## LOCALIZING CHEMICAL AND BIOLOGICAL THREAT DETECTION

# Cases - A Low-swap Low-cost "wearable" For Early Warning Of Airborne Pathogen Exposure.

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Allied forces must be able to respond faster and more flexibly to CBRN events; achieve enhanced situational awareness; and manoeuvre safely, effectively and unimpeded in complex contaminated environments for prolonged periods of time. For this reason, the Operating in CBRN Environments science, technology and research project (the “OCE Project”) was initiated by the Australian Department of Defence. Its mission: to enable the joint force to operate safely and effectively in contested CBRN threat environments through enhancement in CBRN Defence capability.
One high-impact, ambitious integrated CBRN capability of developmental focus for the OCE Project is the “Active Collaborative CBRN Environmental Sense and Sense-making System (ACCESSS)” - a scalable network of hundreds to thousands of low- size weight, power and cost (SWaP-C) sensors that sample the environment for CBRN threats and other information required to identify, characterise and monitor them.

The physical and performance characteristics that are coveted for ACCESSS sensors are equally valid as person centric wearable technologies that provide rapid localised information about threats present in the immediate area. Crucially though, the development of such sensors within the ACCESSS context means that the technology is developed from the ground-up with (amongst other things) multi-platform (including autonomy) integration, fusion with other heterogeneous data feeds, connection into multi-modal advanced analytics and interoperability in mind.
This presentation will focus on a new wearable airborne biological threat detector technology, called “CASES”, that is being developed by the OCE Project in collaboration with Australian academic and industry partners. The eventual application of the technology will be discussed both in the context of individual exposure monitoring and as part of a more holistic ACCESSS. Lab based performance against a number of airborne biological threats will presented as well as resilience to potential confounding contaminants and surrounding environmental conditions. Where appropriate, findings from recent simulated real-world scenario trials/assessments will also be shared.

CASES is designed as a simple to use low size, weight, power and cost technology that detects and reports exposure to airborne biological threats. Most recently, end-to-end validation of an advanced alpha prototype technology has been established with relevant SARS-CoV-2 virus particle challenges. The core detection approach though is extensible to a broad spectrum of threats and rapidly adaptable in the face of emerging threats so as to place CASES in the category of “platform technology”.
The key innovation of CASES lies in the ability to perform isothermal loop mediated amplification at tiny volumes on solid support air filtration substrates paired with cost-effective microfluidic implementation, advanced optical design and clever miniaturisation approaches.

High impact near term “wearable” applications of CASES include early-warning in close living quarters environments (i.e. maritime vessels) or in high risk operational interactions where endemic pathogens, pandemic outbreaks or deliberate release are all possibilities with enormous ramifications for mission success. Analogous applications of a low-cost (100s of dollars) low burden (<500g) easy to use (essentially zero training required) CASES device are apparent in civilian sectors such as health, first responder and law enforcement.

The DMTC Ltd for project management support. The Department of Defence Australia for funding .