

## **A NEW APPROACH IN DEVELOPING A PROTECTIVE DESIGN FOR ACUTE AND FUTURE THREAT SCENARIO'S IN THE MILITARY**

This report is written as the final part of obtaining a Bachelor degree in Industrial Design Engineering (IDE) at the faculty of Engineering Technology (ET) at the University of Twente (UT). The project is in collaboration with experts of Defense / Military Research & Technology, Veterinary Research & Technology and Design Engineering & Technology which provides the foundation of this interdisciplinary study. A non-disclosure agreement is signed at the beginning of the project.

The initial aim of the project was further technical development of a protective design concept into a functional prototype. The protective part of the prototype should protect the user to the inhalation of harmful substances during military missions. Research is performed for this user-case, resulting in a study which uses various sources of information, data and research from multiple domains to provide a foundation in finding a design solution. Standard methodology in the Design Engineering Process is used starting with an Analysis, Ideation, Concept phase. The research and development of such protective design is difficult, leading to various stagnations in the Design Engineering Process. Many design problems were discovered during the analysis, such as ergonomics, usability and proper functioning of the protective design. The analysis created understanding about the topic but also constrained creativity which slowed down the ideation process and initially prototyping. It was challenging finding a balance between idea-thinking with prototyping and testing. However, during the process there was a change of perspective in the approach to solve the design problem which created a new direction in the project.

Instead of focusing on the creating of a functional prototype, an architecture is created to develop a simulative model which resembles the real world to conduct tests. To make prototyping happen, a foundation for a simulative model is created to enable prototype testing. A simulative model will enable quick testing of future low resolution prototypes. Test results will help to optimize prototypes and hopefully lead to a working concept. The measurements of the tests will help to optimize the concepts. Ideally, computer software will support and give body to the measurements by providing a computer simulation. There would be an interaction between the computer and the model. The test results would be translated into a more realistic and visual simulation on the computer, e.g. simulating the ai

The simulative model will mimic the reaction between the real world and low resolution prototypes to help with the development, testing and validation of future prototypes. Different theories currently exist on how to simulate the real world. This thesis tries to combine all theories into new proposals relevant for the validation of future protective designs. The architecture created in this thesis provides an foundation for the development of a simulative model to enable further development and prototyping of a protective design.