Defence
Science
Institute

**2024 VICTORIAN & TASMANIAN**
# Defence Research Capability
LAND FORCES EDITION

# Foreword

Victoria's excellence in defence research and development puts us in an unrivalled position to support projects across a wide range of fields, including aerospace, land, maritime, cyber and other joint systems.

Victorian universities contribute around $61 million or 40 per cent of Australia's annual university defence research and development spend – more than any other state in the country.

With world-leading researchers and state-of-the-art facilities, our universities have a lot to offer to the defence industry.

Global firms like Boeing, BAE Systems, Lockheed Martin and Hanwha have chosen Melbourne as their base for significant research and development activities, drawing on the talent and expertise available here.

Our state also provides the ideal environment for partnerships on defence innovation, such as DMTC Limited, RMIT University's Sir Lawrence Wackett Defence and Aerospace Centre and the Oceania Cyber Security Centre.

To address current and future defence needs, governments, industry and academia continue to work together.

That is why the Victorian Government, in partnership with the Defence Science and Technology Group and the University of Melbourne, established the Defence Science Institute in 2010.

From advanced robotics, 3D printed explosives, high strength protective woven fabrics, enhanced radar detection and identification capabilities to chemical and biological sciences and cyber security.

These are some of the areas of expertise that Victoria has, and this directory provides an overview of what's possible when you partner with our defence specialists or businesses.

I encourage those seeking partners, suppliers or solutions to defence and national security challenges to use this directory.

*Natalie Hutchins*

**THE HON. NATALIE HUTCHINS MP**
Minister for Jobs and Industry
Minister for Treaty and First Peoples
Minister for Women

# Defence and National Security Research in Victoria and Tasmania

The universities of Victoria and Tasmania, along with allied research organisations, are recognised internationally for their work and make significant contributions to Australia's defence and national security research efforts. They are key partners in initiatives such as DMTC Ltd, the Centre for Advanced Defence Research and Enterprise in Operating in Chemical, Biological, Radiological and Nuclear Environments (CADRE-OCE) and the Oceania Cyber Security Centre (OCSC). With research capabilities across an expansive range of disciplines and technologies, they form a vital resource for the Defence and National Security sector to draw on.  Through their research activities, the universities and research organisations also provide essential training for the Defence scientists of the future and are home to world class facilities.

Together, Victoria and Tasmania's universities and research organisations form a community of practice which supports Defence and National Security priorities, both short- and long-term. They work closely with each other, and with industry and government, to share knowledge and expertise in pursuit of a secure future for us all.

## Universities



## Research Centres

# Victorian and Tasmanian Defence and National Security R&D Capabilities

Victoria and Tasmania's universities and research centres have a proven research record in a wide range of discipline areas applicable to all aspects of Defence and National Security operations. Their capabilities and credentials are identified in this Directory against the broad capability areas outlined below.

**Advanced Sensors & Processing**
Technologies and tools to collect, send and analyse information from land, sea, air and space environments.

**Big Data Processing & Visualisation**
Tools and techniques for extracting and presenting meaningful information from big data sets to support effective decision making.

**Cyber & IT Security**
Technologies, tools and techniques ensuring network integrity and addressing threats arising from information and communications technology dependencies and vulnerabilities.

**Enhanced Human Performance & Protection**
Techniques, technologies and therapies to save lives, reduce injuries, promote resilience and improve performance in moderate and extreme environments.

**Hypersonics & Directed Energy Capabilities**
Materials and technologies for future directed energy capabilities, propulsion, dynamics, and control surfaces to support hypersonic systems in air, space and sea.

**Integrated Intelligence, Surveillance & Reconnaissance**
Technologies, tools and techniques for effective enterprise intelligence, surveillance, reconnaissance integration and interoperability.

### Medical/Pharma/Bio Technologies

Tools, technologies and products to protect from a range of chemical, biological and radiological threats, pandemics and emerging infectious diseases.

### Propulsion & Energy Storage

Tools and technologies for increased efficiency, performance and safety in propulsion and energy storage systems for land, sea, air and space use.

### Sustainment

Materials, tools, technologies and techniques supporting the ongoing operations and maintenance of all defence and aerospace assets and activities.

### Modelling, Simulation & Analysis

Live, virtual and constructive simulation, modelling and analysis tools for use in operations, training, design, scenario development, risk analysis and forecasting.

### Quantum Technologies

Quantum-based sensor and computing technologies to increase security and improve the performance of communications and computing.

### Trusted Autonomous Systems

Autonomous technologies and tools for high risk, difficult or remote tasks while increasing efficiencies and operational flexibility.

### Multi-Disciplinary Material Sciences

Materials and processes to support advanced manufacturing and material designs, enhance operational longevity, reduce platform detection and improve ballistic and shock protection.

### Space Systems

Materials, technologies and tools to design, build, launch, position, operate and safeguard satellite networks and communications.

# Defence Science Institute

The Defence Science Institute (DSI) supports the development of Australia's defence technology and national security industry.  Facilitating connections and relationships between industry, universities, funders and Defence researchers, DSI helps the sector make use of the considerable talent found in our universities and research centres.

Supported by the State Government of Victoria and the Defence Science and Technology Group (Australia's defence research organisation), DSI acts on behalf of Victorian and Tasmanian universities to help them grow their contribution to defence research and innovation.
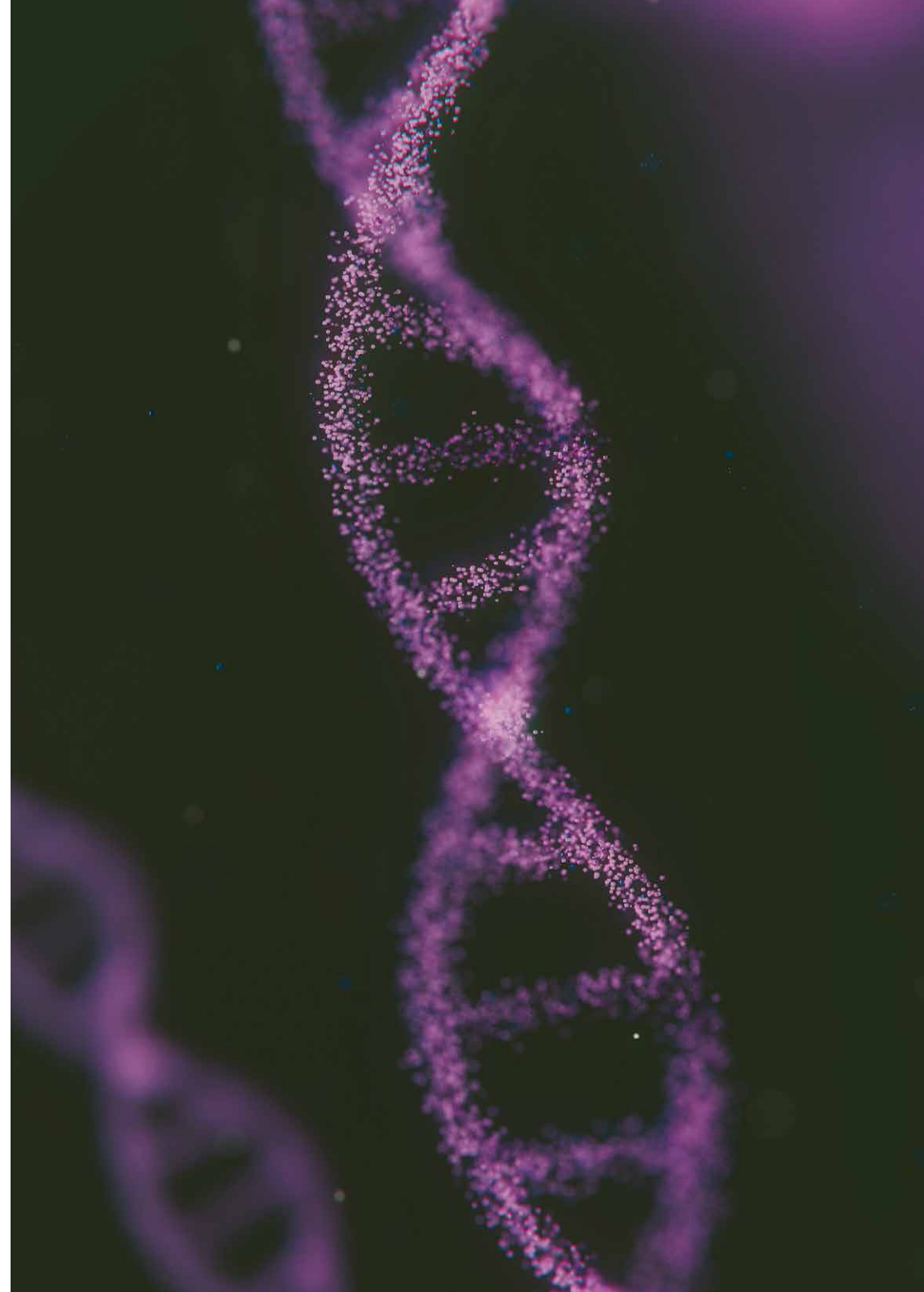
Taking a regional and multi-disciplinary approach to the defence and national security sector, DSI focuses on fostering defence research engagement by:

- Connecting defence and industry to R&D expertise;

- Promoting and showcasing R&D and innovation capabilities in the public and private sectors;

- Identifying defence-relevant research and technology development opportunities; and

- Providing advice on the local and international defence research and development environment.

With strong links into universities, industry and government, the DSI provides a broad overview of defence-relevant capabilities, facilities and priorities, across Victoria and Tasmania and works closely the Australian Defence Science and Universities Network (ADSUN) for national reach across Australia. Practical support for engagement is provided through activities such as:

- Discovery workshops;

- Seed funding grants for collaborative research;

- Postgraduate student support grants;

- Industry internship grants for research students;

- Hosting of trade mission, funder and industry delegates;

- Training for and hosting of innovation pitches focused on investment; and

- Participation in major defence industry events.

**Bringing together the capabilities of industry and government with academia, the DSI is committed to helping the sector find innovative solutions to defence problems.**

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**www.defencescienceinstitute.com**

# Proven Expertise – Defence Excellence

Victoria leads Australia in innovation, new technologies, R&D and advanced manufacturing. Our defence sector is an important part of the state's economy, with proven expertise across the spectrum of defence capabilities: aerospace, cyber security, digital technology, land, maritime and, weapons and munitions.

One of the key pillars supporting Victoria's defence sector is its strength in R&D. The state has internationally recognised research institutes and organisations supported by a world class tertiary education sector.

In 2010, the Victorian Government underscored its support for the state's university-led defence R&D by establishing the Defence Science Institute in partnership with the Defence Science and Technology Group. The Defence Science Institute brokers the interface between industry and researchers, as well as leading a true community-of-practice among Victoria's and Tasmania's universities, while bringing in best practice researchers from other geographies when needed.

Defence technology research is undertaken by Victoria's tertiary institutions, often in collaboration with Defence, industry and other national and international institutions. Melbourne, Monash, La Trobe, Deakin, RMIT, Swinburne, Victoria, Australian Catholic and Federation universities all have world class research capabilities.

Victorian universities contribute approximately 28 per cent ($3.4 billion) of national university R&D spend and approximately 40 per cent ($61.1 million) of national university defence R&D spend. It is one of Australia's leading states for graduates in disciplines underpinning the defence industry, including information technology, engineering and related technologies.

When UK investment giant Savill's released its 2020 rankings of the world's Tech Cities, Melbourne was rated **first** on its Digital Nomads Essentials Index and **fourth** on its Tech Lifestyles City list – the only Australian city to feature in its report. Victoria's competitiveness in fast-developing technologies is internationally recognised.

Global defence firms like Boeing and Lockheed Martin have chosen to locate significant R&D laboratories in Melbourne, drawing on the pipeline of expertise to be found here. Victoria also provides innovation leadership through a matrix of complementary hubs where research and industry interact, such as DMTC Limited, RMIT University's Sir Lawrence Wackett Defence and Aerospace Centre and the Oceania Cyber Security Centre.

The Victorian Government, through the Department of Jobs, Skills, Industry and Regions, will continue to work closely with Victorian universities, the Commonwealth Department of Defence and defence industry to identify and support the development of new technologies to meet strategic defence industry capability requirements.

With proven expertise in delivering complex defence projects and recognised globally for innovation and world class defence industry capabilities, Victoria can make an important contribution to Australia's future defence needs.
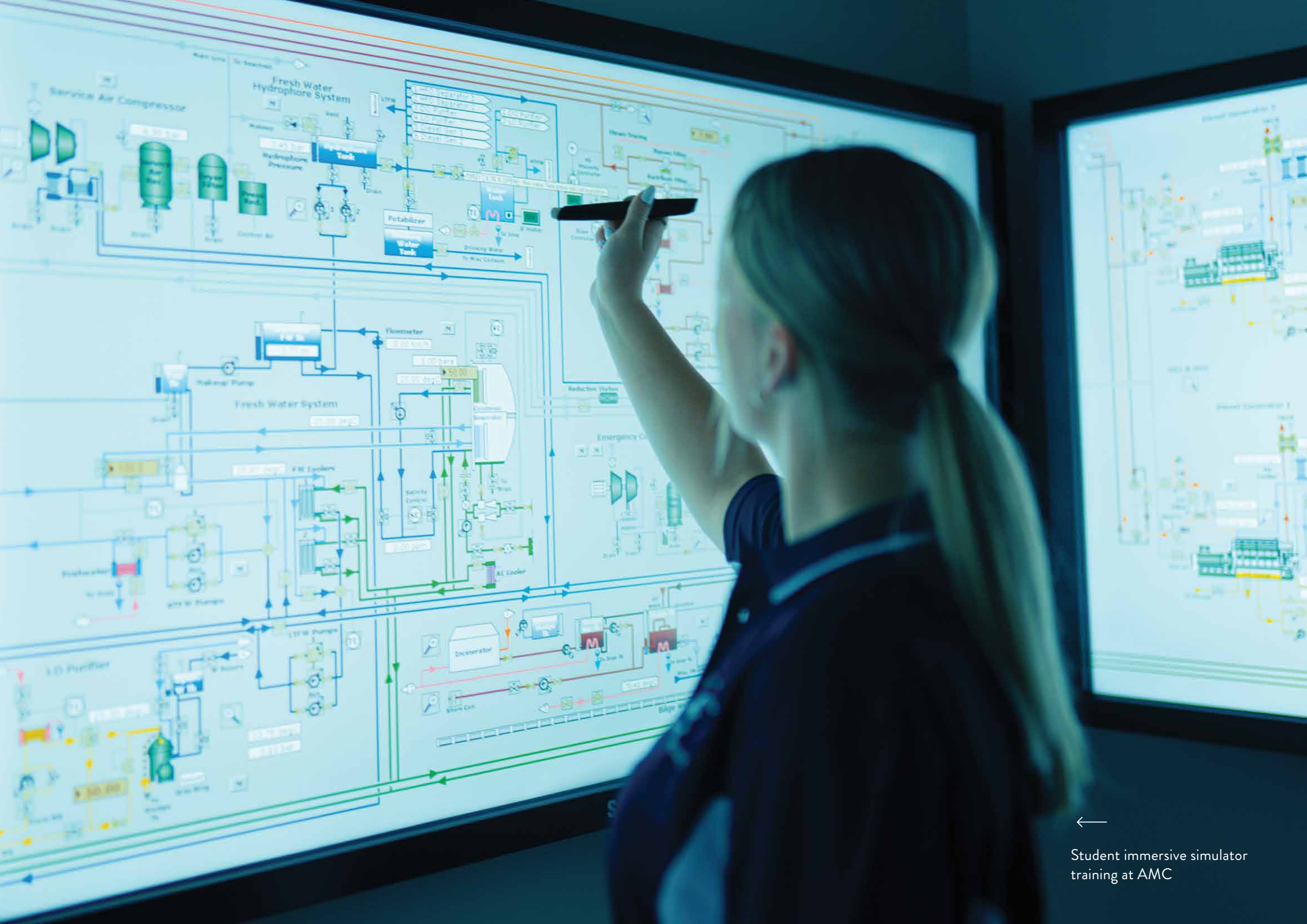
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Student immersive simulator
training at AMC

**ACU**

AUSTRALIAN CATHOLIC UNIVERSITY

**PRIMARY CONTACT**

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SPRINT Deputy Director

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**www.acu.edu.au**

# ACU Defence Personnel and Veteran Research Capability

ACU's commitment to human dignity and the common good underlines all our research and enterprise activity. Our partnerships are key to our success in developing public facing, innovative, and impact-focused research that aligns with our mission.

Recent partnerships led by researchers from ACU's Mary MacKillop Institute for Health Research (MMIHR) and the Research Centre for Sports Performance, Recovery, Injury and New Technologies (SPRINT) include: a Health Research Precinct in collaboration with St Vincent's Institute for Medical Research at ACU's Melbourne Campus; collaborating with the Australian Institute of Sport to study mental fatigue in elite athletes; partnering with US-based Springbok Analytics and the National Football League to investigate the prevention and treatment of hamstring injuries in elite football players; and an International Centre of Training Excellence (ICTE) based in the Blacktown International Sports Park.

Beyond exercise science and human performance, our researchers have developed innovative collaborations in health humanities, focusing on disability and wellbeing including veteran mental health. Multi-disciplinary research led by the Healthy Brain and Mind Research Centre (HBMRC) brings together neuroscience, addiction science, clinical psychology, developmental psychology and rehabilitation science to understand and treat mental health, brain related and developmental disorders. Our Information Technology research is uniquely positioned at the intersection of human, artificial intelligence (AI), and software with an aim to support a wide range of industrial applications.

Our research in ethics explores agency, responsibility, and duties both individually and collectively, as well as concepts of autonomy in bioethics. In education we focus on self-determination and motivation while our humanities researchers bring new perspectives on gender, displacement, and the Asia-Pacific in understanding Australia's place in the world.

