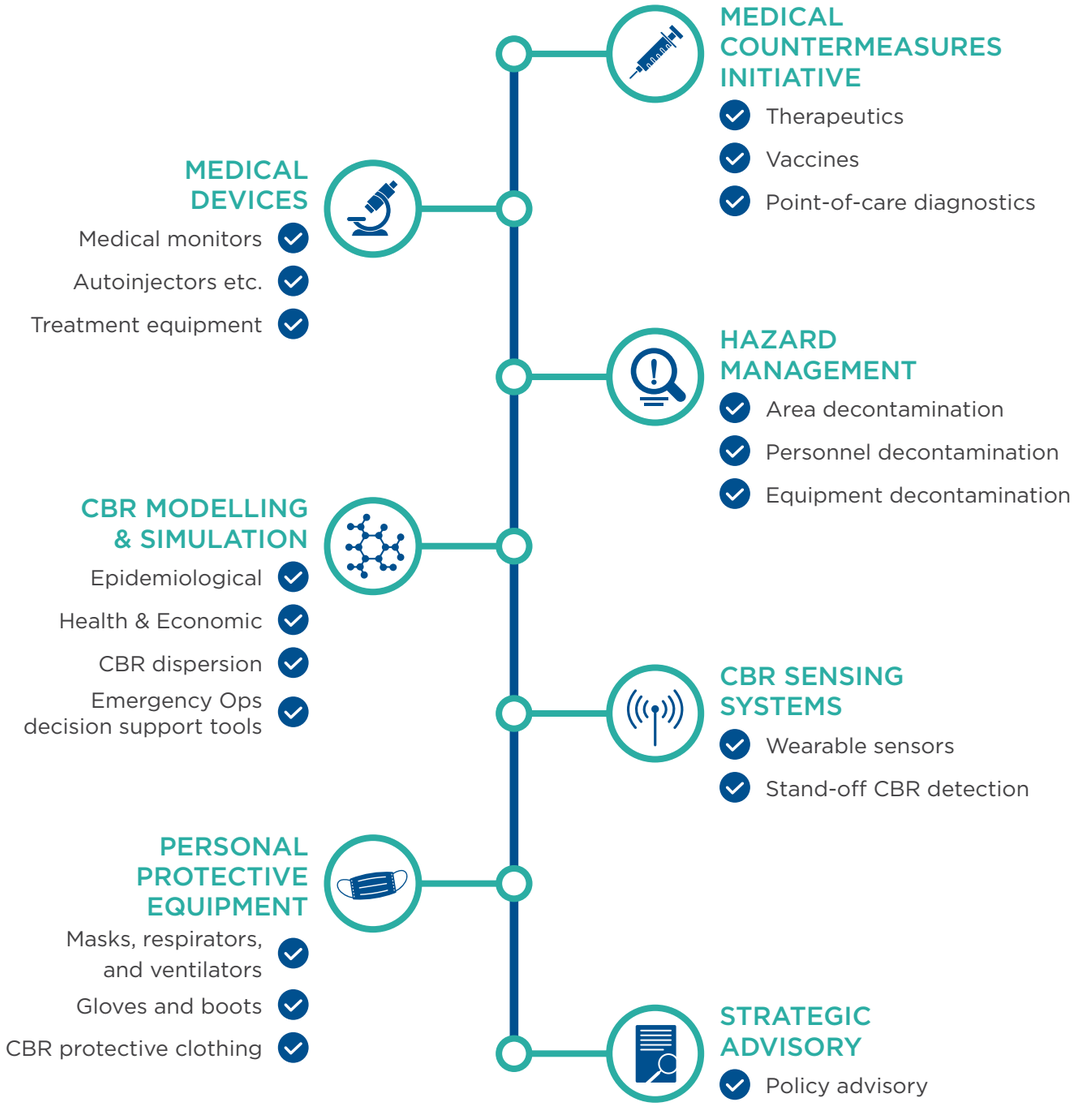
NEW

HSSA Division

A new division of DMTC, known as Health Security Systems Australia (HSSA), has been established with effect from 1 July 2021. HSSA encompasses DMTC's existing Medical Countermeasures (MCM) program as well as new areas relevant to national health security (illustrated below).

More information on the HSSA Division can be found at https://dmtc.com.au/health-security-systems/.



OVERVIEW

HSSA Division

A new division of DMTC, known as HSSA, has been established with effect from 1 July 2021.

The mission of the new division is to lead collaborative programs and projects to develop products and decision-support systems for the protection of military and civilian personnel against Chemical, Biological and Radiological and Nuclear (CBR) threats, emerging infectious diseases and pandemics.

The HSSA division is led by Dr Leigh Farrell, while Dr Felicia Pradera has been appointed to the role of General Manager, HSSA and Program Leader for the MCM Program.

