How vulnerable are you?

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Introduction

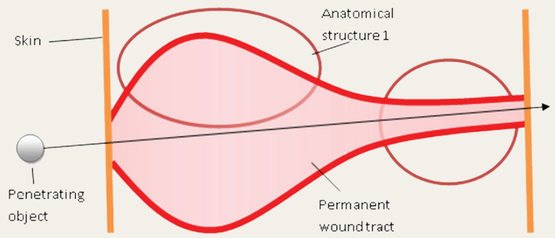
Current personnel vulnerability modelling, within models available to Dstl, could be improved to make the modelling more robust and provide a more detailed output. These assessments are required by the Ministry of Defence to inform policy, procurement and operational risk, thereby improving the future survivability of personnel.

Current Work

Method of Model

The new model works by propagating bullets or fragments through a human geometry, determining retardation and wound tract formation via quick running algorithms derived from high detailed simulations and experiments developed in collaboration with other areas of the lab.

The model then calculates the overlap of the wound tract with specific structures and organs to give Structure/Organ Injury Level (SOIL). Individual SOILs are then aggregated to give a Human Injury Level that quantifies the level of injury caused to the person.



Future Direction

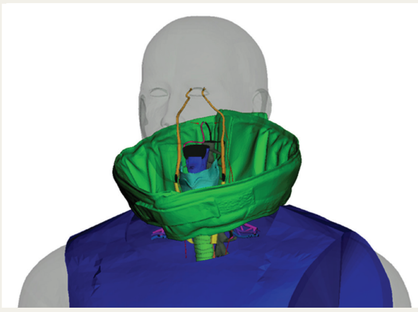
Future Development

In order to obtain a robust validated model further development needs to occur. This will be focused on:

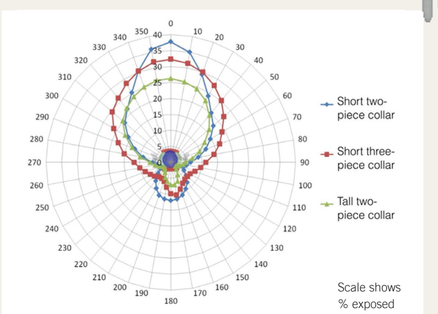
- Algorithms for a wider range of bullets and fragments
- Inclusion of shielding effects of internal structures (e.g. bone)
- More postures and sizes of human to assess against
- Further development of injury scoring
- Assessment of other injury effects

Existing capability

The main current tool available to Dstl for Operational Analysis vulnerability assessments is the Coverage of Armour Tool (COAT). COAT is a quick running geometrical analysis tool designed to assess the coverage provided to vulnerable components and systems of a target by different protective solutions.



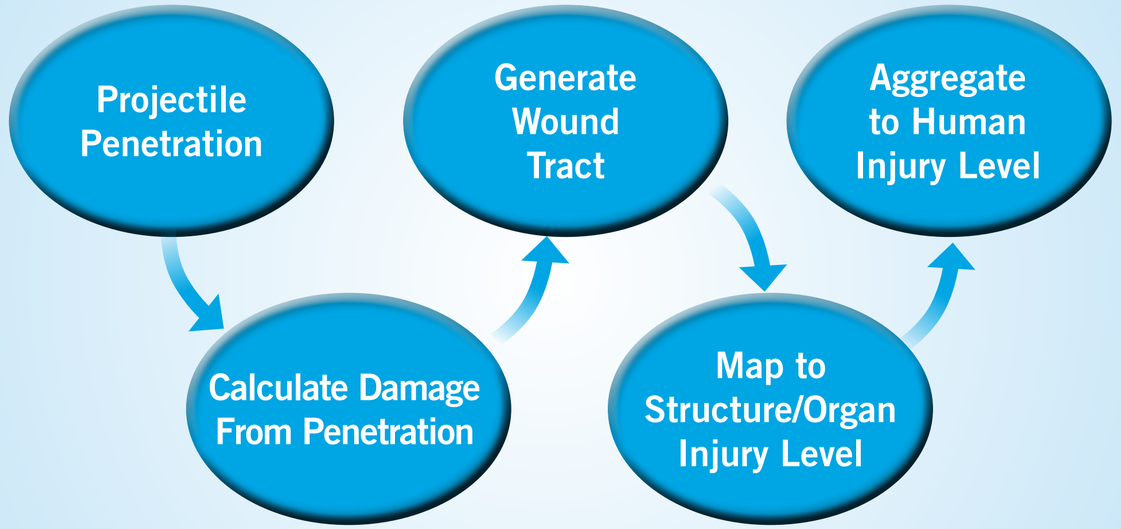
COAT uses a shotline methodology to assess the percentage of each vulnerable group which is exposed by the protective groups across a range of attack aspects.



Main limitations include:

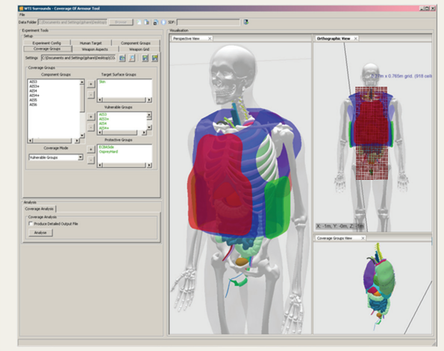
- No account of penetrative effects
- No shielding (e.g. by bones)
- No account of wound tract
- No discrimination between different threats

Model Flow



Impact

This model will provide evidence on vulnerability of new and existing protective systems. This will feed directly in to the wider Dismounted Integrated Survivability Tool (DIST), which will put into context the impact that reduced vulnerability has with wider survivability issues, such as mobility and burden. This will provide evidence for decision making on future procurement and policy.

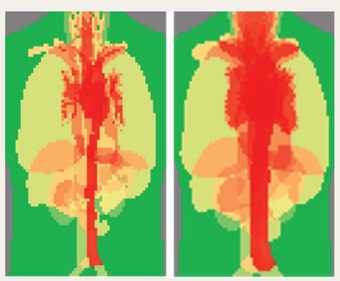


Integrated survivability across the lab

Injury Scoring

A key part of the model is the mapping of tissue damage to injury levels. Work is ongoing to refine these injury scores.

This includes analysis of operational and medical data and collaboration with research being undertaken with military surgeons at the Royal Centre for Defence Medicine.

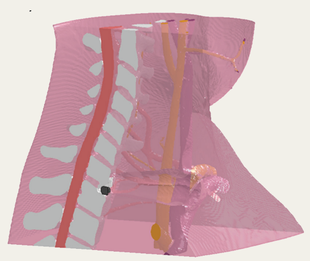


Finite Element Modelling

Highly detailed Finite Element Modelling is used to simulate the penetration of bullets and fragments through tissue and other material.

Fast running robust algorithms are extrapolated for use in the model.

This work is conducted in collaboration with experts in Structural Dynamics.



Experiments

Physical experiments are used to validate the Finite Element Modelling and algorithms that are extrapolated.

Higher level arena trials can also be utilised in order to further validate the outputs of the model. This work is conducted in collaboration with experts in Biophysics.