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Faculty of Health Sciences at ACU

# AUSTRALIAN CATHOLIC UNIVERSITY (ACU)

**acu.edu.au/sprint**

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## KEY INFRASTRUCTURE

- Southern Hemisphere's only Metabolic Chamber
- Dual Energy X-Ray Absorptiometry
- High resolution peripheral quantitative computed tomography (HR pQCT)
- Ultrasound machine that allows for muscle architectural and stiffness measures
- World class PC2 Laboratory for the analysis of biomarkers
- Biochemistry and tissue culture laboratory
- Commercial grade gym equipment
- Speed and power testing equipment

## TECHNOLOGY TRANSFERS

- End-user partners including: St Vincent's Hospital, Australian Institute of Sport, OrthoSport Victoria Institute, Springbok Analytics (US), National Football League (US)

## KEY PILLARS

| | | | | |
|---|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | | |
| Big Data Processing & Visualisation | | Multi-Disciplinary Material Sciences | | |
| Cyber & IT Security | | Propulsion & Energy Storage | | |
| Enhanced Human Performance & Protection | /// | Quantum Technologies | | |
| Hypersonics & Directed Energy Capabilities | | Space Systems | | |
| Integrated Intelligence, Surveillance & Reconnaissance | | Sustainment | | |
| Medical/Pharma Technologies | /// | Trusted Autonomous Systems | /// | |

# HUMAN PERFORMANCE

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## CAPABILITIES

- Physical capacity profiling
- Training and competition load & fatigue monitoring
- Sleep and recovery
- Collaborations and consultancy with elite sports and industry
- Biomechanics and neurophysiology for prevention and management of sports and exercise-related injury
- Periodisation of nutrition intake for health, training adaptation and muscle recovery
- Fracture prediction
- Biomarkers of blood, iron and other metabolites
- 3D scan of lower leg and arm bone density and microstructure as well as arterial calcification and muscle area measurements
- Measure oxygen consumption and carbon dioxide production

## KEY INFRASTRUCTURE

- Dual Energy X-Ray Absorptiometry
- High resolution peripheral quantitative computed tomography (HR pQCT)
- Metabolic carts
- Ultrasound machine that allows for muscle architectural and stiffness measures
- World class PC2 Laboratory for the analysis of biomarkers
- Biochemistry and tissue culture laboratory
- Commerical grade gym equipment
- Speed and power testing equipment

## KEY PILLARS

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| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | | |
| Big Data Processing & Visualisation | | Multi-Disciplinary Material Sciences | | |
| Cyber & IT Security | | Propulsion & Energy Storage | | |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | | |

# HEALTH AND WELLBEING

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## CAPABILITIES

- Multi-task performance capability assessment
- Decision making assessment (e.g. emotional reactivity, cognitive control, stress)

- Longitudinal data modelling, multi-site data integration, and complex 3D and 4D data visualization
- Human cognition and neuroscience measures

## KEY INFRASTRUCTURE

- Digital Health Innovation E-Studio
- Fully immersive Virtual-Reality technologies
- Augmented Reality multitouch tabletop displays

- Motion analysis and human performance laboratory
- State-of-the art purpose built neuroscience lab to support computationally demanding neuroimaging analyses

## KEY PILLARS

| | | |
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| Big Data Processing & Visualisation | Multi-Disciplinary Material Sciences | |
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# PEOPLE AND PLACE

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## CAPABILITIES

- Demographic mapping/analysis
- Refugees, migration and humanitarian studies
- Gender, military and politics
- Australian and Pacific Islander relations
- Populism and localism studies
- Professional role ethics
- Psychiatric ethics with regard to moral identity and moral agency

- Ethics review/audit
- Wellbeing in the workplace
- Diversity, difference and inclusion
- Governance, strategy and risk
- Organisational culture
- Recovering trust
- Crisis management

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# INFORMATION TECHNOLOGY

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## CAPABILITIES

- Artificial intelligence – focussed on machine learning, deep learning, and reinforcement learning
- Human-computer and human-AI interaction
- Software engineering
- System automation, integration, and decision support

## KEY INFRASTRUCTURE

- Human-centred intelligent learning and software technologies research lab (HilstLab)
- GPU-equipped AI computing servers for advanced big data analytics and deep learning
- Simulation and visualisation display

## TECHNOLOGY TRANSFERS

- Collaborative human-centred AI (CHAI) assistant in a submarine control room
- Context-aware visualisation as a service
- Real-time sentiment analysis and morale visualisation
- Explainable fracture detection from X-rays
- Classification and semantic annotation of IoT datastreams
- Structural corrosion detection from drone Images

## KEY PILLARS

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| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | | ▨ |
| Big Data Processing & Visualisation | ▨ | Multi-Disciplinary Material Sciences | | |
| Cyber & IT Security | ▨ | Propulsion & Energy Storage | | |
| Enhanced Human Performance & Protection | ▨ | Quantum Technologies | | |
| Hypersonics & Directed Energy Capabilities | | Space Systems | | |
| Integrated Intelligence, Surveillance & Reconnaissance | ▨ | Sustainment | | |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | | ▨ |

DEAKIN
UNIVERSITY

**PRIMARY CONTACT**

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**deakin.edu.au**

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Images generated via a process
called DeepInversion (from
NVIDIA), which attempts
to extract representative
images from a pre-trained
deep learning model for image
classification (in this case
ResNet-50).
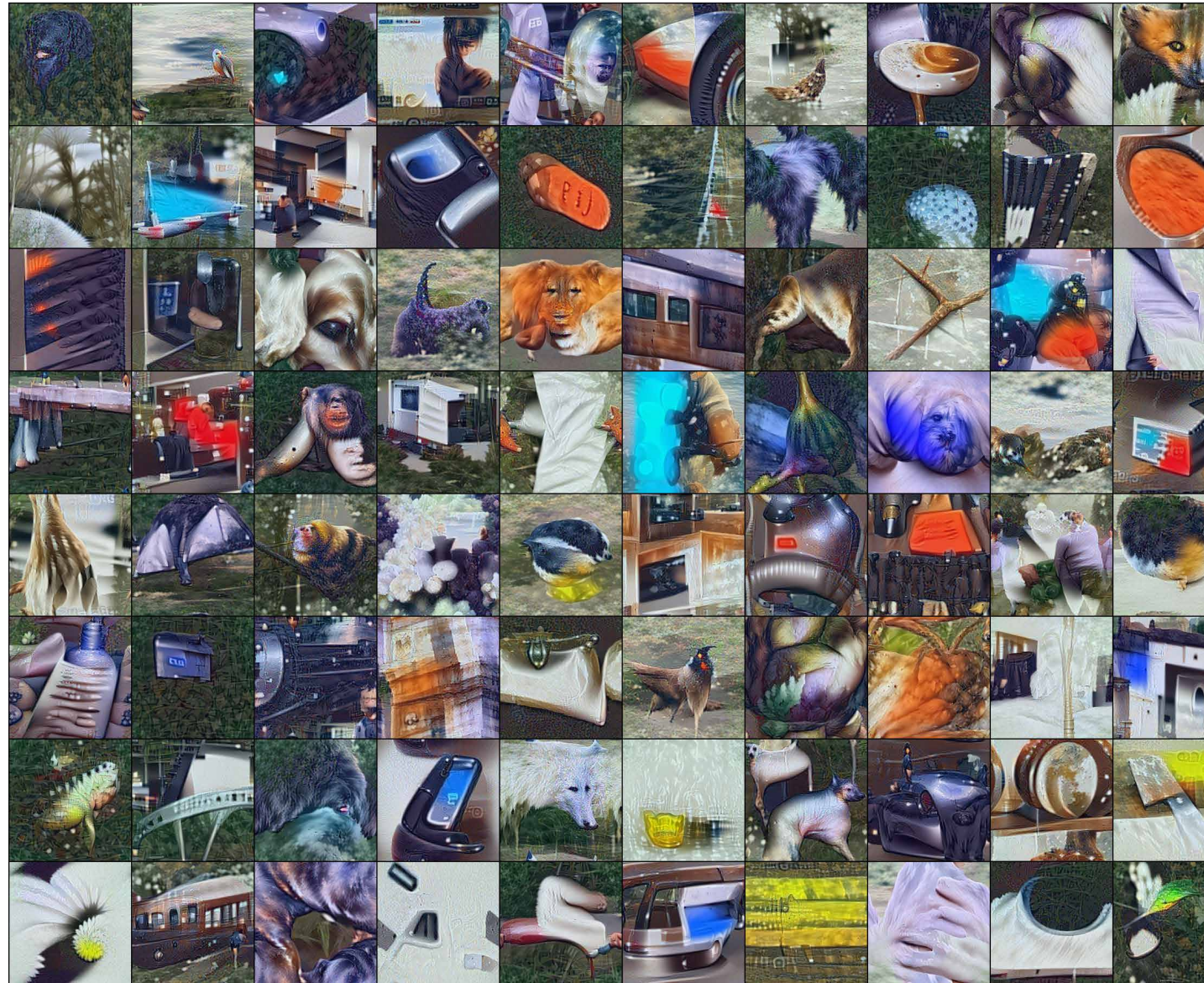
# Deakin University – Defence Research Capability

Advancing Defence research and innovation for more than 30 years, Deakin University works with the Australian Defence Force and commercial partners to deliver high-TRL R&D solutions and provides cutting edge and smart technologies for the ADF operational advantage.

Deakin's Institute for Intelligent Systems Research and Innovation (IISRI) built the world's first haptically-enabled robot-based motion simulator, the Universal Motion Simulator (UMS). The UMS can simulate a variety of land and air vehicles, and also marine vessels in a virtual environment, without eliciting simulator sickness. It may be utilised for spatial disorientation and motion sickness desensitisation. IISRI also developed automated and rigorous evaluation techniques to support expert trainers and instructors with After Action Review in simulation-based training.

The Carbon Nexus research facility at the Institute for Frontier Materials (IFM) is the world's only open-access pilot-scale research plant capable of producing aerospace-grade carbon fibres. Research projects at Carbon Nexus enable the transition from laboratory to advanced manufacturing in industries as diverse as aerospace, automotive, Defence, wind energy and construction.

The Institute for Frontier Materials (IFM) at Deakin focuses on advanced battery prototyping and commercialisation of energy storage technologies, along with corrosion inhibitors, coatings and sensors.

The BatTRI-Hub facility is creating emerging "beyond lithium-ion" battery technologies which are safer, perform better and have smarter design for portability and function with better energy management systems.

The Applied Artificial Intelligence Institute (A$^2$I$^2$) provides technology solutions for applied AI challenges in Defence by constructing, training and applying state-of-the-art AI/ML techniques to achieve agile solutions tested and evaluated in the field. The focus is on AI systems to provide support to human operators through monitoring, analysing and supplementing information provided to human decision makers.

Deakin's School of Information Technology is the home of IT research and education at Deakin University with over 140 staff and a comprehensive range of expertise across Data Science and Artificial Intelligence, Internet-of-Things and Cyber Physical Systems, Software Engineering and Cyber Security. Defence is one of our strategic industry verticals, with DSTG as a key partner with over 20 funded projects over the past 5 years.

Deakin University has a proven track record in Defence and industrial innovation, and welcomes opportunities for new partnerships.

## DEAKIN UNIVERSITY

www.deakin.edu.au

**Dr James Mullins** AM
Director
— Defence and Security

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### CAPABILITIES

- Design & built world-class autonomous systems. Aus' only road certified fully autonomous military vehicles
- Haptically enabled robots allow defence law enforcement agencies to explore hostile environments
- Protective cybersecurity & information warfare, cyber analytics, forensics and incident management
- Sovereign capability, world leading facility for design, fabrication & testing of nextgen battery technology
- Human-centred AI focussing on Bayesian optimisation, deep learning, robust responsible AI and reinforcement learning
- Provider to Australian War College of education & professional development to senior Aus military officers
- In-field measurement of physiological & psychological responses for defence's health, wellbeing & performance
- Development of ground-breaking advanced materials to help protect our forces in the harshest of environments

### KEY INFRASTRUCTURE

- IISRI: Aus's largest research group in simulation & automation
- A²I²: with a proven record of solving challenges no one else can
- Institute for Frontier Materials (IFM): Re-designing material properties for extraordinary functionality
- Alfred Deakin Inst. for Citizenship Globalisation (ADI): Delivering equitable and sustainable change in society
- IPAN: Reducing chronic disease through nutrition/ physical activity
- Institute for Mental & Physical Health & Clinical Translation (IMPACT):Causes and impacts of mental health
- School of Engineering: Co-designing infrastructure of the modern world with industry.

### TECHNOLOGY TRANSFERS

- Universal Motion Systems : World-class motion platform and driver training L400 phase 2.
- Battery Hub: Innovation centre for design, development & commercialisation of energy storage
- HYCEL: A regional hub focused on technologies for the novel use of hydrogen
- Renewable Energy Microgrid: Australia's largest university based solar farm & living laboratory
- ManuFutures: Advanced manufacturing innovation hub supporting start-ups to create, commercialise & export new products
- Recycling & Clean Energy Commercialisation Hub (REACH): Leading a recycling & sustainable manufacturing revolution
- Circular Economy Initiative (CEI): Scalable & commercially ready solutions for new circular materials & technologies

### KEY PILLARS

| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | ▨ |
| --- | --- | --- | --- |
| Big Data Processing & Visualisation | ▨ | Multi-Disciplinary Material Sciences | ▨ |
| Cyber & IT Security | | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | ▨ | Quantum Technologies | |
| Hypersonics & Directed Energy Capabilities | | Space Systems | |
| Integrated Intelligence, Surveillance & Reconnaissance | | Sustainment | ▨ |
| Medical/Pharma Technologies | ▨ | Trusted Autonomous Systems | ▨ |

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## APPLIED ARTIFICIAL INTELLIGENCE INSTITUTE (A²I²)

a2i2.deakin.edu.au

**Professor Kon Mouzakis**
Co-Director

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### CAPABILITIES

- Simulation – improving complex phenomena prediction and synthetic training
- Artificial intelligence – delivering intelligent systems designed to augment human capabilities
- Bayesian optimisation – optimising black-box functions via probabilistic techniques
- Data analysis – extracting actionable and valuable insights from large or complex data streams
- Visualisation – effective human computer interaction techniques to enhance information delivery
- Decision support systems – distilling diverse data into holistic info for complex decision making
- Learning support systems – streamlined learning via constructive alignment & activity-based experiences
- Augmented and virtual reality – enriching complex content delivery through immersion and experience design

### KEY INFRASTRUCTURE

- AI Computing Cluster
- Advanced Data Analytics and Pattern Recognition Laboratory
- Defence Applied AI Experiential CoLab
- Synthetic Environments Laboratory
- Command & Control Laboratory
- Emerging Technologies Test & Evaluation Laboratory
- Intelligent Analyst Assistant

### TECHNOLOGY TRANSFERS

- TRR – intelligent decision support tool used to assist doctors while treating trauma patients
- iCetana – video surveillance analytics to detect potential security threats in large data sets
- iHosp – big data analytics for hospital management systems
- Ekko – extracting insights from duplex call centre recordings using natural language processing and statistics
- Groundtruth – predicting deterioration of mental state and developing an early-warning system
- EDIE – experiencing dementia via virtual reality in order to educate carers
- Sofihub – digital assisted living and in-home monitoring for the elderly
- TOBY Playpad – learning and early intervention therapy for children living with autism

### KEY PILLARS

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## CENTRE FOR CYBER RESILIENCE AND TRUST (CREST)

——————

**deakin.edu.au/crest**

**Professor Robin Doss**
Director

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✉ robin.doss@deakin.edu.au

### CAPABILITIES

- Big data – machine learning and security analytics
- Security by design for critical infrastructure and IoT
- Social media and information security – privacy and surveillance
- Information assurance and privacy preservation
- Cyber security information manipulation and warfare
- Human aspects of cyber security and decision making
- Malware analysis
- Blockchain research and applications

### KEY INFRASTRUCTURE

- Malware analysis lab
- Cisco Cyber Range
- Eye tracking technology
- Functional magnetic resonance imaging (fMRI)
- Electroencephalography (EEG)
- Robotics laboratory
- Australian Cyber Protection Centre

### TECHNOLOGY TRANSFERS

- Honeypot technologies to detect threat actors
- SME education on cyber security resilience
- Cyber security advice for executives (government and industry)

### KEY PILLARS

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## INSTITUTE FOR FRONTIER MATERIALS (IFM)

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**deakin.edu.au/ifm**

**Professor Sally McArthur**
Director

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### CAPABILITIES

- Fibres, polymers, composites and textiles – new technologies, processes and products
- Alloy design and processing – lightweight materials for increased fuel efficiency
- Biomaterials and biomimicry – inspiration from nature for medical and textile applications
- Corrosion and protection – safeguarding vital infrastructure and industries
- Materials and process modelling – predicting the way molecules and materials react
- Nano and plasma technology – energy storage, surfaces/ interfaces, novel nanomaterials, liquid plasma
- Carbon fibre pilot scale production including precursor synthesis and composite fabrication
- Electromaterials and membranes – creating new electroactive materials

### KEY INFRASTRUCTURE

- Advanced Characterisation Facility including electron microscopy, nuclear magnetic resonance and x-ray
- National Facility for Pipeline Coating Assessment – coating assessment & corrosion evaluation, NATA accredited
- Carbon Nexus – carbon fibres, textile pre-forms & composites for new tech, processes & products
- Advanced Plasma Facility – including combined physical vapour/plasma-enhanced chemical vapour deposition
- BatTRI-Hub – adv battery prototyping, commercialising energy storage technologies, with CSIRO
- Metal Surfaces Facility – wire drawing/crossed cylinders rig, surface/heat treatment testing, GDOES, nanoindentor
- Mechanical Testing Facility – high temperature tension strain-rate, compression, fatigue, bend, shear, Bauschinger
- Light Metals Facility – 300 ton horizontal extrusion press, melting and metal forming, thermo-electric properties

### TECHNOLOGY TRANSFERS

- Next generation batteries
- New carbon fibre manufacturing technology and specialised machinery– energy, cost, space and time savings
- HeiQ real silk – short polymer fibre with the key properties of natural silk
- Carbon fibre/composite products including carbon fibre wheels

### KEY PILLARS

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# INSTITUTE FOR INTELLIGENT SYSTEMS RESEARCH AND INNOVATION (IISRI)

**deakin.edu.au/iisri**

**Professor Douglas Creighton**
Director

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- douglas.creighton@deakin.edu.au

## CAPABILITIES

- Universal motion simulator for land, air and sea vehicles
- Haptically-enabled remote tele-operated robotics for medical and law enforcement applications
- Haptically-enabled medical training simulators
- High-G centrifuge simulator
- VR/AR training simulators
- Advanced artificial and computational intelligence techniques for decision support
- Process modelling and analysis, modelling complex systems
- Human performance assessment, after action review methodologies