HSSA is committed to building in-country industrial and research capabilities that align with Australian national health security priorities.

This is achieved through management and leadership of collaborative research and industry teams to progress innovative and promising concepts into maturity, as well as monitoring of Australia's national health security capabilities – an example of this is detailed on Pages 22-23 – and providing expert advice and guidance on this to Government partners.

Each of the HSSA research areas illustrated on Page 20 will be managed through Programs containing research projects of relevance. An example of this is the Sensing Systems Program. This Program consists of research projects focused on the development of technologies that sense the presence and/or concentration of CBR threats and provide a resulting measurement. More information on this new Program of research can be found on page 24.

National Health Security Resilience Assessment (NHSRA) Spotlight

The National Health Security Resilience Assessment (NHSRA), led by HSSA, is expanded in scope compared to the two National Capability Audits led by DSTG undertaken in 2012 and 2017 respectively. HSSA was asked to deliver the expanded remit of the NHSRA on behalf of DSTG. Traditionally the Audit would have begun in 2022, however the COVID-19 pandemic led to a request from the MCM Stakeholder Group for it to begin this year.

The NHSRA is supported by the Next Generation Technologies Fund (NGTF) which is managed by DSTG.

Previous National Capability Audits focused on Medical Countermeasures i.e., vaccines, therapeutics, and diagnostics, with potential application against CBR threats generated by either natural or manmade activities.

The scope of the NHSRA comprises a detailed examination of Australia's capability and capacity for research, development, manufacturing, supply chain resilience, and distribution of priority products and solutions in the six key national health security sectors that comprise the HSSA, seen on Page 20.

Utilising more than 800 questions across all sectors, each survey aims to extract information about supply chain resilience and in-country manufacturing capacity, as well as the strengths and vulnerabilities of Australia's prevention, preparedness, response, and recovery (PPRR) ecosystem in the context of CBR threats.

The NHSRA's outcomes will be presented to the HSSA whole-of-Government Stakeholder Group established to support DMTC's work in relation to medical countermeasures and broader health security issues. Stakeholders were consulted throughout the development of the NHSRA. In addition to its expanded remit, the NHSRA is different from the two previously undertaken National Capability Audits in that it harnesses Gravity iLabs' enterprise software platform, StrategyDotZero. Rather than being a static spreadsheet which is a snapshot in time, the vision is to create a health security 'data lake' that can be progressively updated as part of an appropriately secure single software system.

The workplan to digitise the NHSRA included the creation of both a user-friendly online survey portal for participants, and an analytics engine to organise and aggregate the data that is collected. This allows for generation and visualisation of insights (as illustrated on Page 23) into the collected data in real-time, both through a series of dashboards, and, for government stakeholders, through a bespoke user interface.

The survey portal was launched in November 2020. Since then, efforts have focused on optimisation of the analytics engine, dashboards and user interface for improved data analysis and display, in parallel with initiatives to raise the profile of and participation in the NHSRA.

DMTC engaged a second technology services partner, Opyl, to design and utilise an algorithmic scraping tool to create a contact list of 700 potential NHSRA participants.

Through the NHSRA, DMTC and its whole-of-Government Stakeholder Group hope to better understand the academic and industrial organisations contributing to Australian health security. Outcomes may be used to inform public policy initiatives and strategic investment aimed at enhancing Australia's PPRR ecosystem and national health security posture.

The full report from the NHSRA will be released in 2022.

> DMTC has been a really valued partner to Pfizer – we've been working with them throughout 2021 to explore issues around supply chain resilience and pandemic preparedness. Completing the NHSRA is a benefit to all of us in the life sciences sector, but also Australia and Australians not only during times of pandemic but in the future.
>
> Anne Harris, Managing Director,
> Pfizer Australia & New Zealand and Board Member, Medicines Australia

HIGHLIGHT

HSSA

New programs delivering novel technologies

Chemical, Biological and Radiological (CBR) Modelling and Simulation is one of the six key areas of research within the newly formed HSSA.

This research theme aims to develop computer models and simulations to investigate the potential impact of various CBR threats under a number of scenarios and inform the development of prevention, preparedness, response and recovery plans for both military personnel and civilian populations.

HSSA is working with Defence to leverage the capabilities of Australian industrial and academic organisations in this domain. This new activity is underpinned by a three-year funding commitment from DSTG. In the first instance, the program will have three key streams of projects: plume modelling, radiation modelling and decision support tools.

HSSA is commencing four research projects in the CBR Modelling and Simulation program that will:

- Progress an existing algorithm that provides chief decision makers with advice on how to respond to novel disease outbreaks, through modelling of epidemiological data
- Predict and map levels of vulnerability within the body, should a human become exposed to a radiological threat, as well as potential shielding solutions, and
- Develop real-time, high-resolution hazard prediction models for predicting CBR dispersion in both complex urban and indoor environments.

