Defence-related Research Action - DEFRA

ACRONYM: VENT-DEFENSE

Title: Tackling a ventilator surge capacity problem by developing an AI based protocol for Individualized Shared Ventilation.

Duration of the project: 01/12/2023 - 31/07/2026

Key words: CBRNe, ventilation, surge capacity

Budget: 895.135€

of which RHID contribution: 633.185€

PROJECT DESCRIPTION

The VENT-DEFENCE project focuses on increasing the capabilities of the Belgian Defence by enhancing their preparedness, deployability, and sustainability in the domain of CBRNe and addressing a ventilator surge capacity problem. Furthermore, the deployability for operations in remote areas or resource-limited environments will be improved.

The COVID-19 pandemic triggered renewed research in the domain of ventilator surge capacity. The existing concept of shared ventilation, where multiple patients share the same ventilator, has been widely discussed and triggered novel research. It was even applied during the surge in the US. Among others, Stiers et al. introduced the novel concept of Individualized Shared Ventilation (ISV), whereby critical ventilation parameters are individualized via a modified ventilation circuit with a ventilator in a pressure-controlled mode. The barrier to clinical implementation lies in the lack of accurate, predictable, and individual control of the ventilation volumes (VTs) over time by the existing valves or current devices. Several solutions added expensive measuring devices to compensate for the poor performance of the existing valves, increasing the workload for medical personnel. Furthermore, the limited real-world experience highlights the critical importance of a clinical protocol. The shared ventilation paradigm is currently being challenged by the development of a new valve type, the flow modulator, and a prototype protocol in the multidisciplinary RESCIUS-project by KUL and RMA.

ISV enables rapid augmentation of ventilation capabilities, without loss of care excellence, in a Special Operations Surgical Team or Role 2 (Enhanced) and role 3 medical support facilities according to NATO doctrine. To facilitate clinical implementation of this disruptive technology and support the military physician by reducing additional monitoring and workload of the medical team, we will develop an artificial intelligence-based ISV-protocol. The smartphone application will determine the different settings and configurations for the ventilator and ISV-circuit given the physician's desired ventilation parameters per patient.

Therefore, we will leverage our knowledge, expertise, and laboratory facilities in the current KU Leuven – RMA collaboration with the additional expertise in medical device software development from Codevid in a triple helix model. Our research strategy will focus on the expansion of the current ISV database, a software development phase according to MDR regulations, and the validation of the AI-based ISV protocol. KUL's research group is part of Leuven.AI, a multidisciplinary consortium within KU Leuven of AI experts, and Codevid has expertise in developing AI-based medical software applications. This staged approach will gradually de-risk the R&D phase, keep focus on the end-user in a military context, and maximize valorization for all stakeholders.

The business development and valorization will be leveraged by the RESCIUS project by presenting the smartphone application to the end-user and industry. No other research groups have previously assessed our research objectives to predict the ventilation parameters and guide the use of ISV by a software application replacing the normal ventilator user interface. The VENT-DEFENCE team will deliver a state-of-the-art validated ISV solution with an AI-based ISV-protocol, facilitating the military physician when a ventilator surge capacity problem occurs, and will increase the deployability and preparedness of the Belgian Defence. Furthermore, the VENT-DEFENSE project will leverage the necessary knowledge, expertise, and building blocks to engage in innovative and disruptive R&D projects focused on value creation for both military and civilian applications (positive dual-use) within the broad field of ventilation.

CONTACT INFORMATION

Coordinator

Prof. dr. Marc Sabbe
Department of Emergency Medicine, KU Leuven
marc.sabbe@kuleuven.be

Partners

Prof. ir. Benoît Marinus
Royal Military School (RMA)
benoit.marinus@mil.be

David Van Canegem
Codevid BV
david@codevid.be

LINK(S)

The link to the project website will be provided once the website is ready.