## KEY INFRASTRUCTURE

- Universal Motion Simulator – world's first haptically-enabled motion simulator
- High-G centrifuge simulator for pilot training
- Motion capture laboratories, motion tracking systems
- Virtual and augmented reality simulators
- Human performance laboratories, eye tracking and EEG systems
- Haptics, autonomous robotics platforms

## TECHNOLOGY TRANSFERS

- Haptically-enabled Universal Motion Simulator (UMS)
- High-G centrifuge simulator
- HUman Monitoring System (HUMS)
- Haptically-enabled VR/AR firefighting training simulator
- HeroSurg – Haptically-enabled robotic assisted minimally invasive surgical system
- HaptiScan – Haptically-enabled remote tele-operation ultrasound robotic platform
- OzBot and OzTouch – Haptically-enabled tele-operated robotic platforms for counter-IED
- iPupilXH - Enhanced Situational Awareness with Haptics Alert

## KEY PILLARS

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# THE INSTITUTE FOR PHYSICAL ACTIVITY AND NUTRITION (IPAN)

**ipan.deakin.edu.au**

**Professor Jo Salmon**
Director

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- +61 3 925 17254
- jo.salmon@deakin.edu.au

## CAPABILITIES

- Enhanced Defence Personnel Performance Management
- Ability to develop high quality simulation for individual tasks -up to multi-day operations
- In-field measures for physical activity, load, stress, sleep, mood, vigour, fatigue, cognition, thermoregulation
- Optimising human physical performance in different scenarios
- Dedicated investment in female ADF members including optimising training and injury prevention
- Laboratory measures for physiological and psychological responses to simulated tasks and operations
- Cognitive assessment for individuals
- Expertise in muscle, stress, cardiovascular, bone, neural and endocrine physiology

## KEY INFRASTRUCTURE

- Dual Energy X-ray absorptiometry (DXA), Quantitative Computed Tomography (QCT) and Magnetic Resonance Imaging (MRI)
- Electrocardiogram to measure heart rate and heart rate variability
- Metabolic carts to measure oxygen consumption and carbon dioxide production
- Ultrasound machine to measure cardiovascular function including blood flow
- Metabolic gas analysers to assess maximal oxygen uptake and blood sampling devices
- Commercial-grade gym equipment, speed and power testing equipment
- World class laboratory facilities PC2/PC3 laboratory for the analysis of biomarkers (saliva, blood, muscle etc)
- Climate chamber with a working temperature range of 0-50'C and humidity range of 0 to 95%

## TECHNOLOGY TRANSFERS

- SCRAM - Remote exercise coaching and lifestyle behaviour change program

## KEY PILLARS

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# SCHOOL OF INFORMATION TECHNOLOGY

**deakin.edu.au/information-technology**

**Professor Trina Myers**
Head of School

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## CAPABILITIES

- Machine-to-Machine communication
- 5G/6G/SATCOMM
- Smart Energy Solutions
- Large-scale Distributed Systems Cloud/Edge/Fog Computing
- Design Thinking and User-centric Design
- Immersive Environments using Virtual and Augmented Reality

- Blockchain-powered solutions
- Model-driven Engineering and Visual Languages
- Chaos Engineering
- Explainable AI
- Situation-awareness solutions
- Data analytics and anomaly detection solutions
- Computer vision
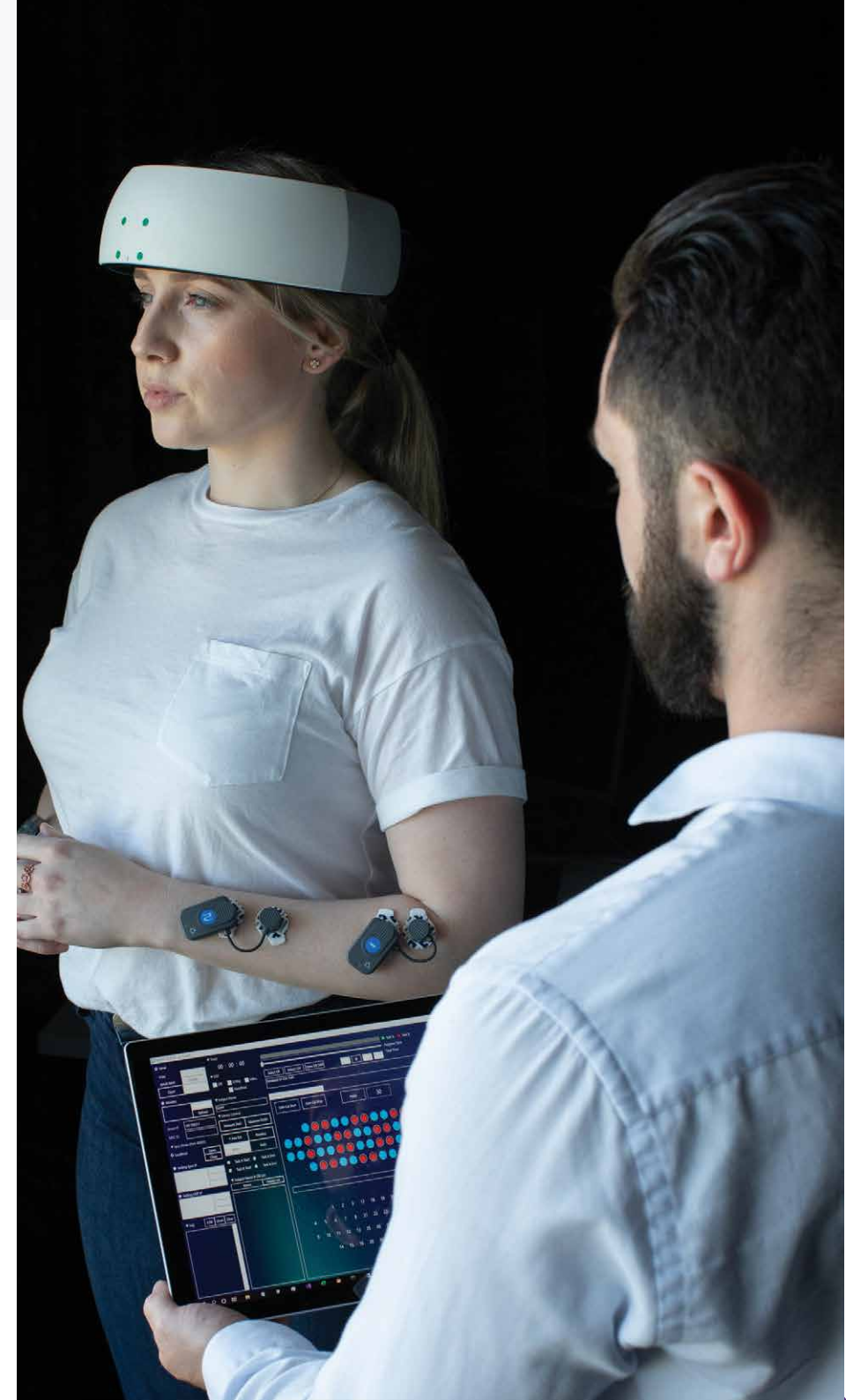- Reinforcement learning

## KEY INFRASTRUCTURE

- Industry Co-Innovation and Design Thinking Lab
- Makerspace
- Robotics and IoT Lab
- HPC

- AR/VR Lab
- Deakin Microgrid
- Cyber Defence Centre (Under Construction)

## TECHNOLOGY TRANSFERS

- Navy workforce scheduling, planning, and resource allocation using simulation, optimisation, and data analytics
- Agile force design in complex war-fighting using multi-objective optimisation
- Distributed Situation/Context-aware-as-a-Service Platform

- Multi-objective reinforcement learning for adversarial learning
- Cooperative Swarm Behaviour Generation for multi-platform and target surveillance
- Distributed Large-scale Combat Simulations
- Robust framework for practical data analytics
- Deakin ML-powered Microgrid Digital Twin

## KEY PILLARS

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| Medical/Pharma Technologies | ▨ | Trusted Autonomous Systems | ▨ |

![DMTC logo]

**PRIMARY CONTACT**

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Head Government Relations

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**dmtc.com.au**

→

Melbourne-based company ZiP Diagnostics is working alongside DSTG, Axxin and DMTC to progress a prototype Point-Of-Care testing device to detect leading mosquito-borne diseases.

This aligns with HSSA's mission to develop diagnostics, therapeutics and vaccines to protect military and civilian personnel against chemical, biological and radiological (CBR) threats, emerging infectious diseases and pandemics.

# DMTC – Accelerating technology development and innovation

DMTC is a not-for-profit company that designs, manages and leads multi-party R&D initiatives that deliver enhanced defence and national security capabilities, and strengthen Australia's industrial capacity.

Headquartered in Melbourne, our programs are delivered by a multidisciplinary team comprised of experienced professionals. This allows DMTC to bring an integrated perspective on national innovation, science and technology ecosystems, in addition to specific domain and technical knowledge.

Critically, DMTC's work emphasises technology adoption and scalability, not just research for research's sake. Across a broad portfolio, DMTC-managed innovations are advancing Australia's manufacturing, research and development capability, leading to improved outcomes for the defence and national security sectors.

One example is the work of DMTC and partners, including Thales Australia and researchers from RMIT and the University of Queensland, to pursue research breakthroughs in composite material selection, lightweighting and thermal management for small arms systems.

This collaboration is an important contribution to ensuring that Defence is able to provide leading-edge equipment for its personnel, and is also contributing significantly to both workforce and sovereign industrial capability development in Australia.

Established in 2021, DMTC's Health Security Systems Australia (HSSA) division is tackling health protection challenges, applicable to both military personnel and public health, across Australia's national health security landscape.

DMTC has cultivated an extensive network of innovation and technology development partners. Trust and engagement at both strategic and working levels delivers consistent results and ensures the ongoing relevance of applied research outcomes to the end-user.

# DMTC LIMITED

**dmtc.com.au**

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## CAPABILITIES

- Leading and managing industrially-focused innovation, science and technology collaborations
- Strategic investment to translate home-grown research into fielded capability, at scale.
- Building sovereign industrial capability aligned to defence, national security and health security priorities.
- Sector intelligence: A systematic approach to capability mapping and industry and research sector engagement.

- Encouraging the rapid adoption of new technologies for industrial and supply chain uplift.
- DMTC has stewardship of over 600 intellectual properties, managing them beneficially on behalf of the Commonwealth.
- Nationwide collaboration with industry and research partners in, or looking to enter, defence markets.
- STEM workforce development, supporting more than 100 PhD, Master's and Undergraduate students since 2009.

## KEY INFRASTRUCTURE

- Access to nationwide infrastructure, research facilities and industrial sites through industry and research partners
- Fabrication, test and evaluation facilities
- Laboratories and research trial sites

- Additive and subtractive manufacturing expertise, research projects and equipment
- Welding technologies, robotics, automation
- Access to Non-Destructive Testing capabilities

## TECHNOLOGY TRANSFERS

- Strong focus on rapid adoption of new technologies for industrial uplift and for further areas of research
- Successfully transferred over 400 discrete technologies to industry since 2008
- Digital, welding and machining technologies successfully transferred to small businesses
- Enhanced shipbuilding steels and associated technologies

- High temperature and exotic materials for use in extreme environments
- Ceramics, hard and soft body armour manufacturing techniques and applications
- Power and energy technologies, including fuel cell and dismounted power generation technologies
- New technologies to advance Australian industrial capability in vaccines, therapeutics and diagnostics

## KEY PILLARS

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A DMTC-led project to advance the development of breathable fabrics for combat uniforms that protect the wearer from chemical or biological threat agents. The textile developed in this project provides excellent air permeability while maintaining a high level of protection against aerosol particles. A critical milestone was achieved in early 2023 with the successful production of 90 metres of the fabric by Bruck Textiles.

# FedUni Transforms
# Knowledge To Reality

**PRIMARY CONTACT**

**Professor Remco Polman**
Pro Vice Chancellor Research
and Executive Dean
— Institute of Health and Wellbeing

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**federation.edu.au**

Federation University Australia has unique capabilities that can be applied in defence and maritime technology development.

Sensor technologies, sensor information processing, remote condition monitoring, wireless networks, as well as acceleration and protection of human performance are areas of strength at Federation University Australia. We also undertake work in intelligent image and video analysis to extract knowledge from real time scenes remotely. This real time scene analysis underpins remote operation of drones and robots to undertake complex tasks and enable end-users with enhanced capabilities to take 'actionable decisions' for safe, resilient, and efficient operation. Our researchers, partnering with local industries, have developed surveillance robots called GUS (Ground Unmanned System), which has received particular interest from Australian Army and the concept won the Pitchfest competition at Land Forces 2022 Defence Exposition.

Our cybersecurity team conducts cutting-edge research for malware and intrusion detection, and vulnerability analysis to keep Australian businesses safe from cyber-attacks.  Another essential part of our capabilities is in regard to new energy and new energy transition areas related to maritime bases, ships, and/or submarines. In these areas, our strength is mainly on energy system planning, operation optimization, dynamics monitoring and control.

Commerce Security Laboratory works at the cutting-edge of vulnerability modelling of physical system (IoT) and cyber-attack analysis to promote confidence in the operational security of interconnected systems.

Federation University Australia is committed to working with industry and government in finding real solutions to developing and future needs.

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Meet GUS – a robot to help in the fight against poaching.

# CENTRE FOR SMART ANALYTICS (CSA)

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**federation.edu.au**

**Professor Joarder Kamruzzaman**
Centre Director
— CSA

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## CAPABILITIES

- Smart sensor technologies and analytics for sustainable future
- Big data analytics and machine learning
- Multimedia signal processing and coding
- Intelligent Robotic Systems
- Malware and reverse engineering
- Automated cyber operations

- Applied blockchain and digital traceability
- Critical infrastructure security
- IoT data trust, privacy and security
- Real time asset monitoring and decision making
- Applied optimisation and climate modelling

## KEY INFRASTRUCTURE

- Internet Commerce Security Laboratory (ICSL)
- Federation - IBM IoT Watson Centre
- IoT Lab – sensor system development & integration

- Mechatronics Lab - sensors, robots and data acquisition software
- Centre for eResearch and Digital Innovation (CeRDI)

## TECHNOLOGY TRANSFERS

- Malware detection technologies for banking sector
- Optimisation tool for water utilities
- Multimedia tools for remote PG training

- Structural health monitoring tool for VicRoads bridges
- Trailer loading catalogue for design improvement

## KEY PILLARS

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|---|---|---|---|---|
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# INTERNET COMMERCE SECURITY LABORATORY (ICSL)

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**federation.edu.au/icsl**

**A/Prof. Paul Pang**
Acting Director
— ICSL

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## CAPABILITIES

- Darknet and livenet cyber threats monitoring
- Advanced analytics for malware attack identification
- Cyber space data integration and visualisation
- Cyber resilience of systems and services
- Blockchain as a platform for data governance, exchange, and traceability

- Online and offline disaster recovery technology
- Lightweight device security edge computing
- AI production cyber maturity audit and standardisation

## KEY INFRASTRUCTURE

- Secure cyber security lab for the development of cyber security solutions
- Actionable open-source threat intelligence

- High performance computing server
- Hyperledger blockchain platform testbed

## TECHNOLOGY TRANSFERS

- Malware attack detection and prevention at the process injection level for a major bank
- Optimal clustering for phishing attack characterisation for a major bank
- Phisher attack behavior analysis for preventive measures and harm minimisation
- Virtual machine replication and synchronisation for low latency and high availability services

- 3D visualisation cloud monitoring system
- Blockchain digital traceability for production quality assurance
- Blockchain-based agricultural product traceability for the agriculture sector
- Vulnerability and patch analysis for DSTG

## KEY PILLARS

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# CENTRE FOR NEW ENERGY TRANSITION RESEARCH (CFNETR)

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**federation.edu.au/research/
research-centres/cfnetr**

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Centre Director
— CfNETR

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## CAPABILITIES

- Alternative fuels and renewable energy
- Low carbon technology
- Remote power system
- Hybrid/AC/DC microgrids
- Forecast processes of Energy Systems
- Water and energy nexus for low carbon society
- Resilient energy system design for remote maritime bases (on remote islands and offshore)
- Propulsion energy optimization using variable speed diesel and battery for maximum thrust and fuel efficiency
- Condition monitoring of energy systems

- Energy storage planning, operation, and control
- Modeling, simulation, optimization, and control of energy systems
- Planning of resilient energy systems
- Fault diagnosis and failure analysis of energy systems
- Optimal planning of renewable energy integration into power systems
- Demand management and demand response
- Fault diagnosis and failure analysis of shipboard microgrid
- Data-driven operation and control of Shipboard microgrid
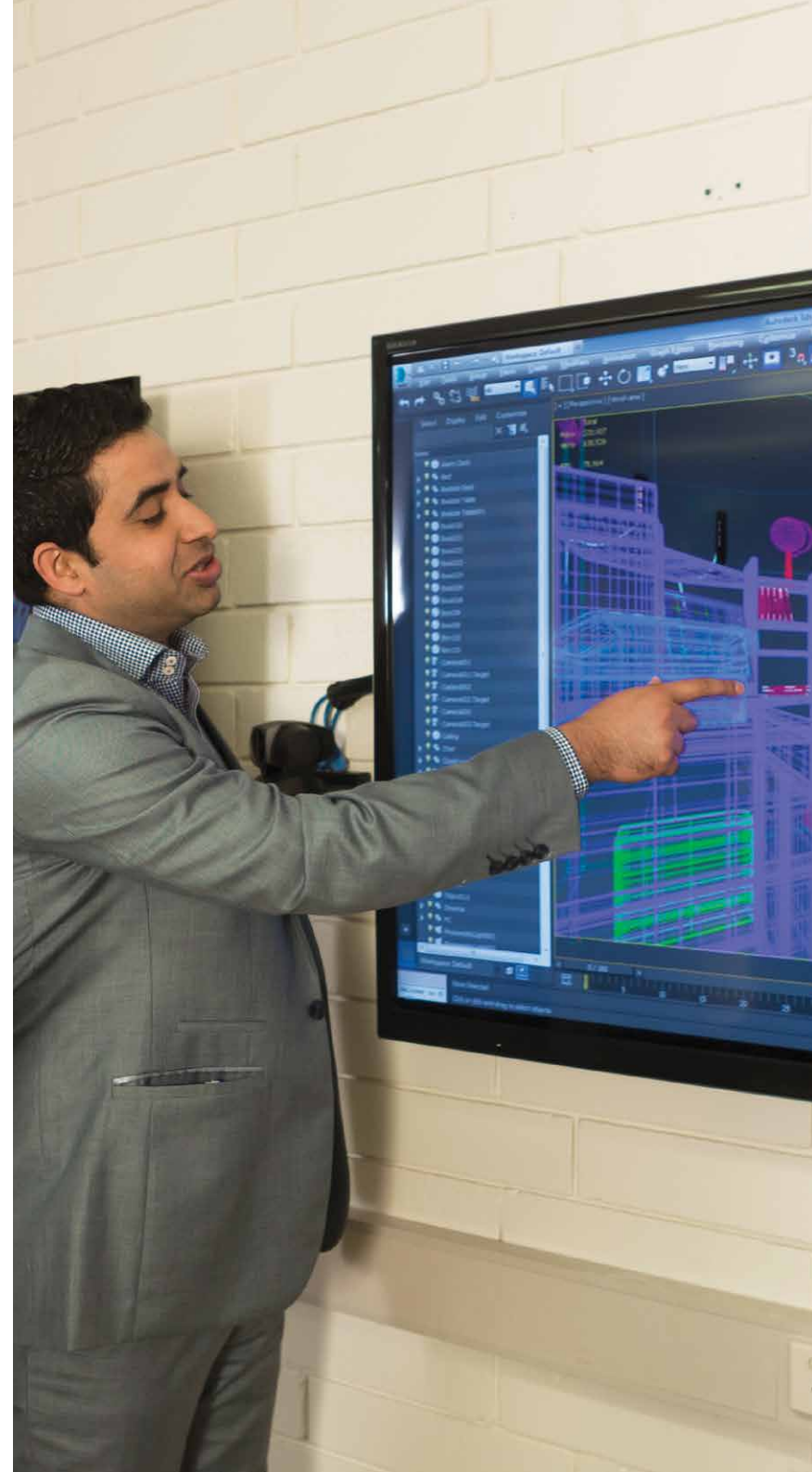
## KEY INFRASTRUCTURE