Outcomes from this program will enhance defence and national security capability and contribute to the depth of expertise in the wider hazard modelling community.

Another key HSSA research area is CBR Sensing Systems. This area is dedicated to the development of wearable and stand-off technology for detection of CBR threats, to provide enhanced situational awareness for military and civilian personnel.

HSSA is coordinating and delivering this program of work on behalf of the DSTG team leading the Department of Defence's Operating in CBRN Environments (OCE) STaR Shot. Currently, the program consists of two projects: Compact Aerosolized SARS Exposure Sentinel (CASES) and Human Integrated Sensor Systems (HISS).

The CASES project is the first of the wearable sensing systems that has begun during this reporting year and aims to develop a prototype wearable device that is capable of detecting SARS-CoV-2 virus. This complex system will integrate the rapid molecular detection technology loop-mediated isothermal amplification (LAMP), microfluidics and micro air filtration technology into a matchbox sized wearable sensor.

The HISS Challenge began in this reporting year with the release of a Request For Information, which resulted in over 70 responses. This led to a workshop, co-hosted by DMTC and DSTG, where scenarios for the application of the HISS technology and its potential requirements where considered by workshop participants.

A subsequent Request For Proposals by DMTC and the OCE STaR Shot defined a clear scope for HISS. Collaborative teams will apply advanced biotechnology, sensing systems and data analytics, to measure and interpret pre-symptomatic indicators from the human body when exposed to a biological threat.

The CBR Sensing System Program will progress sensing technologies, with the aim to create sensors that alert the wearer to chemical and biological threats, allowing more time for interventions such as medical countermeasures, and supporting rapid operational decision making.

OVERVIEW

Medical Countermeasures

Now a major component of DMTC's HSSA division, the MCM program continues to develop Australia's defence and national security capabilities against CBR threats, infectious diseases and pandemics, by improving the sovereign development of vaccine, therapeutic and diagnostic technologies.

The program currently has nine active projects comprising two vaccine candidates, two therapeutic candidates, three rapid diagnostic technologies, and two manufacturing projects. This variety and dual focus on capability and capacity makes the MCM project portfolio a major asset in the development of sovereign capability and health security resilience.

The MCM program has continued to have strong engagement with its whole-of-government Stakeholder Group, with senior representatives from the Departments of Defence; Health; Industry, Science, Energy and Resources; Foreign Affairs and Trade; and Home Affairs.

In May, DMTC hosted an MCM Conference session as part of the hybrid 2021 DMTC Annual Conference. The physical event was held in Brisbane, however the majority of speakers and attendees participated online.

The significant breadth of expertise developed through the MCM program was displayed through technical presentations by MCM project leaders Associate Professor Joanne Macdonald, Professor Stephen Graves, Dr Oliver Hutt, Professor Louis Schofield, and early career researcher Joanne Allard.

In August, DMTC co-hosted a workshop with the Indo-Pacific Centre for Health Security (within the Department of Foreign Affairs and Trade) and the Coalition for Epidemic Preparedness Innovations (CEPI) to brief stakeholders on CEPI's product development requirements, and the capabilities Australian academia and industry have to support this, including novel vaccine technologies.

The MCM program has also contributed to capability analyses of the Australian MCM landscape. In June, the DMTC team collaborated with MTPConnect to provide Austrade with highlights of Australia's opportunities for foreign direct investment in biologics capabilities. The DMTC team is also working collaboratively with industry partner Biointelect to provide the Australian Antimicrobial Resistance Network (AAMRNet) with a national audit of research and development capabilities relevant to antimicrobial resistance (AMR).

Dr Nina Pollak, post-doctoral research scientist at the University of the Sunshine Coast (USC) tests the rapid diagnostic technology being designed in the DMTC project involving BioCifer, USC, UQCCR and CSIRO.

HIGHLIGHT

Medical Countermeasures

Scaling for success: diagnostic capability partnership

DMTC has partnered with Queensland University of Technology, DSTG, and Microbio Pty Ltd, to develop a platform diagnostic capability for identification of seven bacterial agents of concern to Defence.

The aim of this project was to progress a promising diagnostic technology, called InfectID®, which can identify multiple different bacterial species in clinical samples such as blood, without the need for prior culture, significantly reducing the time to diagnosis from days to just hours.

InfectID® focuses on Single Nucleotide Polymorphisms (SNPs) – a substitution of a single nucleotide at a specific position in the genome. The technology analyses the amplification of regions of DNA containing SNPs, to differentiate bacterial species quickly, effectively and accurately.

During this project, a single set of primers were designed and optimised to clearly differentiate the various bacterial pathogens. The InfectID® technology was determined to have high sensitivity and specificity. The project team further demonstrated that the InfectID® technology could be used to differentiate between closely related bacterial species.

