

Temasek Defence Systems Institute

## Design Methodology of Ground Combat Vehicles for Enhanced Crew Protection

Melvin Chin Hon Keong  
ST Kinetics Ltd

Thesis Advisor: Professor Christopher Adams

Platform survivability does not imply crew survivability. This thesis researches the area of ground combat vehicle survivability, with a focus on crew vulnerability and personnel protection. It addresses how crew vulnerability can be systematically assessed and quantified so that protection technology can be efficiently applied to increase survivability of the mounted warfighters.

By understanding the different threats to combat vehicles and reviewing the vulnerability reduction concepts and design technology available for occupant protection, a comprehensive portfolio of vehicle threats, injury mechanisms and protection solutions was built.

This design approach was illustrated in a case study of Behind-Armor Debris effects on occupants of a notional combat vehicle.

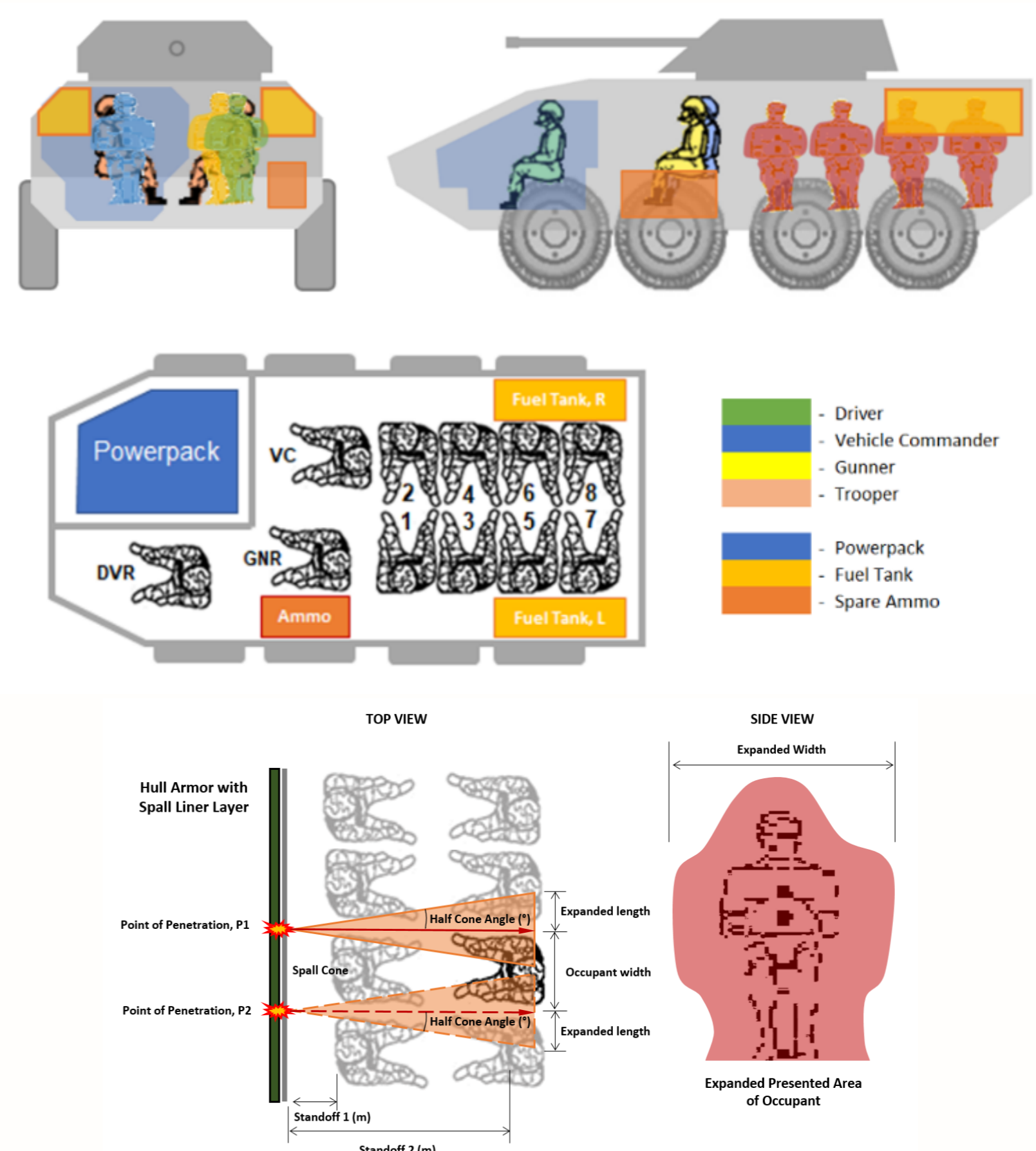


Figure 3: Estimating the Behind-Armor Debris Effects on Occupants of a Notional ICV