- Federation - IBM IoT Watson Centre
- Power Engineering Lab
- IoT Lab – sensor system development & integration
- Power System Simulation Lab

- Centre for eResearch and Digital Innovation (CeRDI)
- Mechatronics Lab - sensors, robots and data acquisition software
- Electric Vehicle Lab (emerging)

## TECHNOLOGY TRANSFERS

- Data mining and analysis in energy system
- Smart energy management
- Condition monitoring of transformer and energy systems

- Application of artificial intelligent methodologies for energy system planning, operation optimization, and control

## KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | ▨ |
| Big Data Processing & Visualisation | ▨ | Multi-Disciplinary Material Sciences | |
| Cyber & IT Security | | Propulsion & Energy Storage | ▨ |
| Enhanced Human Performance & Protection | | Quantum Technologies | |
| Hypersonics & Directed Energy Capabilities | ▨ | Space Systems | |
| Integrated Intelligence, Surveillance & Reconnaissance | ▨ | Sustainment | ▨ |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | ▨ |

**LA TROBE UNIVERSITY**

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**PRIMARY CONTACT**

**Mr Quin Chang**
Director
— Enterprise Development

✉ defence@latrobe.edu.au

**latrobe.edu.au**

# A Universe Of Possibilities At La Trobe

La Trobe University is making giant leaps with its research and development work in defence and aerospace. In a recent collaboration with the German Aerospace Centre, La Trobe has seen their DESIS high-resolution camera launched into space on one of Elon Musk's Space X rockets.

Attached to the International Space Station, the camera will monitor bushfires, floods, ash clouds, storms and rainfall across the globe. The DESIS camera is a huge win for La Trobe but it's simply the most high-profile in a range of exciting projects happening at the University.

La Trobe's work in advanced sensors, signal processing and big data have applications in everything from driverless transport to healthcare. Imagine an automated fleet of trucks moving produce from farm to market at the moment of harvest. The farmer, who is diabetic, has a sensor in her arm that updates her health data in real time. This lets her doctor know important information without the need for invasive techniques.

Two hundred kilometres away, a fleet of drones developed with La Trobe, fight a bushfire. Protected by a fireproof coating, the drones work as a team, using modelling, simulation and analysis techniques to predict where the blaze will go next. On the ground, an experienced firefighter helps them stay on task. Up above, DESIS provides essential intelligence to the operation.

$\longrightarrow$

Time-of-flight secondary ion mass spectrometer
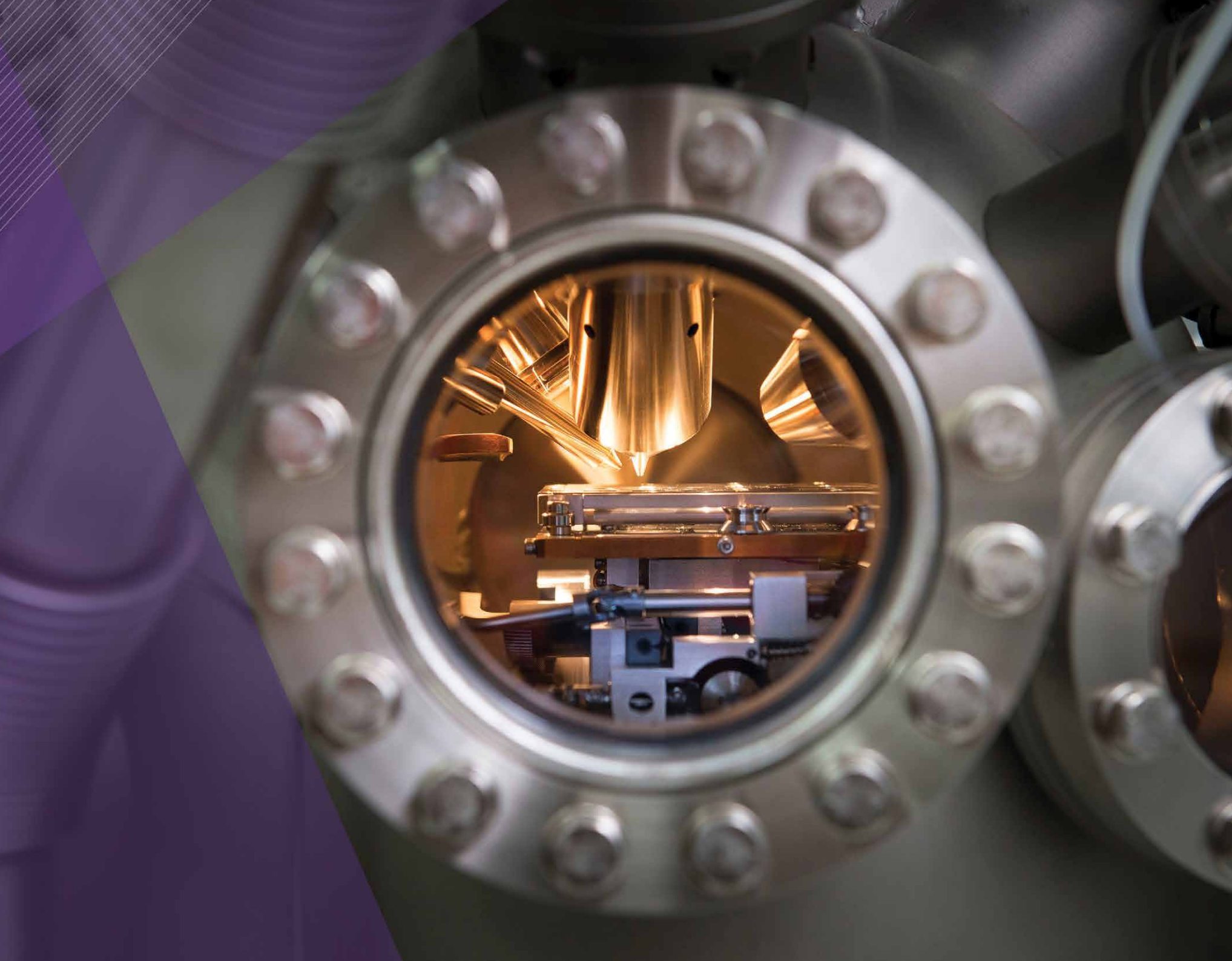
# LA TROBE UNIVERSITY

latrobe.edu.au

**Professor Ashley Franks**
Pro Vice-Chancellor
— Research Capability

- La Trobe University, Bundoora VIC 3083
- +61 3 9479 2206
- a.franks@latrobe.edu.au

## CAPABILITIES

- Enhanced Human Performance
- Space Qualified Engineering TRL 4 -> TRL9
- Medical Countermeasure Products
- Multidisciplinary materials sciences
- Advanced Sensors
- Intelligence, Surveillance, Reconnaissance, Electronic Warfare, Space and Cyber
- Operating in CBRN Environments
- Emotionally engaging social technologies for 'person-centered' care and well-being

## KEY INFRASTRUCTURE

- Cisco Centre for AI and IoT
- Cyber Security Research Hub
- Centre for Data Analytics and Cognition
- Centre for Technology Infusion
- Regional Advanced Manufacturing Hub 4.0
- Biomedical & Environmental Sensor Technology Centre
- La Trobe University Sport & Exercise Medicine Research Centre
- Institute for Human Security and Social Change

## KEY PILLARS

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# APPLIED AND ENVIRONMENTAL MICROBIOLOGY LAB (AEM)

scholars.latrobe.edu.au/j5wood
scholars.latrobe.edu.au/afranks

**Professor Ashley Franks and Dr Jen Wood**
Laboratory Heads
— AEM

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- +61 3 9479 2206
- a.franks@latrobe.edu.au, Jen.Wood@latrobe.edu.au

## CAPABILITIES

- Bioengineering - developing novel probiotic strains to improve the gastrointestinal and mental performance
- Antimicrobials – development and testing of novel antimicrobial compounds and materials
- Gut-brain axis - mechanisms of how the gastrointestinal microbiota influences the mind
- Microbial Community Analysis – genetic and functional prediction
- Application of Ecological theory for functional outcomes – use of trait based analysis

## KEY INFRASTRUCTURE

- Comprehensive Bioinformatics Platform - suite of synergistic capabilities for the analysis of extensive data
- State of the Art PC2 Lab - microbiological technology eg an anaerobic chamber, Illumina Miseq machine

## TECHNOLOGY TRANSFERS

- Discovery of novel probiotic strains
- Testing novel antimicrobial compounds and medications
- Identification of how the gastrointestinal microbiota influences the mind
- Bioremediation
- Corrosion

## KEY PILLARS

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# BIOMEDICAL & ENVIRONMENTAL SENSOR TECHNOLOGY (BEST) CENTRE

**latrobe.edu.au/research/centres/disease/best**

**Professor Conor Hogan**
Centre Director

La Trobe University, VIC 3086

+61 3 9479 3747

best@latrobe.edu.au

## CAPABILITIES

- Development of Novel Sensing technologies for medical diagnostics, food testing and environmental analysis
- Design and synthesis of new molecules and materials for sensing applications
- Electrochemical and/or spectroscopic characterisation of sensing molecules

## KEY INFRASTRUCTURE

- State-of-the-art electrochemical characterisation instrumentation
- Unique luminescence spectroscopy facility: UV to NIR, lifetimes, quantum yields and spectro-electrochemistry.
- Full suite of molecular characterisation instrumentation including NMR, MS and X-ray crystallography
- Sensor prototyping facility including Materials ink jet printer, laser cutter and 3D printers

## TECHNOLOGY TRANSFERS

- ElecTrobe: Fast, accurate, portable SO2 sensor for the wine industry (licenced).
- nanoMslide: Revolutionary cancer sensing platform (start-up)

## KEY PILLARS

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Environmental Mining for Microbial Community Engineering: Identifying New Biological and Genetic Resources for Community-Level Applications

## CISCO-LA TROBE CENTRE FOR AI AND INTERNET OF THINGS

latrobe.edu.au/aiot

**Professor Wei Xiang**
Director
— Cisco-La Trobe Centre for AI and IoT

La Trobe University, Bundoora VIC 3083
+61 458685500
w.xiang@latrobe.edu.au

### CAPABILITIES

- Machine learning for 5G/6G wireless communications
- Integrated satellite-terrestrial communications and networks
- AI for image processing and computer vision
- Explainable AI for responsible decision-making
- Low-power and wide-area IoT communications
- AIoT for water quality monitoring and management
- AIoT for bushfire early warning and detection
- Edge AI / edge computing systems

### KEY INFRASTRUCTURE

- Cisco industrial route
- Cisco Meraki cameras
- Cisco LoRaWAN gateways
- Cisco industrial sensors
- Cisco networking equipment

### TECHNOLOGY TRANSFERS

- Intelligent transport - crowd movement modeling

### KEY PILLARS

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## CENTRE FOR DATA ANALYTICS AND COGNITION (CDAC)

latrobe.edu.au/cdac

**Professor Damminda Alahakoon**
Centre Director

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+61 3 9479 3109
CDAC@latrobe.edu.au

### CAPABILITIES

- Computer vision and video analysis, surveillance
- Developmental robotics and transfer learning
- Self structuring/self evolving AI, Deep machine learning and generative AI
- Human-centric AI with deep emotion representation with machine theory of mind
- Evolutionary computing, optimisation, swarm intelligence, simulation and gaming system development
- Intelligent Federated Search
- Natural language processing and large text corpus analysis
- Cognition-inspired intelligence & memory system design and development

### KEY INFRASTRUCTURE

- Research lab with GPU powered command center type visualisation system
- Customizable AI empowered advanced big data analytics technology platform with interactive dashboard based UI
- A suite of AI and machine learning innovations for big data handling based on self structuring AI

### TECHNOLOGY TRANSFERS

- La Trobe Energy Analytics Platform (LEAP) for energy consumption management across all buildings at La Trobe Uni
- Deep emotion modelling empowered AI Co facilitator to support therapists for Cancer Chat Canada
- Adversarial Co-evolutionary Gaming System for Dynamic Planning under Cyber Threats for DST
- A big data integration and management platform for Australasian Fire and Emergency Service Authorities Council
- Social media and text based federated search engine for Data 2 Decisions CRC

### KEY PILLARS

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## CENTRE FOR MATERIALS AND SURFACE SCIENCE (CMSS)

**latrobe.edu.au/surface**

**Professor Paul Pigram**
Centre Director

La Trobe University, Bundoora VIC 3083
+61 3 9479 2618
cmss@latrobe.edu.au

### CAPABILITIES

- Creating, controlling and understanding molecular structures at surfaces and interfaces
- Classifying materials and predicting behaviour in one, two and three dimensions supported by machine learning
- Understanding changes in and degradation of materials systems and coatings in service
- High spatial resolution microenvironment characterisation of tissue sections and biomaterials
- Identifying and investigating failures in materials systems
- Development and in service assessment of sensors and devices

### KEY INFRASTRUCTURE

- Comprehensive surface analysis capability including ToF-SIMS, XPS, scanning auger nanoprobe, SPM instrumentation
- Sample preparation and mounting systems allowing correlated analyses of samples across multiple techniques
- Materials fabrication and processing capability including electrodeposition, plasma treatment, and laser etching
- Surface wettability and surface energy measurement including captive bubble and drop shape analysis
- Comprehensive machine learning capacity including GPU acceleration for 3D hyperspectral datasets

### TECHNOLOGY TRANSFERS

- Product and coating failure analysis in polymers and packaging, glass, semiconductor and building products sectors
- Forensic investigation of "factory of origin" in the manufacturing sector
- Development of protective coatings for aerospace componentry
- High throughput testing and selection of antibody orienting surface treatments for bioassays

### KEY PILLARS

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## CENTRE FOR TECHNOLOGY INFUSION (CTI)

**latrobe.edu.au/technology-infusion**

**Professor Aniruddha Desai**
Director
— Centre for Technology Infusion

La Trobe University, Bundoora VIC 3083
+61 3 9479 1242
a.desai@latrobe.edu.au

### CAPABILITIES

- Full custom system-on-chip design across digital, analogue, RF and mixed-signal, incl 3rd party IP integration
- Ultra-low-power hardware and firmware development, including energy characterisation and battery optimisation
- Custom RF transceiver design and test including frontend, modulation schemes and baseband, and protocol stack
- Design for test, manufacturing and certification from SOC to PCB hardware including pre-compliance testing
- Precision manufacturing, surface and dopant engineering in diamond for quantum computing and sensing applications
- System integration across sensing, processing, data manipulation, storage, decision support, and communication
- Complex multi-domain modelling and simulation, including custom simulator development on HPC platforms
- Big data management and processing including decision support systems and visualization

### KEY INFRASTRUCTURE

- Dedicated HPC cluster with compartmentalised access
- In-house RF design - test facilities up to 20GHz mixed-signal (incl full time domain capability)
- Synchrotron based toroidal analyser - angle resolved photoemission for materials & electronic characterisation
- Ultra-high vacuum Scanning Tunnelling Microscopy for atom-scale surface imaging and engineering
- End-to-end full-custom semiconductor chip & FPGA design suites - Synopsys, Altium, Mentor Graphics
- High speed FGPA prototyping and verification platforms - Actel, Xilinx etc
- Ultra-low-power design/test facility - precision power analysers, battery characterisation, simulation
- Access to range of custom IPs across memory, computing and verification from Synopsys, ARM etc.