During the COVID-19 pandemic, industry partner Microbio pivoted on adapting their InfectID® diagnostic for rapid detection of the replicating and non-replicating SARS-CoV-2 virus in patient samples. The underpinning technologies required for this viral diagnostic capability were developed during the DMTC project for bacterial detection.

DMTC has supported this rapid pivot to diagnose COVID-19, as the technology has relevance to national and international diagnostic strategies for the COVID-19 pandemic. This project underlines the importance of developing agile, platform MCM capabilities which can pivot to address a particular health security threat of national consequence.

InfectID® was shown to rapidly identify different bacterial species in clinical samples. In future health threat scenarios this is expected to enable more timely and accurate treatment decisions, improving prospects for successful medical intervention.

Looking Ahead

DMTC is planning to expand the MCM Program portfolio in 2022. An Expression of Interest call will be released in early 2022 for a new round of MCM projects. This EOI will focus on research into novel broad-spectrum therapeutics and/or new vaccine technologies that aim to tackle antimicrobial resistance (AMR) and infectious disease threats. Down-selected projects will be invited to submit a White Paper by July 2022, with successful projects expected to begin in the last quarter of 2022. Information surrounding this EOI will become available on the HSSA website: https://dmtc.com.au/health-security-systems/

Broad spectrum therapeutic against nerve agents

DMTC has partnered with UQ and DSTG to develop a cost effective, broad spectrum, medical countermeasure to counteract nerve agents.

Nerve agents disrupt the normal transfer of messages from the brain to organs and muscles within the body by blocking an enzyme that is responsible for breaking down neurotransmitters. When this enzyme is blocked, it is unable to break down the neurotransmitter as normal, resulting in an increase in signals from the brain to the body, which in turn causes life threatening symptoms such as convulsions and respiratory arrest. Nerve agents are a genuine threat to both Defence personnel and public health.

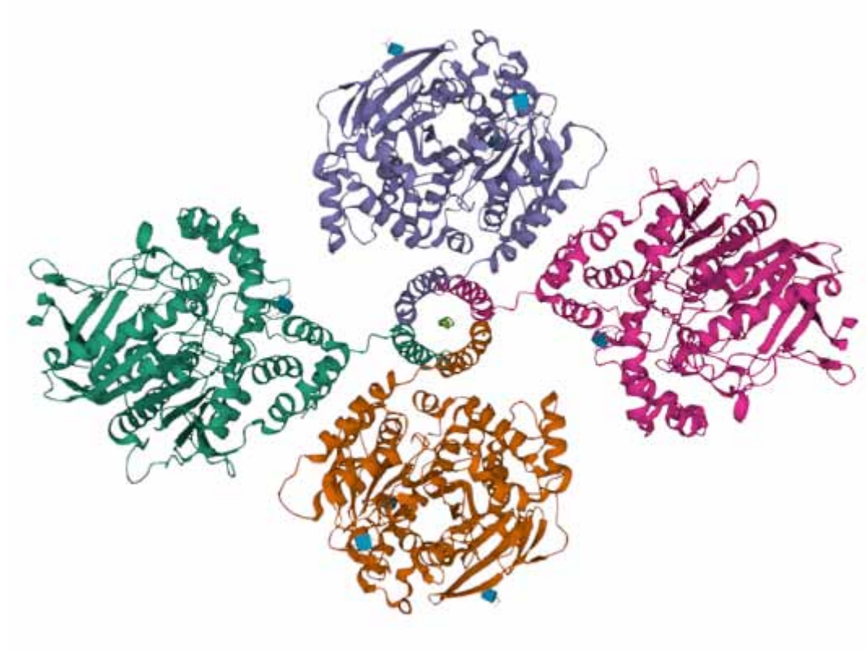
The current therapeutics against nerve agents are sub-optimal, as they either only treat symptoms rather than the cause, do not treat all classes of agent, or have unwanted side effects.

The aim of this project is to produce an improved therapeutic that binds to and inactivates nerve agents within the body.

UQ and DSTG are working collaboratively to develop expertise in a range of areas required for success in this project. The current focus of work is investigations into a range of potential therapeutic constructs which will produce bioscavengers with ability to bind to nerve agents. Promising therapeutic constructs will be subject to more rigorous analysis.

The successful completion of this project will result in a drug candidate which is ready to move into pre-clinical testing, and advanced product development aligned with Good Manufacturing Practice (GMP) manufacture.

The project aims to provide Australia with an in-country capability to produce nerve agent therapeutics at GMP standards for the protection of both Defence and civilian populations.



Human plasma Butyrylcholinesterase (huBChE) is the protein molecule that binds to and inactivates nerve agents within the body.