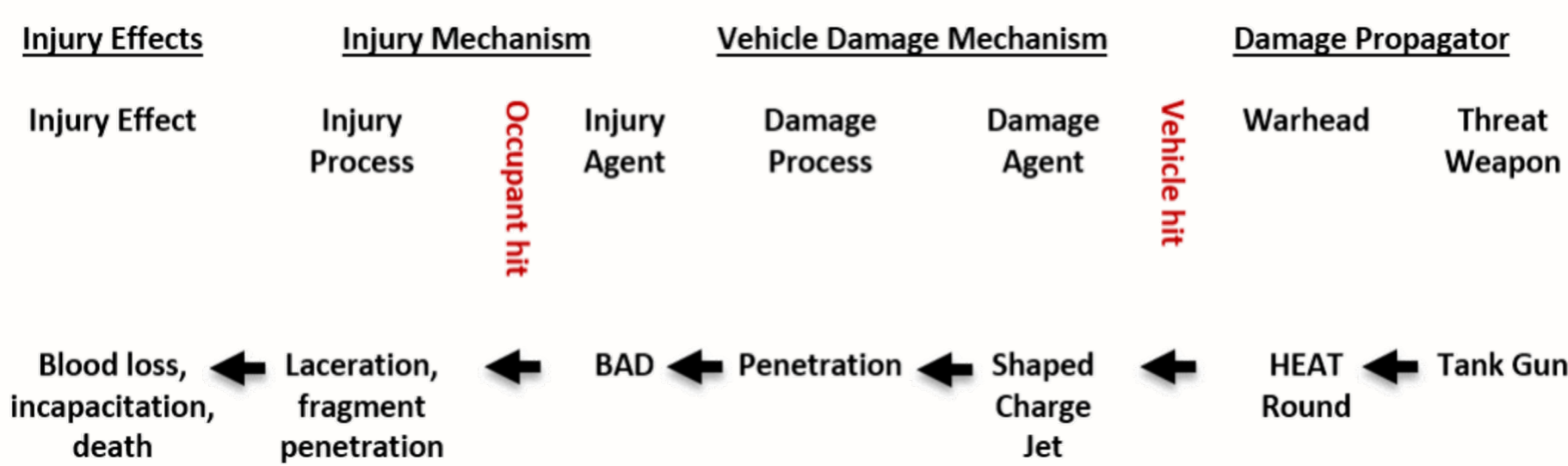


Figure 1: Example of an Occupant-Centric Threat Analysis Flow

A design methodology for enhanced crew protection was established, which covers the analysis of occupants and kill modes, followed by the assessment of crew vulnerability through the computation of probabilities of incapacitation before implementing the various solutions to enhance their protection.

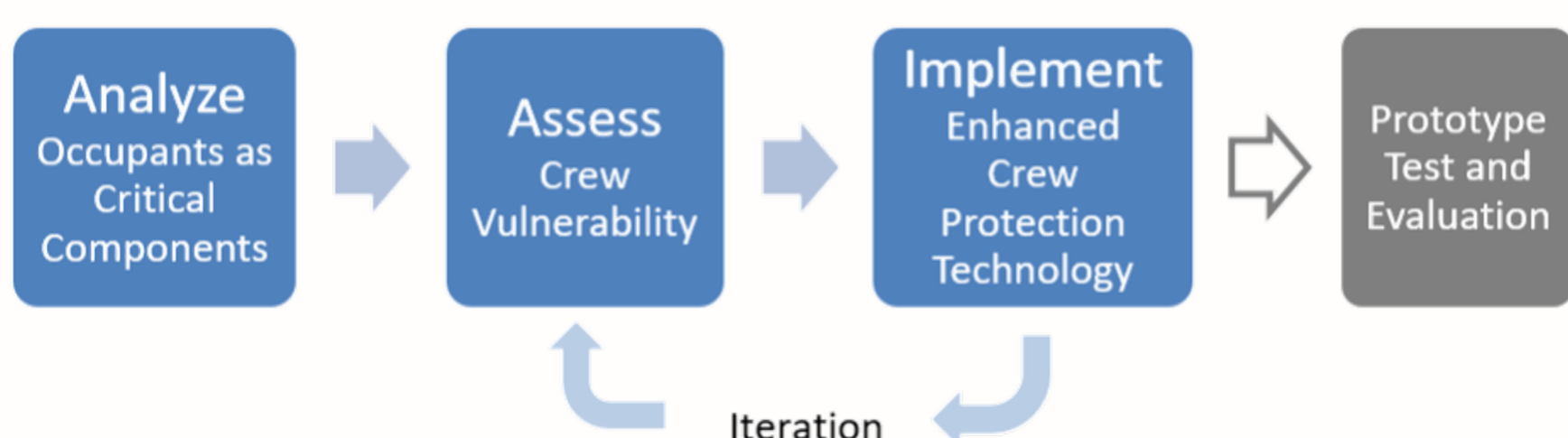


Figure 2: Design Flow Based on the Three Tasks of a Vulnerability Program

This thesis introduced the approach to crew vulnerability analysis, presented design options for personnel protection and outlined potential system trade-offs of the implementation. The land combat systems community, inclusive of the Army, the defense acquisitions agencies and the defense contractors, will benefit from the results presented in the study by incorporating crew survivability into the early stages of ground combat vehicle design flow or acquisition process. To further contribute to the foundation of the discipline in ground vehicle survivability, it is recommended that future works focus on computer modeling and simulation to verify the probability assumptions.