### TECHNOLOGY TRANSFERS

- Intelligent Transport System for Transport Safety and Efficiency
- Smart Energy and Grid Systems
- Ultra low power IoT microchip for supply chain monitoring and traceability
- Wearable & fixed sensor solutions for Agriculture
- Smart City management solution for local government using IoT - sensors, data analytics & visualisation
- Digital vehicle identification solution to prevent the theft and misuse of number plates

### KEY PILLARS

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# CYBERSECURITY INNOVATION NODE

**latrobe.edu.au/research/centres/health/cyber-security**

**Professor Naveen Chilamkurti**
Director
— La Trobe Cybersecurity Research Hub

⊙ La Trobe University, Bundoora VIC 3083
▯ +61 94791269
✉ n.chilamkurti@latrobe.edu.au

## CAPABILITIES

- Cyber-enabled war
- Privacy and security
- Secure communications
- Blockchain
- Federated Learning
- Anomaly Detection in Cyber
- Ethics in Cyberspace
- Secure IoT

## KEY INFRASTRUCTURE

- Cyber forensic software
- CISCO routers
- Raspberry Pi sensors

## TECHNOLOGY TRANSFERS

- Secure Cloud computing
- Anomaly Detection in IoT
- Blockchain based trusted communication

## KEY PILLARS

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| Medical/Pharma Technologies | | Trusted Autonomous Systems | ▨ |

# DEPARTMENT OF ENGINEERING

**latrobe.edu.au/engineering**

**Professor James L. Maxwell**
Professor
— Manufacturing Engineering

⊙ La Trobe University, Flora Hill, VIC
▯ +61 4 7814 6110
✉ j.maxwell@latrobe.edu.au

## CAPABILITIES

- Space-based systems, satellites, high altitude balloon (HAB) payloads, and systems for demanding environments
- Multi-Spectral Remote sensing, Radar, & communications, including satellite, HAB, UAV, and ground systems
- High performance digital electronics design, including FPGA and embedded systems; robotics & automation
- Advanced digital image/signal processing and compression
- Advanced functional polymer composites - design, synthesis and characterisation
- NextGen 3D printing of materials for extreme environments incl adv functional alloys, ceramics & composites
- Chemical, biological, and nuclear sensing expertise, including distributed & Networked sensors & MEMS
- Remote power systems, including power harvesting & long-duration sensor networks

## KEY INFRASTRUCTURE

- Radar and satellite remote sensing laboratory
- Advanced polymer and composites laboratories
- Extreme engineered metals, ceramics and composites laboratory (EϵMC2)
- Robotics, automation, mechatronics, prototyping and sensing laboratory
- Embedded signal processing laboratory
- Modern machining and fabrication laboratory
- Advanced Manufacturing Hub
- Centre for Technology Infusion

## TECHNOLOGY TRANSFERS

- Tiger Radar (Buckland Park, British Antarctic Survey, SANSA)
- Autonomous vehicle technology
- Space qualified instrumentation for space missions
- Advanced functional composite materials
- Cochlear signal processing
- Precision FPGA, hardware and software for space platforms
- Robotic systems for condition assessment
- Novel nano/micro-architectured materials & metamaterials

## KEY PILLARS

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# INSTITUTE FOR AGRICULTURE AND FOOD

**latrobe.edu.au/research/centres/liaf**

**Professor Tony Bacic**
Director
— La Trobe Institute for Agriculture and Food

⊙ La Trobe University, Bundoora VIC 3083

☐ +61 (03) 9032 7463

✉ liaf@latrobe.edu.au

## CAPABILITIES

- World-class capabilities for imaging from cells to molecules to field
- State-of-the-art genomics, metabolomics, proteomics and transciptomics
- Integration and analysis of complex imaging, -omics, other data-sets
- Gene discovery and functional genomics
- Structure, function and biosynthesis of complex carbohydrates in biological systems
- Improving the nutritional profile of pulses and grains.
- Impacts of biotic/abiotic stress on plants
- Biosensors

## KEY INFRASTRUCTURE

- Single cell Sequencing (Laser capture microdissection; 10x Genomics single cell anal. Transformation/gene editing
- Bioinformatics and high-performance computing, integration of complex data
- Transcriptomics (Small RNA; DNA Methylation sequencing; Protein-DNA interactions (ChIP-seq, DAP-seq); Genome seq
- -Omics (Genomics/(Phospho)Proteomics/Metabolomics/Glycomics) and related bioinformatics/data integration
- Database development, data integration, BigData and IoT
- Imaging platforms (including fluorescence/TEM/SEM)
- Plant Phenomics - 2D, 3D, cloud-based analytics/hyperspectral imaging from lab to field
- Controlled environment growth facilities (PC2/QC2) for plant and pest research

## TECHNOLOGY TRANSFERS

- Molecular diagnostics and management strategies for weeds, plant, animal pests and diseases
- Physiology and genetics related to plant and animal bioactives and health
- Molecular breeding for disease resistance, drought tolerance, bioenergy and health
- Stand-off detection technologies for plant imaging relevant to chem/bio detection
- Improving the nutritional quality of food, including alternative proteins.
- Australia's Hub for Medicinal Agriculture
- Evaluation of efficacy of plant-based therapies

## KEY PILLARS

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La Trobe Institute for Molecular Science (LIMS)
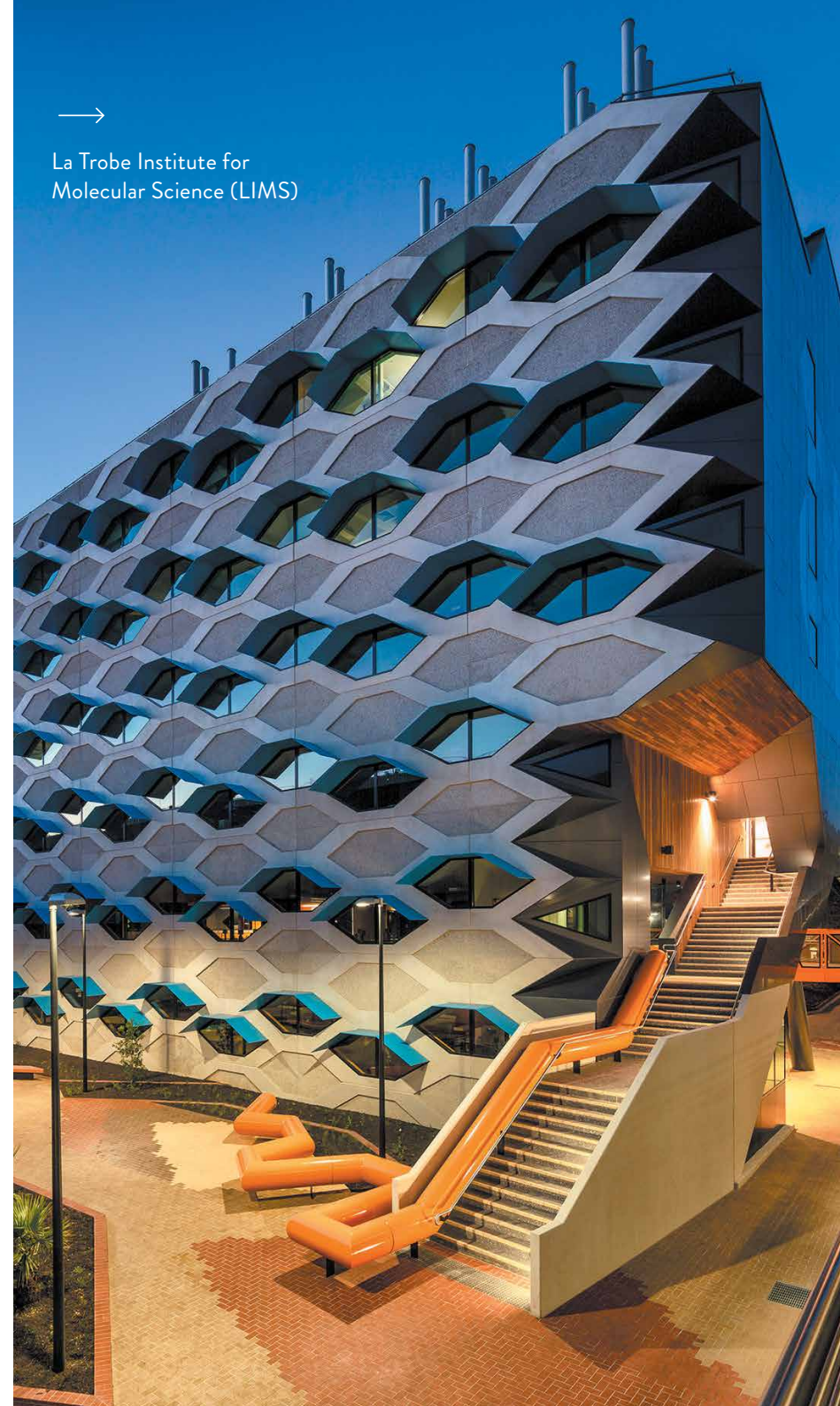
# SPORT & EXERCISE MEDICINE RESEARCH CENTRE (LASEM)

**latrobe.edu.au/sport-and-exercise-medicine**

**Professor Kay Crossley**
Director
— LASEM

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k.crossley@latrobe.edu.au

## CAPABILITIES

- Prevention and management of sports and exercise-related injury
- Development and evaluation of exercise and rehabilitation in health and disease
- Large grouping of clinical disciplines focused on the management and prevention of injury
- Close working collaborations with elite sports and industry
- Comprehensive evaluation of human performance, in laboratory and field settings
- Strong focus on translation and partner driven research

## KEY INFRASTRUCTURE

- State-of-the-art Human Performance Laboratories - for biomechanics, physiology, cognition, performance analysis
- Vicon 3D motion analysis systems and GAITRite walkway
- 3D foot scanner and plantar pressure analysis equipment - Matscan, Pedar and Emed
- Neurocom Balance Master, Biodex and Humac Dynamometers
- Video and sensor performance tracking systems. laboratory, gymnasium and field enabled
- Neuroplasticity Research Laboratory (NRL) - non-invasive methods of measuring neuroplasticity
- Portable force plates

## TECHNOLOGY TRANSFERS

- Reduced injury incidence by 30% in Australian navy recruits with prefabricated foot orthoses
- Developed commercial footwear to prevent falls in older adults
- Developed and tested an effective falls prevention program for older adults
- Developed and tested effective treatments for common foot, knee, hip and shoulder injuries
- Co-designed, with industry, bespoke injury prevention for football and implementation strategy

## KEY PILLARS

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# DEPARTMENT OF SPORT, EXERCISE AND NUTRITION SCIENCES

**latrobe.edu.au/department-of-sport-exercise-and-nutrition-sciences**

**Professor Kate Webster**
Head of Department

La Trobe University, Bundoora VIC 3083
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## CAPABILITIES

- Apply data science and machine learning techniques to extract and visualise information from big data sets
- Assess and optimise nutrition knowledge, intake, body composition, and nutritional adequacy of menus/rations
- Assess the impact of, and recovery from, physically- and cognitively demanding tasks in complex dynamic scenarios
- Cognitive testing (working memory, vigilance, executive function, performance under mental fatigue/stress)
- Design, monitor, and evaluate strength training programs to quantify and augment relevant strength capacities
- Field-based monitoring and analyses of individual and team movement patterns, formations, and strategies
- Sleep and recovery monitoring and intervention strategies
- Use biotechnologies and biomarkers to monitor, quantify, and assess warfighter responses to external stimuli

## KEY INFRASTRUCTURE

- Biomechanics: 3D motion capture, isokinetic dynamometer, EMG
- Cognition and training: : Eye-tracking and ocular-motor function systems, Virtual Reality (VR) systems
- Food, Nutrition, and Dietetics: Dual energy x-ray absorptiometry (DXA)
- Metabolic Kitchen: 3D food printer and food innovation facilities
- Physiology: Metabolic carts, heart rate monitors, climate chamber (heat & hypoxia), muscle oxygen sensors
- Portable: IMUs, GNSS and LPS, metabolic units, force plates, timing gates, linear position transducers, IMTP rig
- Sleep & Recovery: Polysomnography sleep monitoring, actigraphy monitors
- Strength: Instrumented lifting platforms with force platforms, kinetic and kinematic feedback

## TECHNOLOGY TRANSFERS

- Assessed wearable and mobile technology to inform stakeholder procurement decisions
- Improved sleep, physical performance, and wellbeing in NZ Defence Force personnel
- Quantified task demands to inform workplace health and safety guidelines
- Use of live and virtual simulations to assess weapon-system designs and inform training design
- Supporting retention of Army personal using biological and non-biological screening tools
- Conduction of clinical trials to assess effectiveness of food/nutrition interventions to improve performance, health and retention of soldiers

## KEY PILLARS

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The La Trobe Institute for Agriculture and Food (LIAF) is a world-class research institute for seed production, food and health



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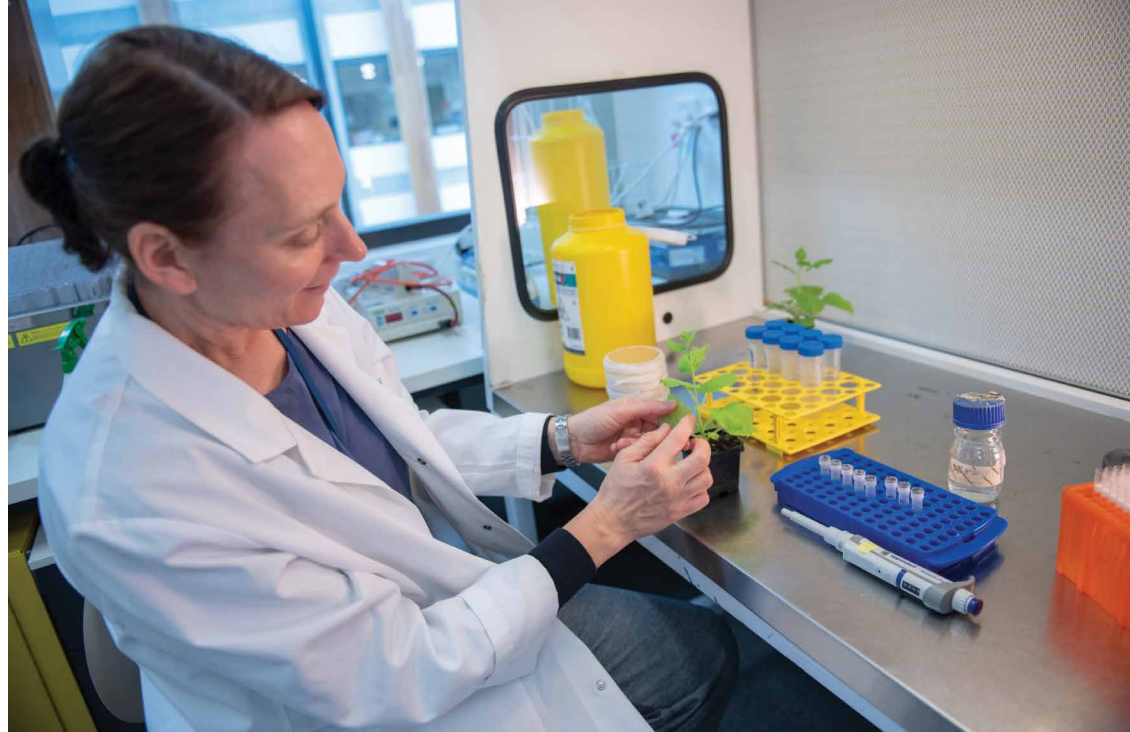
Controlled Environment Rooms for plant and pest research at The Biosciences Research Centre (AgriBio) , La Trobe University

# INSTITUTE FOR MOLECULAR SCIENCE (LIMS)

**latrobe.edu.au/lims**

**Professor Patrick Humbert**
Director
— LIMS

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✉ P.Humbert@latrobe.edu.au

## CAPABILITIES

- Nanoscience - molecular structure & function, identification and quantitation of chemical and biochemical species
- Infection and immunity - molecules used by infections and the immune response associated with this.
- Molecular design - using molecules to solve real world problems across a broad range of disciplines
- Cancer - mechanisms of cancer initiation and progression
- Federated Learning
- Anomaly Detection in Cyber
- Ethics in Cyberspace
- Secure IoT

## KEY INFRASTRUCTURE

- Comprehensive Proteomics Platform - suite of synergistic capabilities for the characterisation of proteins
- Centre for Materials & Surface Science - Australia's most comprehensive surface science and surface analysis
- LIMS Bioimaging facility - range of high performance confocal and conventional widefield microscopes
- Flow cytometry - analysis or physical collection of fluorescently labelled cells
- LIMS Histology Facility - suite of precision instruments for high quality specimen preparation and sectioning
- Comprehensive range of different types of qualitative and quantitative mass spectrometry

## TECHNOLOGY TRANSFERS

- Treating sepsis - identified mechanism of immune cell death & developed a treatment using a bile acid derivative
- Testing drug compounds that showed a reversal of Parkinson's Disease symptoms
- Discovery of a novel mechanism that forces cancer cells to self-destruct
- Identification of how African Swine Fever hijacks cells to establish infection
- Development of an ultra-thin film that enables the coding of light at the nanoscale
- Developed new imaging techniques to characterise the interaction of protein microcrystals and x-rays
- Developed a surface that improves antibody orientation and enhances the sensitivity of disease detection in blood

## KEY PILLARS

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Scanning Auger Nanoprobe
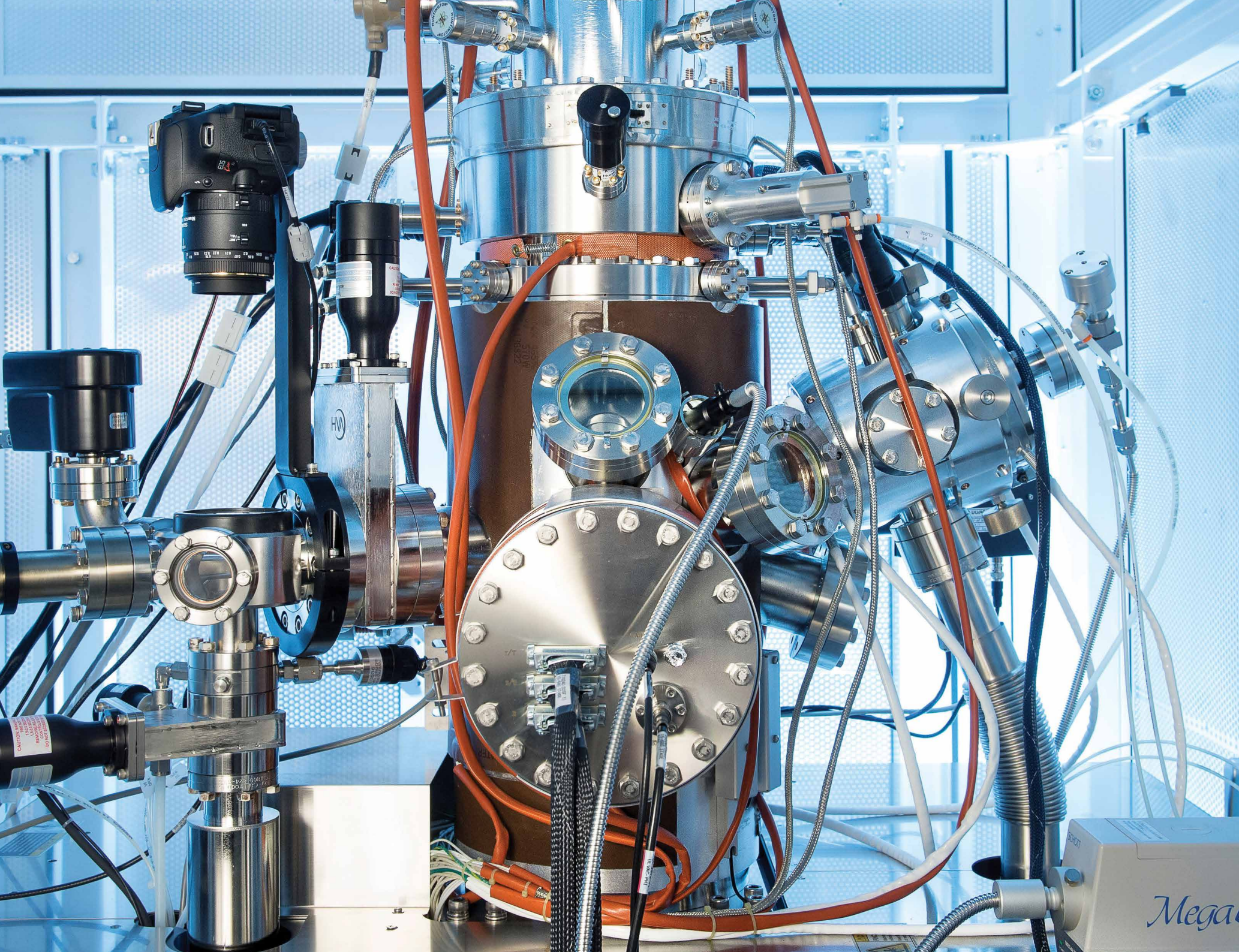
MONASH University

**PRIMARY CONTACT**

**Professor Doron Ben-Meir**
Deputy Vice-Chancellor
(Enterprise and Engagement) and
Senior Vice President

✉ DVC.Enterprise@monash.edu

**monash.edu**

# Research and education supporting global security and thriving communities

Monash University's capability in working with Defence is grounded in our Strategic Plan, Impact 2030, which commits Monash to a path that is driven by purpose. Through research, education and innovation, we weave industry and government into the fabric of our institution, to address the global challenges of our time: geopolitical security, climate change, and fostering thriving communities.

