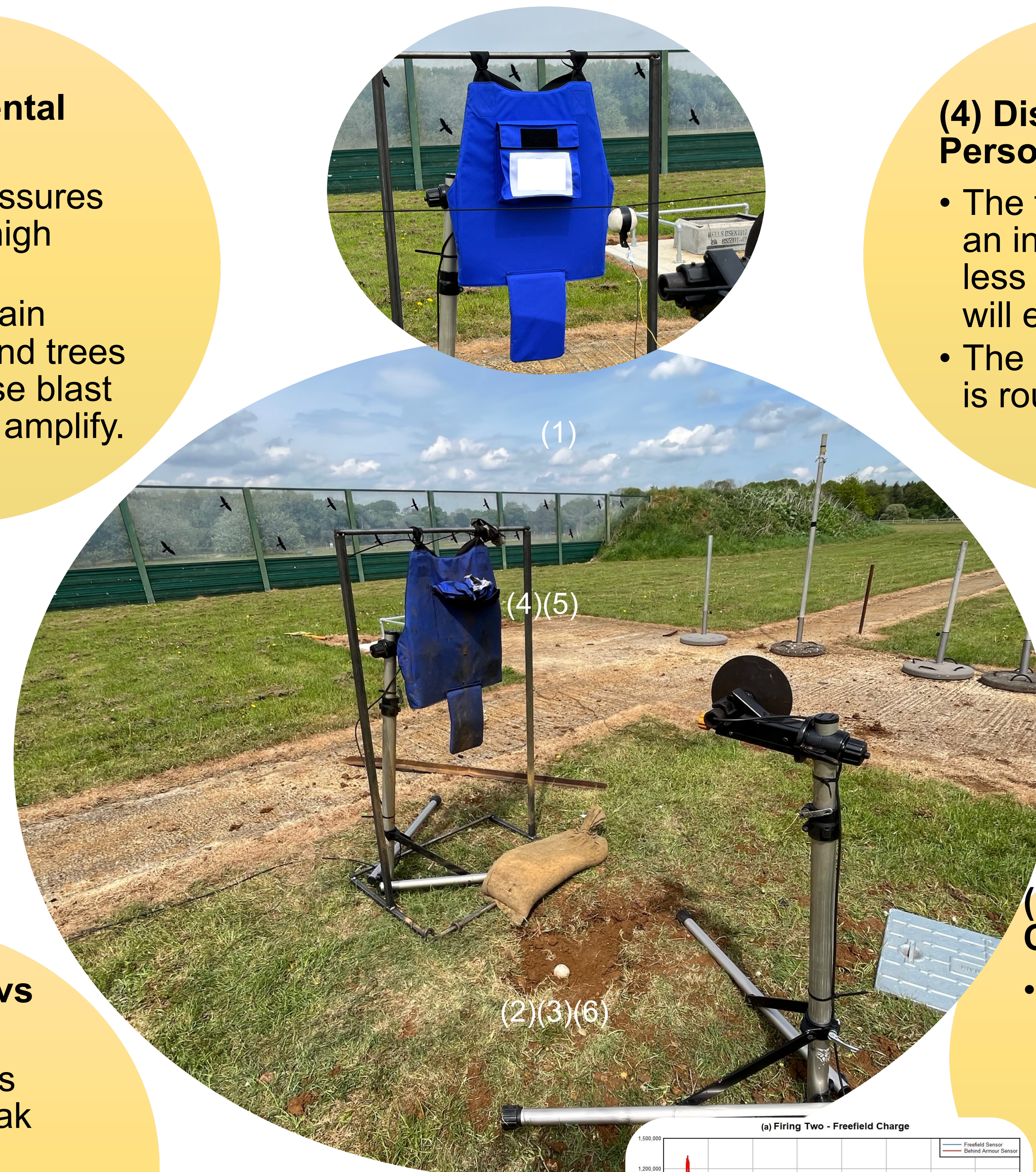
- The further away an individual, the less pressure they will experience.
- The rate of decay is roughly $1/\text{radius}^3$

(5) Angle/Position of Vest

- The angle of a blast wave will influence the pressure and impulse.
- Reflected pressures reach a maximum value when the reflected surface is perpendicular to the blast

(6) Location of Charge

- A free field charge will exert a higher peak overpressure (1332kPa) behind the vest than a buried charge (37.5kPa).



Results of experimental work looking at the effect of changing the location of a charge when (a) the charge was placed in free field and (b) when the charge was buried 10cm underground.

Next Steps

- Continue to review and quantify each of the ambiguities within the IMAS 10:30 via experimental work and a review of literature.
- Determine which variable could have the greatest effect on experimental results.
- Propose an overall test method which will include fixed states of some of the ambiguous variables.

References

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