In 2022, we ranked as the top Group of Eight university for research income from industry and international sources, strengthening collaboration and capacity to deliver multifaceted solutions to Defence needs. With over 84,000 students, every undergraduate has the opportunity to undertake industry-based experiences. For existing, and new, workforces we offer a service menu of bespoke and scalable educational offerings.

Monash University has a strong track record in research commercialisation that has led to meaningful global impact. From breakthroughs in therapeutics for a range of diseases, to pioneering developments

in renewable energy, production of green ammonia and membrane technology for lithium extraction, our efforts remain dedicated to creating positive changes for the world.

Our geopolitical security expertise includes better governance structures and policy making, countering and preventing violent extremism, coercive and greyzone activities, countering disinformation and economic coercion, cognitive neuroscience and inter-cultural competence for tactical operations, cybersecurity and enhanced human performance.

Monash has a cutting-edge network of 25 open-access Research Platforms (ISO9001 certified) including Monash Centre for Additive Manufacturing, Monash Centre for Electron Microscopy, the Monash X-ray platform and the Melbourne Centre for Nanofabrication.

Fetch Robotics

# AI, CYBER AND INFORMATION SYSTEMS

**monash.edu/it/research**

**Professor Carsten Rudolph**
Deputy Dean, Faculty of Information Technology and Director for Research — Oceania Cyber Security Centre

⊙ Monash University, Clayton VIC 3800
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✉ Carsten.Rudolph@monash.edu

## CAPABILITIES

- Development of advanced cyber warfare, electronic warfare and influence operations capabilities
- Integration of cyber warfare, electronic warfare and influence operations into a single information warfare capability
- Application of AI and ML to deliver information warfare capabilities at speed and scale
- Development of new information warfare command-and-control concepts, algorithms and architectures

- Human Centred Computing, people are central as we refigure our societal, organisational and environmental relationships
- Mixed-reality human-machine teaming to support physically embedded workflows
- Designing AI systems to collaborate with human decision makers in high risk, time critical environments
- Design of exploratory AI systems for interactive sensemaking, value-based software

## KEY INFRASTRUCTURE

- Monash Data Futures Institute
- AiLECS Lab
- HumaniSE Lab
- Woodside Futures Lab

- Collective Behaviour Lab
- Centre for Learning Analytics (CoLAM)
- Monash Blockchain Technology Centre
- Monash Energy Institute

## TECHNOLOGY TRANSFERS

- RepuCoin: world-first security blockchain with good reputation
- MatRiCT: Family of Private Blockchain Payment Protocols
- Opturion: Intelligent Decision Support, dynamic optimisation and automation

- nOde: AI to control energy consumption
- Optimisation software – workforce planning, production, schedules, freight, timetabling operations

## KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | |
| Big Data Processing & Visualisation | | Multi-Disciplinary Material Sciences | |
| Cyber & IT Security | | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | | Quantum Technologies | |
| Hypersonics & Directed Energy Capabilities | | Space Systems | |
| Integrated Intelligence, Surveillance & Reconnaissance | | Sustainment | |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | |

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# AIR AND SPACE

**monash.edu/engineering**

**Professor Chris Davies**
Deputy Dean, Operations — Faculty of Engineering

⊙ Monash University, Clayton VIC 3800
▯ +61 3 9905 4929
✉ Chris.Davies@monash.edu

## CAPABILITIES

- Advanced fluid dynamics including water channel studies, particle imaging velocimetry
- Aero-acoustics, including ultra high speed schlieren imaging
- Computational fluid dynamics, including large eddy simulation and direct numerical simulation
- Alloy and composite design and manufacture, including additive manufacture, material protection and remediation

- Monash Nova Rover, students building the next generation of Mars and Lunar rover 2nd in Global Rover Challenge 2023
- Degrees and courses, including Bachelor of Aerospace Engineering (Honours) and programs in Aviation Medicine
- Indigenous internships at NASA's Jet Propulsion Lab

## KEY INFRASTRUCTURE

- Monash Wind Tunnel Platform (ISO 9001 certified)
- Monash Additive Manufacturing (ISO 9001 certified)
- Laboratory for Turbulence Research in Aerospace and Combustion

- Monash Centre for Electron Microscopy (ISO 9001 certified)
- Monash Makerspace and Smart Manufacturing Hub
- National Indigenous Space Agency

## TECHNOLOGY TRANSFERS

- Amaero International Limited (ASX:3DA): integrated metal 3D printing across aerospace, defense and tooling industries
- Kite Magnetics: creating powerful zero-emission electric motors (Drone technology)

- Material repair and degradation mitigation strategies for aerospace platforms
- Rapid component design and prototyping
- Aerodynamic computational modelling

## KEY PILLARS

| | | | |
|---|---|---|---|
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Artificial Intelligence
and Machine Learning
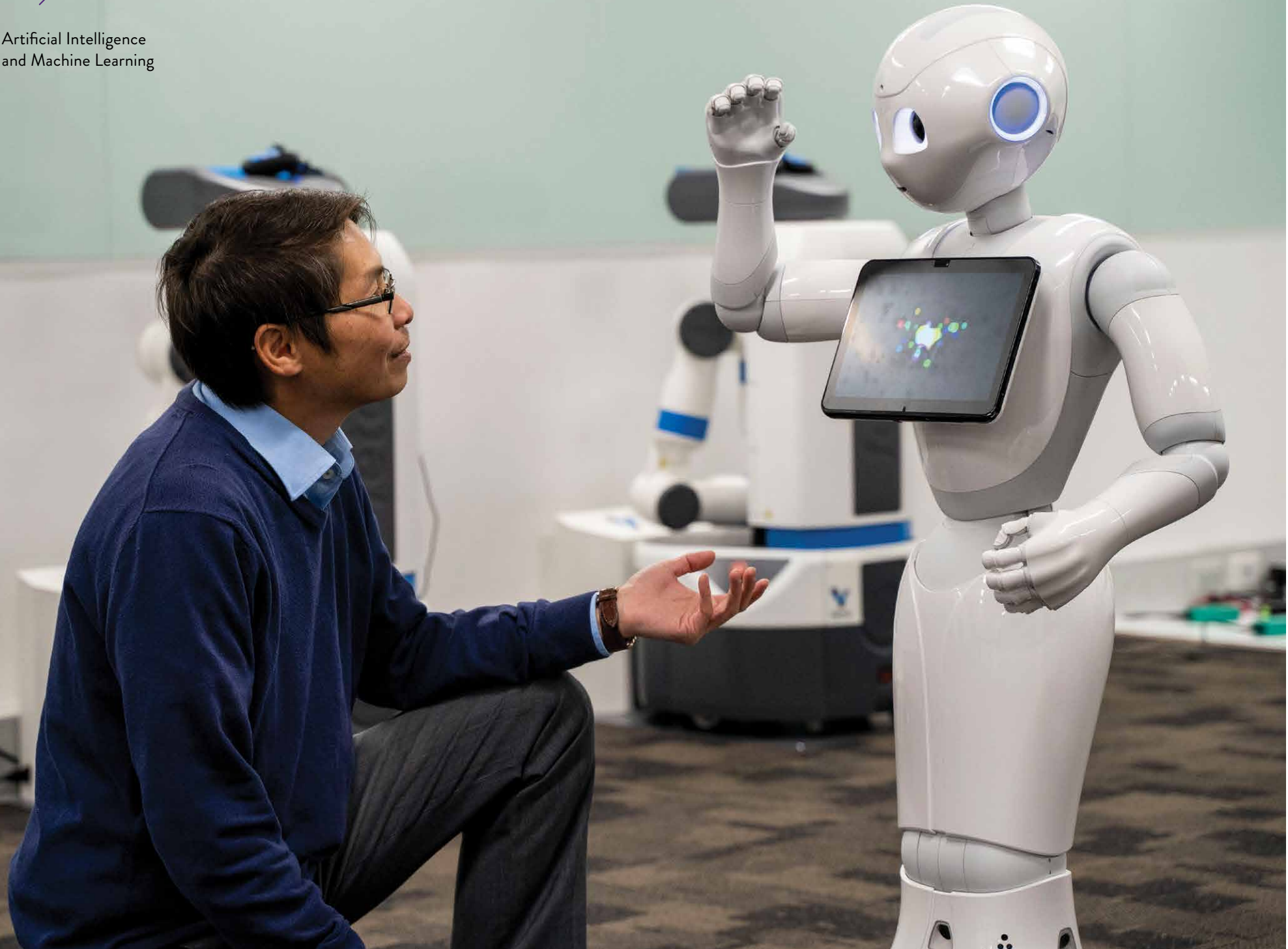
# CBRN DETECTION AND REMEDIATION

monash.edu/science/schools/
chemistry/research-and-enterprise

**Professor Kellie Tuck**
Professor
— School of Chemistry

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## CAPABILITIES

- Environmental contamination detection and sensing development
- Containment and decontamination innovation
- Countering the malicious use of highly toxic chemicals
- Deep geological safe disposal of spent nuclear fuel and low to intermediate nuclear waste

## KEY INFRASTRUCTURE

- Chemistry Analytical Facility: NMR/Mass Spectrometry, Infrared, UV, Raman and Atomic Spectroscopy/Thermal and Microanalysis/X-ray diffraction
- Green Chemical Futures: supports academic and industrial research within the chemicals sector in Australia

## TECHNOLOGY TRANSFERS

- Chemical Probes for chemicals of interest to defence
- Molecularly Imprinted Polymers
- NematiQ: Graphene Membrane Filtration Technology

## KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | ▨ |
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| Medical/Pharma Technologies | ▨ | Trusted Autonomous Systems | ▨ |

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# DRUG DELIVERY AND MEDICAL COUNTERMEASURES

monash.edu/mips

**Professor Chris Porter**
Professor and Director
— Monash Institute of Pharmaceutical Sciences (MIPS)

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## CAPABILITIES

- mRNA vaccine development; and medicinal chemistry
- Drug target identification & validation; discovery & development; formulation & delivery
- Anti-infective evaluation (pharmacokinetics, pharmacodynamics & dosage regimen optimisation)
- Novel pain management
- Medical devices: prosthetics, biosensors, bionic vision, mind-machine interface, anti-microbial materials
- Regenerative medicine: heart & muscle development, immunity, neural & stem cell regeneration
- Emergency & trauma medicine: paramedic training, resuscitation, disaster preparedness and management
- Medical devices & PPE: prosthetics, biosensors, bionic vision, mind-machine interface, anti-microbial materials

## KEY INFRASTRUCTURE

- Australian Drug Target Identification Platform (Proteomics, lipidomics and metabolomics)
- Australian Translational Medicinal Chemistry Facility and Fragment-based drug screening platform
- Centre for Drug Candidate Optimisation and Medicines Manufacturing Innovation Centre
- Monash Centre for Advanced mRNA Medicines Manufacturing and Workforce Training
- HMSTrust analytical laboratory (UHPLC, LCMS. GCMS, GC-FID, MALDI, DSC, TGA, XRD, FTIR, Raman)
- Imaging (confocal, multiphoton, lifetime imaging, CARS, super resolution, lightsheet)
- Cryo-EM, NMR, SPR and crystallography structural biology platform
- Murine disease model facility

## TECHNOLOGY TRANSFERS

- Glyph: lymph targeting prodrug platform licensed to PureTech Health, Phase 2 trials commenced in mid-2023
- QPX9003 - antibiotic for superbug infections developed by Monash in clinical trials with Qpex Biopharma
- Relenza – anti-influenza drug developed by Biota and Monash, marketed by Glaxo Smith Kline
- mRNA COVID vaccine - developed at MIPS and completed phase 1 clinical trials
- Cincera Therapeutics spin-out to develop therapies for metabolic syndrome & type-2 diabetes
- Phrenix Therapeutics spin-out to develop therapies for schizophrenia
- Synriam - anti-malaria drug developed by Medicines for Malaria Venture in a consortium with MIPS scientists
- Nanomedicines – partnership with Starpharma to develop DEP-dendrimer based nanomedicines. In clinical trials.

## KEY PILLARS

| | | | |
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## EDUCATION, TRAINING AND WORKFORCE DEVELOPMENT

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**monash.edu/study/monash-professional-development**

**Ms Leanne Strout**
Director: Enterprise Education
— Portfolio of the DVC & Vice President (Education)

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▢ +61 427 645 300
✉ Leanne.Strout@monash.edu

### CAPABILITIES

- Accredited and non-accredited short courses including online and intensive study options
- Micro-credentials which offer academic credit into Monash degree programs
- Bespoke capability building programs designed specifically for Defence and partners
- Program design, delivery and learning systems developed specifically for Defence
- Access to unparalleled networks and mentors across global and regional networks and partnerships
- Defence specific career development pathways and recognition of prior learning

### KEY INFRASTRUCTURE

- Cranlana Centre for Ethical Leadership
- Monash Centre for Advanced mRNA Medicines Manufacturing and Workforce Training
- William Cooper Institute - promoting Indigenous leadership and advancement
- Monash Business School - Leadership and Executive Education Centre
- Monash Talent - Creating tailored talent solutions for industry
- Monash Online - fully online accredited programs
- The Generator - Monash University's central startup hub

### TECHNOLOGY TRANSFERS

- Bespoke Ethical Leadership Programs - Defence (Cranlana)
- Gender, Peace and Security Graduate Certificate
- Mindfulness and wellbeing for team performance - Navy

### KEY PILLARS

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## ENGINEERING AND MATERIALS PERFORMANCE

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**monash.edu/engineering**

**Professor Chris Davies**
Deputy Dean, Operations
— Faculty of Engineering

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▢ +61 3 9905 4929
✉ Chris.Davies@monash.edu

### CAPABILITIES

- Advanced fluid dynamics - hydrodynamics, turbulence, experimental and CFD capabilities
- Engineering alloy design and characterisation - light alloys (Al, Ti, Mg), steels, composites
- Intelligent robotics - vision systems, haptics, human/machine interaction, decision augmentation, swarm robotics
- Energy storage - low emission, low energy technologies
- Sensor networks, wireless networks, photonics
- Biomedical engineering - implants, biomaterials, imaging
- Micro and nano scale mechanical devices
- Materials for personnel and vehicle protection

### KEY INFRASTRUCTURE

- Laboratory for Turbulence Research in Aerospace and Combustion - PIV, including holographic PIV
- Monash Wind Tunnel - ISO9001 certified, vehicle aerodynamics at full and reduced scale
- New Horizons Research Centre - including materials characterisation labs, polymer and metal additive manufacturing
- Monash Centre for Electron Microscopy - SEM and TEM instrumentation
- Monash X-Ray Platform - x-ray characterisation of engineering materials
- Monash Energy Materials and Systems Institute (MEMSI) - new energy technologies
- Monash Institute of Medical Engineering - translational medtech
- Woodside Innovation Centre

### KEY INFRASTRUCTURE

- Enygy: Smaller, Lighter, Faster, and Longer-Life Ultracapacitors
- Vehicle aerodynamic testing and optimisation
- Hydrodynamic modelling for optimisation of defence platforms
- Material repair strategies for defence platforms
- Rapid component design and prototyping
- Energy storage devices for spin-off companies

### KEY PILLARS

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# GEOPOLITICAL SECURITY

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**monash.edu/arts/global-peace-security**

**Professor Kerry O'Brien**
Associate Dean Research
— Faculty of Arts

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## CAPABILITIES

- Coercive/Grey Zone Activities: future threats/innovative countering approaches, security studies, civilians in conflict
- Politics and governance of small island developing states in the Pacific region
- Gender-sensitive approaches to countering/preventing violent extremism and enhancing role of Military Gender Advisors
- Countering disinformation campaigns, economic coercion, election interference
- Social Media and cyber security- emerging and disruptive technologies
- Better governance structures and policy making for team performance and decision superiority
- Neuroscience, critical thinking and inter-cultural competence for tactical, operational and strategic decision-making
- Military-media relations, military ethics, robotic weapons and robotic ethics

## KEY INFRASTRUCTURE

- Monash Gender, Peace and Security Centre
- Better Governance and Policy, multi-disciplinary research supporting local and global government, and policy development
- Centre for Consciousness and Contemplative Studies
- Monash Intercultural Lab
- Monash Media Lab
- SoDA Labs- Internet and data insights for social good from global observational and analysis platform

## TECHNOLOGY TRANSFERS

- Islamic Awareness Professional Development Program
- Inter-cultural Competency Professional Development Program
- KASPR Datahaus PTY LTD, provides several measures of internet activity and quality, at national and subnational level

## KEY PILLARS

| | | | |
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| Medical/Pharma Technologies | /// | Trusted Autonomous Systems | /// |

# HUMAN PERFORMANCE, PSYCHOLOGY AND HEALTH RESEARCH

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**monash.edu/medicine**

**Alison Greenway**
Senior Director Enterprise and Partnerships

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✉ alison.greenway@monash.edu

## CAPABILITIES

- Human cognitive performance, nutrition health and performance, including wearables and sensors
- Neurosciences: mental health and wellbeing, leadership and decision making capability
- Sleep and fatigue: effect on mood, memory and cognition, role in disorders such as depression and PTSD
- Traumatic brain injury: identification and therapies
- Accident research: prevention, management and rehabilitation of injury, transport safety technologies
- Large-scale clinical trials/clinical registries/data management, and rapid evidence synthesis to inform policy and practice
- Therapies for addictions and compulsive disorders
- Epidemiological modelling of risks and control strategies

## KEY INFRASTRUCTURE

- Institutes: Turner Institute for Brain and Mental Health/Monash Institute of Medical Engineering/Victorian Heart Institute
- Brain Park
- Monash Sleep and Circadian Medicine Lab
- Monash Biomedical Imaging
- Functional Genomics Facility
- Advanced Technology Research Platforms (ISO accredited) - imaging, antibodies, animals incl non-human primates
- Australian Living Evidence Consortium
- School of Public Health and Preventive Medicine

## TECHNOLOGY TRANSFERS

- Bionic eye with Monash Vision Group in partnership with Minifab and Grey Innovation
- Attention software – world first training program, TALI, aimed at increasing attention and concentration
- Heads-up smartglasses for trauma resuscitation and reception, trauma reception and resuscitation software
- MoodMission app: empowers you to overcome feelings of depression and anxiety

## KEY PILLARS

| | | | |
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# QUANTUM SCIENCES AND TECHNOLOGIES

**monash.edu/science/schools/physics**

**Professor Kristian Helmerson**
Research Director
— School of Physics & Astronomy

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✉ kristian.helmerson@monash.edu

## CAPABILITIES

- Quantum-safe cryptography: design, security analysis, and implementation
- Quantum Information: Noise characterisation and mitigation; Complex quantum process simulators
- Quantum Matter: Exciton-polarons, polaritons, plasmonic, impurities, semiconductors and ultracold atoms.
- Magnetometry: Ultraprecise atomic gas-based sensors; Wide-field diamond sensors

- Surfaces: Bioinspired and atomically precise surface; 2D material such as plasmene
- Electrodynamics simulators; resonance energy transfer; transistors, lasers and spasers
- Nano-scale engineering: charge transfer, antenna, detectors, quantum dots and wires
- Developing/integrating software/hardware at the interface between classical and quantum technologies

## KEY INFRASTRUCTURE

- NIST-A environmentally stable laboratories for ultracold atomic gases (BECs). Visible to near-IR laser systems
- CW and pulsed excitation and single photon detection for quantum based optical systems. Custom HOE fabrication
- Quantum material fabrication/characterisation incl e-beam lithography, low T STM, PPMS, fs laser system

- Melbourne Center for Nanofabrication
- Monash Centre for Electron Microscopy
- Monash Microimaging Facilities
- Australian Synchrotron
- High Performance Computing for Data Processing, Modelling, Simulation and Visualisation (MASSIVE, MonARCH)

## TECHNOLOGY TRANSFERS

- MatriCT, quantum-safe privacy-preserving payment protocol - patented by Monash and Data61

## KEY PILLARS

| Pillar | | Pillar | |
|---|---|---|---|
| Advanced Sensors & Processing | ▨ | Modelling, Simulation & Analysis | ▨ |
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# MATERIALS FOR DEMANDING ENVIRONMENTS

**monash.edu/infrastructure/themes/structures/corrosion**

**Professor Michael Preuss**
Professor of Structural Materials and Director of Research Infrastructure
— Faculty of Engineering

⊙ Monash University, Clayton VIC 3800
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✉ michael.preuss@monash.edu

## CAPABILITIES

- Nuclear Engineering
- Metallurgy, Materials Performance, Structural Integrity, Corrosion
- Materials for Demanding environments - Aerospace and Nuclear Materials (Ti, Ni, Zr, steel)

- Advanced Manufacturing
- Irradiation damage
- Computational mechanics and materials science
- Multiscale characterisation

## KEY INFRASTRUCTURE

- Metallurgy & Corrosion Research Cluster
- Extensive selective laser melting capabilities, in addition to the world's largest direct laser deposition instrument
- Monash Centre for Electron Microscopy: SEM, TEM, x-ray microanalysis, tomography, dual beam focused ion beam milling
- Monash x-ray platform: XRD, small angle x-ray analysis, XRF, SAXS, XCT, potentiostats (AC/DC)

- and corrosion measurement
- Electrochemical spectroscopy: scanning electrochemical microscopy and on-line ICP analysis
- Optical profilometry and AFM: provides non-contact information regarding surface topography, structure and condition
- Mechanical testing from cryogenic temperature to 1000C and non contact strain mapping techniques

## TECHNOLOGY TRANSFERS

- Amaero International Limited (ASX:3DA): integrated metal 3D printing across aerospace, defense and tooling industries
- Additive Assurance: process monitoring and quality assurance solution for laser powder bed fusion

- additive manufacturing
- 3D printed corrosion resistant alloys
- Corrosion resistant ultra-lightweight alloys
- Hardfacing alloys
- Friction joining

## KEY PILLARS

| Pillar | | Pillar | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | ▨ |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | ▨ |

# RMIT UNIVERSITY

**PRIMARY CONTACT**

**Professor Pier Marzocca**
Director
— Sir Lawrence Wackett Defence
& Aerospace Centre

**Dr John Besida**
Associate Director – Business and
Technology Transition
— Sir Lawrence Wackett Defence
& Aerospace Centre

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**rmit.edu.au/defence-aerospace**

# RMIT defence research impacts in every domain: Sea, Air, Land, Space and Cyber

For over 100 years, RMIT has supported the Australian defence sector with consistent impact in science, technology and innovation.

Our key Defence aligned strengths are:

**Advanced Manufacturing & Sustainment**

- Additive Manufacturing

- Composites

- Structural Integrity & Sustainment

- Joint RMIT/DSTG Centre for Advanced Research in Structures and Materials Experimentation

**Sensor Technologies & High-Speed Flight Systems**

- Antennas & Radar Systems

- Photonics & Quantum PNT

- Propulsion and Energy Storage Systems

- DSTG Joint Chair Supersonic Propulsion and Flight Technologies

**Trusted Autonomy & Digital Engineering**

- Autonomous Systems

- Digital Twins (Aerostructure Design and Simulation)

- AI and Human-Machine Teaming

- Rapid Prototyping & Testing

Enabling our key strengths are our expertise in: AI/ML; Big Data; Quantum; Photonics; Industry 4.0; Cyber; Supply Chain and Logistics; Global Relations and Security; Ethics and Defence Sector Training and Education.

**The Sir Lawrence Wackett Defence & Aerospace Centre engages with the defence sector to:**

- Serve national defence and aerospace priority areas to develop sovereign capability by partnering with Australian and global organisations

- Leverage RMIT's research expertise to deliver end-to-end solutions to partners, from concept, prototyping, and testing to policy and implementation

- Build and support cross-sector teams to deliver outcomes for the defence and aerospace sectors across technology readiness levels 1-7, using best practice

- Deliver innovation and cutting-edge solutions to make the defence and aerospace sectors safer, more efficient and sustainable

←

Composite braiding machine capable of producing triaxially braided fabric architecture. RMIT Aviation and Aerospace Engineering.

## RMIT UNIVERSITY

**rmit.edu.au/defence-aerospace**

**Prof Pier Marzocca & John Besida**
— Sir Lawrence Wackett Defence
& Aerospace Centre

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✉ defence&aerospace@rmit.edu.au

### CAPABILITIES

- Multifunctional Materials & Structures, Advanced & Additive Manufacturing
- Power & Energy Solutions, Space Systems & Technologies
- Data, Information & Communication
- Virtual Prototyping & Digital Twin
- Autonomy & Automation, Remote & Embedded Sensors
- Human Performance & Protection
- Policy, Ethics & Law
- Education, Training & Workforce Skills Development

### KEY INFRASTRUCTURE

- Flash-Fire Laboratory for Advanced Manikin & Material Evaluation (FLAMME) facility
- Micro Nano Research Facility
- Rheology & Materials Characterisation Lab
- Microscopy & Microanalysis Facility
- X-Ray Facility
- Virtual Experiences Lab
- Digital Manufacturing Facility - Advanced Manufacturing Precinct
- Mass, Vibrational & Nuclear Magnetic Resonance Spectroscopy Facilities
- Information in Society Platform

### TECHNOLOGY TRANSFERS

- Deep Intelligence Machine Simulator project with Rheinmetall Defence Australia
- Pathfinder Firefly consortium with SmartSat, TAS, RAAF Plan Jericho & RMIT
- Quantum-limited diamond-fibre magnetometer project-Global X Challenge ONR
- Next-gen. spacesuits to protect humans- Human Aerospace, ASA, NASA & ESA
- Rechargeable proton battery prototype - environmentally friendly with greater energy storage capacity
- Black Kite drone - waterproof, lands on & takes off from water, prototype created by DSTG & RMIT
- Precise, compact, cost-effective & high performance photonic gyroscope- Advanced Navigation
- 3D printed high-performance satellite components with Titomic for Lockheed Martin

### KEY PILLARS

| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | ▨ |
| --- | :-: | --- | :-: |
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## SPACE SYSTEMS

**rmit.edu.au/defence-aerospace**

**Prof Cees Bil & Dr Graham Dorrington**
— Sir Lawrence Wackett Defence
& Aerospace Centre

📍 124 La Trobe Street, Melbourne
✉ defence&aerospace@rmit.edu.au

### CAPABILITIES

- 3D printing & composites for space & structures
- Satellite technologies & solutions, tracking & positioning and navigation & timing
- Space communication, IoT over satellites & remote sensing & communications
- DST RMIT Joint Chair in Supersonic Propulsion & Flight Technologies
- Weather & geospatial sciences
- Spacesuits & clothing
- Space debris monitoring & modelling
- Space antennas & deployable structures, RF systems & software defined radio technology

### KEY INFRASTRUCTURE

- Space Industry Hub
- SmartSat CRC Victoria node
- Trusted Autonomous Systems CRC
- Satellite Positioning for Atmosphere, Climate & Environment
- Autonomous & Intelligent Aerospace Systems Lab
- RMIT-DSTG Structures & Materials Experimentation Test Centre Program
- Information in Society Enabling Impact Platform
- Centre for Materials Innovation & Future Fashion

### TECHNOLOGY TRANSFERS

- Hybrid terrestrial-satellite access system for IoT applications with SmartSat CRC
- Platform technologies for space, atmosphere & climate project with the Australian Space Research Program
- Machine learning based solution for space situational awareness & space sustainability with SmartSat CRC
- Developing Australian solutions & capability for the manufacturing of space equipment with Boeing
- Precise Point Positioning service channel & standardisation of message format with Thales
- Additively manufactured satellite structural components for Lockheed Martin to be delivered by Titomic & RMIT
- Space Bridge program sponsored project with OneWeb, managed by SmartSatCRC
- Moon to Mars Trailblazer stage one grant to design and develop a lunar rover with Lunar Outpost, EPE. Trusted to Protect
- Universal Payload Racking System Flight Qualification & Demonstration; & Australian Lunar Experiment Promoting Horticulture, Moon to Mars Initiative Demonstrator Mission Grant

### KEY PILLARS

| Advanced Sensors & Processing | ▨ | Modelling, Simulation & Analysis | ▨ |
| --- | :-: | --- | :-: |
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| Hypersonics & Directed Energy Capabilities | ▨ | Space Systems | ▨ |
| Integrated Intelligence, Surveillance & Reconnaissance | ▨ | Sustainment | |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | ▨ |

# ADVANCED SENSORS & PROCESSING

**rmit.edu.au/defence-aerospace**

**Dist Prof Arnan Mitchell
& Prof Sumeet Walia**
— Sir Lawrence Wackett Defence
& Aerospace Centre

⊙ 124 La Trobe Street, Melbourne

✉ defence&aerospace@rmit.edu.au

## CAPABILITIES

- Antennas & RF microwave systems & components
- Radar & sonar
- Remote imaging
- Photonics and quantum sensors
- Internet of Things sensors
- Situation awareness, surveillance & detection
- Environmental & tactile sensing
- Remote & embedded sensors

## KEY INFRASTRUCTURE

- Functional Materials & Microsystems Research Group
- Centre for Advanced Electronics & Sensors
- Next Generation Internet Architecture Research Group
- Micro Nano Research Facility
- Integrated Photonics & Applications Centre
- ARC Centre of Excellence in Exciton Science
- ARC Centre of Excellence in Optical Microcombs for Breakthrough Science (COMBS)
- RF and Antennas Research Group
- ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS)

## TECHNOLOGY TRANSFERS

- Electronic chip prototype of light powered AI that brings together imaging, processing, machine learning & memory
- Multi-Function Aperture Grand Challenge Research Phase with NGTF DSTG
- World first sleep disorder diagnosis & monitoring trial using invisible sensor technology with Sleeptite Research Program 2 advanced satellite systems, sensors & intelligence with SmartSat CRC
- Ultra-efficient, nano-thin piezoelectric flexible material for self-powered electronics & wearable technologies
- Explainable & Unified Spatial Reasoning & Sensor Fusion prototype; & Intention & Explanation for Fusion of Uncertain, Noisy & Dynamic Spatial Data projects with DSTG
- Sensor technology trials to test fruit for sweetness, ripeness, size & signs of disease or pests by Food Agility
- Lithium niobate photonics: Unlocking the electromagnetic spectrum-super-thin chips set to overtake silicon chips in light-based technologies

## KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | /// |
| Big Data Processing & Visualisation | /// | Multi-Disciplinary Material Sciences | |
| Cyber & IT Security | /// | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | | Quantum Technologies | |
| Hypersonics & Directed Energy Capabilities | /// | Space Systems | |
| Integrated Intelligence, Surveillance & Reconnaissance | /// | Sustainment | |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | /// |

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# BIG DATA VISUALISATION, CYBER IT INTELLIGENCE

**rmit.edu.au/defence-aerospace**

**Prof Matt Duckham
& Prof Monica Wachowicz**
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& Aerospace Centre

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## CAPABILITIES

- Data analytics & data fusion
- Network design & security
- Cyber security & cloud systems
- Cryptology & data security
- Advanced wireless communication for Defence & next-generation systems
- Geospatial data & mapping
- Blockchain

## KEY INFRASTRUCTURE

- Data Analytics Lab
- Centre for Information Discovery & Data Analytics
- Centre for Cyber Security Research & Innovation
- Wireless Innovation Laboratory
- Blockchain Innovation Hub
- Centre for Industrial AI Research & Innovation
- Information Security & Network Science Research Group
- Next Generation Internet Architecture Research Group

## TECHNOLOGY TRANSFERS

- Monitoring atmosphere over Australian & Antarctic regions using GNSS radio occultation
- Maritime platform dynamics & control with DSTG
- Technology to detect emotions in human speech, enabling more natural conversations with robots
- Training intelligent virtual agents using human interaction data phase 2 for DIIS
- Algorithms to predict the time & place of various crimes by analysing location-based data from social media
- Impact of AI on the future of information warfare, cybersecurity, nuclear deterrence & space capabilities
- & implications in a trilateral context, Australia, Japan & US – DSPG Program
- Maritime supply chain security in the Indo-Pacific region: threats & policy implications for Australian Defence- DSPG Program
- Above water laser communication, concept development that aims to improve the performance of communications systems close to sea level with Lockheed Martin Australia & Defence

## KEY PILLARS

| | | | |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | /// |

## ENHANCED HUMAN PERFORMANCE & PROTECTION

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**rmit.edu.au/defence-aerospace**

**Prof Olga Troynikov & Prof Rajiv Padhye**
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### CAPABILITIES

- Human factors
- Medical & biomedical countermeasures
- Preventative medicine
- Food technologies

- Human protection & comfort clothing
- Physical & cognitive performance & functions
- CBRN

### KEY INFRASTRUCTURE

- Behavioural Business Lab
- Food Research & Innovation Centre
- Centre for Materials Innovation & Future Fashion
- Flash-Fire Laboratory for Advanced Manikin & Material Evaluation (FLAMME) facility

- ARC Training Centre in Cognitive Computing for Medical Technologies
- ARC Industrial Transformation Training Centre in Additive Biomanufacturing
- Australian Centre for Electromagnetic Bioeffects Research
- Disaster Research & Response Network

### TECHNOLOGY TRANSFERS

- Use of phase-change textiles materials to control the thermal micro-environment inside crash helmets
- Intelligent garments & materials to protect & monitor health of firefighters & defence personnel
- Next-gen. spacesuits to protect humans from the strains of space project with Human Aerospace, ASA, NASA & ESA
- Next generation smart wound dressings for real-time, non-invasive monitoring of infection in burns

- Materials & garment engineering for assistive technologies to counter exhaustion & reduction of human energy
- Large area detection of improvised explosive devices by portable artificial intelligence-powered electronic noses- ONI NISDRG
- Nano protective adsorbent composite technology demonstration with DMTC, DSTG, Bruck Textiles, NanoLayr & CSIRO
- Antimicrobial platforms for infection prevention & healing with TuCann Medical

### KEY PILLARS

| | | | | | |
|---|---|---|---|---|---|
| Advanced Sensors & Processing | | ▨ | Modelling, Simulation & Analysis | | |
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| Cyber & IT Security | | | Propulsion & Energy Storage | | |
| Enhanced Human Performance & Protection | | ▨ | Quantum Technologies | | |
| Hypersonics & Directed Energy Capabilities | | | Space Systems | | ▨ |
| Integrated Intelligence, Surveillance & Reconnaissance | | ▨ | Sustainment | | |
| Medical/Pharma Technologies | | ▨ | Trusted Autonomous Systems | | |

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## HYPERSONICS & DIRECTED ENERGY

———

**rmit.edu.au/defence-aerospace**

**Assoc Prof Adrian Pudsey & Prof Brant Gibson**
— Sir Lawrence Wackett Defence & Aerospace Centre

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✉ defence&aerospace@rmit.edu.au

### CAPABILITIES

- Hypersonics
- Directed energy
- Fuel technologies
- Computational modelling & simulations

- Advanced materials & structures
- DSTG-RMIT Joint Chair in Supersonic Propulsion and Flight Technologies

### KEY INFRASTRUCTURE

- Centre for Advanced Materials & Industrial Chemistry
- Advanced Manufacturing Precinct
- Centre for Additive Manufacturing
- DSTG HA Wills Structures & Materials Test Centre

- ARC Training Centre for Surface Engineering for Advanced Materials
- Aerospace Intelligent & Autonomous Systems Laboratory
- Industrial wind tunnels
- High-Speed Flight Lab & Facility

### TECHNOLOGY TRANSFERS

- Ultra-efficient 3D printed catalysts to help solve the challenge of overheating in hypersonic aircraft
- Hydrocarbon fuel technology for hypersonic air breathing vehicles with DefendTex
- Development of innovative high fidelity platform for structural diagnostics & prognostics with DSTG
- Australia's first 3D printed rocket booster for space with DefendTex, Rocktech & DSTG

- Diamond technology for instantaneous monitoring of microwave directed energy signals up to 18Ghz
- Prediction & control of aerothermoelastic effects in hypersonics vehicles
- Fabrication of directed energy absorbing composites using hybrid 3D printing to protect humans & equipment
- CRC-P responsive access to space rotating detonation engine with DefendTex & DISR

### KEY PILLARS

| | | | | | |
|---|---|---|---|---|---|
| Advanced Sensors & Processing | | ▨ | Modelling, Simulation & Analysis | | ▨ |
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| Hypersonics & Directed Energy Capabilities | | ▨ | Space Systems | | ▨ |
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| Medical/Pharma Technologies | | | Trusted Autonomous Systems | | ▨ |

# MEDICAL PHARMA BIOTECHNOLOGIES

**rmit.edu.au/defence-aerospace**

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Dist Prof Magdalena Plebanski**
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& Aerospace Centre

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## CAPABILITIES

- Medical & biomedical countermeasures
- Preventative medicine
- Nanotechnology
- Sensors

## KEY INFRASTRUCTURE

- ARC Training Centre in Cognitive Computing for Medical Technologies
- Digital Health CRC. Digital Health Hub. Health Research Hub.
- Micro/Nanomedical Research Centre
- Bioinformatics Network
- ARC Industrial Transformation Training Centre in Additive Biomanufacturing
- ARC Research Hub for Advanced Manufacturing of Personalised Medical Devices
- Nanotechnology & Biopharmaceutics Research Group
- Discovery to Device- MedTech prototyping & scale-up facility

## TECHNOLOGY TRANSFERS

- World first personalised nutrition wearable smart patch with Nutromics, Romar & IMCRC
- Synchrotron microbeam radiotherapy cancer research to revolutionise cancer treatments
- World's first stroke air ambulance with RMH, Ambulance Victoria, Stroke Foundation & RFDS
- Innovative immune-based therapies & diagnostics: using nanotechnology for personalised medicine - NHMRC
- Nano scale toxic vapour detection
- Metal-organic frameworks to deliver the genetic snipping tool CRISPR/Cas9 into human cancer cells with CSIRO
- Precision engineered liquid metals to develop new bacteria-destroying technology to combat antibiotic resistance
- 3D printed spinal implant developed & implanted into a patient with excellent outcome- just in time implants

## KEY PILLARS

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# MODELLING SIMULATION & ANALYSIS

**rmit.edu.au/defence-aerospace**

**Prof Pier Marzocca & Prof Ivan Cole**
— Sir Lawrence Wackett Defence
& Aerospace Centre

- 124 La Trobe Street, Melbourne
- defence&aerospace@rmit.edu.au

## CAPABILITIES

- Engineering systems & structures
- Industrial & environmental design
- Model based systems engineering
- Modelling & simulation
- Digital twin / thread
- Product design & life cycle management

## KEY INFRASTRUCTURE

- Materials Modelling & Simulation Group
- Design Futures Lab. RMIT Design Archives.
- Centre for People, Organisation & Work
- Digital Ethnography Research Centre
- Intelligent Automation Research Group
- Centre of Digital Environments
- Virtual Experiences Laboratory
- Social & Global Studies Centre
- Flight sciences laboratory

## TECHNOLOGY TRANSFERS

- Socio-psychological simulation to study crowd dynamics in normal & emergencies at major transport hubs
- Predictive modelling of building ventilation
- Computer aided biomedical research using CFD modelling & 3D printing
- Design & prototype of vision-based collision warning system utilising advanced signal & graphical processing board
- Air vehicle recovery operations on surface vessels using ship motion prediction with DSI
- Capability development for 3D virtual representation of stress visualisation data in geometrically components with Millikelvin & DSI
- Development of innovative high fidelity platform for structural diagnostics & prognostics with DSTG

## KEY PILLARS

| Pillar | | Pillar | |
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AML3D Arcemy WAM system produces metal 3D printed parts using the Wire Arc Additive Manufacturing process and its 1.4 metre build volume. RMIT Advanced Manufacturing Precinct.

## MULTIDISCIPLINARY MATERIAL SCIENCES

**rmit.edu.au/defence-aerospace**

**Prof Stuart Bateman &
Assoc Prof Andrey Molotnikov**
— Sir Lawrence Wackett Defence &
Aerospace Centre

⊙ 124 La Trobe Street, Melbourne

✉ defence&aerospace@rmit.edu.au

### CAPABILITIES

- Composites technologies
- Lightweighting
- Micro & nano materials
- Alloys
- Fabrics & textiles

- Additive & subtractive manufacturing
- Design, testing & manufacture
- Multifunctional materials & advanced manufacturing

### KEY INFRASTRUCTURE

- Advanced Manufacturing Precinct - Centre for Additive Manufacturing
- Centre for Advanced Materials & Industrial Chemistry
- ARC Training Centre for Surface Engineering for Advanced Materials
- Centre for Innovative Structures & Materials

- ARC Research Hub for Australian Steel Manufacturing
- ARC Research Hub for Nanoscience-based Construction Material Manufacturing
- Sovereign Manufacturing Automation for Composites Cooperative Research Centre (SoMAC CRC)
- ARC Training Centre for Lightweight Automotive Structures

### TECHNOLOGY TRANSFERS

- Explosive blast response of naval composites in Arctic conditions with ONR
- Additively manufactured lightweight hybrid ballistic protection materials
- Advanced joint technology to enhance integration of composites on Defence platforms- QinetiQ & DSTG
- Development of crack growth models for ship welded structural components with DSTG

- Hybrid composite materials & structures with DMTC
- Global 3D printing partnership with Fraunhofer Institute for Material and Beam Technology IWS
- Additive manufacturing & repair for Defence aircraft
- Clean & cost-effective way to upcycle used plastic, transforming it into nanomaterials & high-quality fuel

### KEY PILLARS

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## PROPULSION & ENERGY STORAGE

**rmit.edu.au/defence-aerospace**

**Assoc Prof Adrian Pudsey
& Prof John Andrews**
— Sir Lawrence Wackett Defence &
Aerospace Centre

⊙ 124 La Trobe Street, Melbourne

✉ defence&aerospace@rmit.edu.au

### CAPABILITIES

- Hypersonics, energy conversion & propulsion
- DSTG-RMIT Joint Chair in Supersonic Propulsion & Flight Technologies
- Energy harvesting & storage solutions

- Transport, infrastructure, power & energy
- Rotating detonation engines
- Proton battery

### KEY INFRASTRUCTURE

- ARC Centre of Excellence in Future Low-Energy Electronics Technologies
- CRC for Reliable Affordable Clean Energy for 2030

- Sustainable Hydrogen Energy Laboratory
- Future Fuels CRC
- High Speed Flight Lab/Facility

### TECHNOLOGY TRANSFERS

- Rechargeable proton battery, environmentally friendly with greater energy storage capacity
- Supporting the electrification of Victoria's future fleet - VHESIF
- Prototype dual turbine wave energy conversion technology to double the power harvested from ocean waves
- Powerful, low cost method for recycling used cooking oil & agricultural waste into biodiesel

- Learning from nature: counteracting effects of turbulence on MAVs - US Air Force OSR
- CRC-P responsive access to space rotating detonation engine with DefendTex and Commonwealth
- Alternative power packages for land vehicles & hypersonic fuel

### KEY PILLARS

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# QUANTUM TECHNOLOGIES

rmit.edu.au/defence-aerospace

**Prof Brant Gibson & Dist Prof Arnan Mitchell**
— Sir Lawrence Wackett Defence & Aerospace Centre

📍 124 La Trobe Street, Melbourne
✉ defence&aerospace@rmit.edu.au

## CAPABILITIES

- Quantum computing & communication technology
- Quantum sensing
- Quantum physics
- Quantum effects in biological, chemical & physical systems
- Quantum technologies
- Quantum photonics lab

## KEY INFRASTRUCTURE

- ARC Centre of Excellence for Quantum Computation & Communication Technology
- ARC Centre of Excellence in Exciton Science
- ARC Centre of Excellence for Nanoscale BioPhotonics
- Theoretical Chemical & Quantum Physics Group
- Micro Nano Research Facility
- Integrated Photonics & Applications Centre
- ARC Centre of Excellence in Optical Microcombs for Breakthrough Science (COMBS)
- Diamond Quantum Materials Research Hub with Quantum Brilliance

## TECHNOLOGY TRANSFERS

- Diamond-doped fibre optic cables for magnetic field sensing in air, water & land with Global X Challenge US ONR
- Quantum illumination with multi-mode Gaussian resource states with Asian Office of Aerospace R&D
- QT28: Hybrid diamond fibre optic quantum magneto-sensors with Department of Defence
- Quantum correlation microscopy: progressing nanoscopy with US Air Force OSR
- Cutting edge optical communications that carries data on light waves to allow super fast internet
- Sub-Nanotesla Hybrid Diamond: Fibre Sensing Platform with NGTF DSTG
- Development of Sovereign Chip Scale Quantum Atomic Clock with NGTF DSTG
- Identification, controllability & control of quantum devices using physics- guided neural networks

## KEY PILLARS

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| Medical/Pharma Technologies | | Trusted Autonomous Systems | |

# SUSTAINMENT

rmit.edu.au/defence-aerospace

**Prof Pier Marzocca & Prof Simon Barter**
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## CAPABILITIES

- Structural health management, diagnostics & prognostics,
- Logistics, optimisation & supply chain
- Fatigue research & applications to ASI, full scale fatigue tests.
- Applied structural experimentation & structural assessment, asset management
- Composite aircraft structural integrity
- Australian Defence Logistics College-Department of Defence
- ADF Joint Technical Trades Training
- RMIT Aviation Academy, Flight Training School & UAV flight training

## KEY INFRASTRUCTURE

- DSTG HA WILLS Structures & Materials Test Centre & SMARP
- Post-Carbon Research Centre
- Centre for Environmental Sustainability & Remediation
- Electric Vehicle Living Lab
- Australian Maritime Logistics Research Network
- Global Business & Transport Logistics group
- ARC Centre of Excellence for Environmental Decisions
- Sustainable Building Innovation Laboratory
- Advanced Manufacturing Precinct

## TECHNOLOGY TRANSFERS

- Ultrasonic heat & 3D printing producing finest grain size in titanium alloy Ti6Al4 improving strength & ductility
- Technology to make biosolids management more environmentally sustainable, cost effective & reduce carbon emissions
- Asset management & resilience of railway infrastructure systems by integrating physical & cyber systems -CAMS
- Innovative multi-physics approach to individual aircraft tracking & aircraft sustainment with DSTG
- New 3D printing techniques creating tiny & intricate biomedical structures with St Vincent's hospital
- Quieter propellers prototype using machine learning, echo free chamber & 3D printing with XROTOR & CSIRO
- Laser metal deposition technology to build & repair steel & titanium parts for defence force aircraft with RUAG
- New polymer material that could see ships, armoured vehicles or aircraft to self-repair damage in under 10 minutes

## KEY PILLARS

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| Medical/Pharma Technologies | | Trusted Autonomous Systems | ▨ |

# TRUSTED AUTONOMOUS SYSTEMS

**rmit.edu.au/defence-aerospace**

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Prof Fabio Zambetta**
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## CAPABILITIES

- Human-machine interface with human-machine learning, teaming & swarming
- Artificial intelligence
- Autonomous systems & unmanned vehicles
- Navigation & collision avoidance
- Optimisation & operations management
- Next Generation Graduate Program, AI & Emerging Technologies- Data61/CSIRO

## KEY INFRASTRUCTURE

- Centre for Industrial AI Research & Innovation
- Autonomous & Intelligent Aerospace Systems Lab
- Unmanned Aircraft Systems Lab
- ARC CoE for Automated Decision Making & Society
- Intelligent Mobility & Vehicle Evolutions CRC
- Australia-India Research Centre for Automation Software Engineering
- Cyber-Physical & Autonomous Systems Group
- Trusted Autonomous Systems CRC
- Charles Darwin University-RMIT Industry 4.0 TestLab

## TECHNOLOGY TRANSFERS

- Deep Intelligence Machine Simulator project with Rheinmetall Defence Australia
- 24GHz Collision Avoidance Radar System for Trusted Autonomous Systems CRC
- Distributed Autonomous Spectrum Management with Trusted Autonomous Systems CRC
- Cognitive Human-Machine Interface & Interaction system with Northrop Grumman, Thales Australia & DSTG
- Drones that sense wind gusts & thermals, using them to gain speed or altitude, just like birds-DSTG
- Co-operative simultaneous localisation & mapping for a team of unmanned defence platforms
- Development of a miniaturised sensory device for event perception inspired by human vision and brain - ONI NISDRG
- Trusted scalable effect delivery by expendable, autonomous swarms with Trusted Autonomous Systems CRC

## KEY PILLARS

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| Enhanced Human Performance & Protection | | Quantum Technologies | |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | |



→ Sensitivity characterisation of hybrid diamond-fibre quantum magnetometers for undersea surveillance. RMIT ARC CoE Nanoscale BioPhotonics.
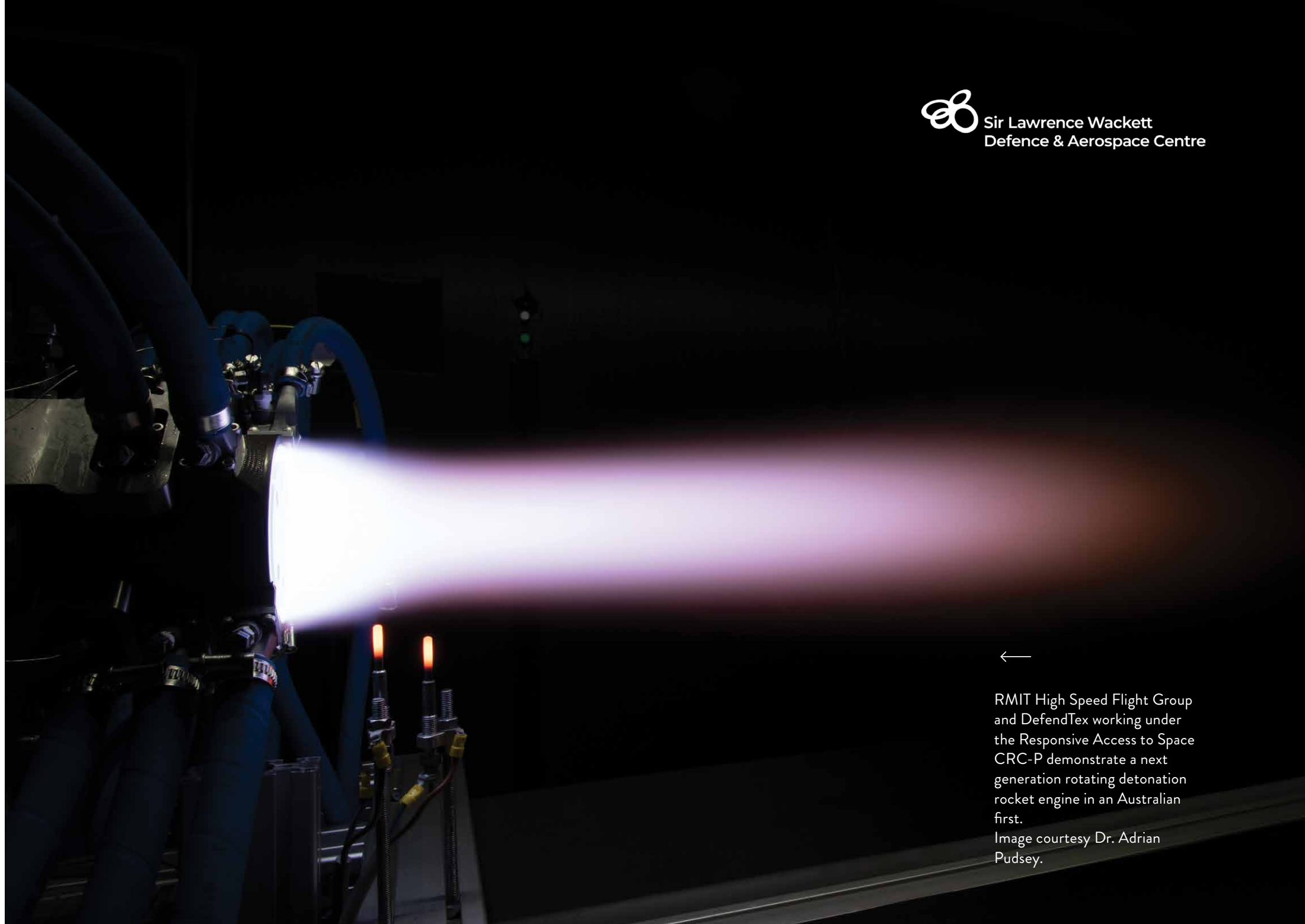
RMIT High Speed Flight Group and DefendTex working under the Responsive Access to Space CRC-P demonstrate a next generation rotating detonation rocket engine in an Australian first.
Image courtesy Dr. Adrian Pudsey.

**PRIMARY CONTACT**

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Research and Chief of Defence
Innovation

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**swinburne.edu.au**

# Developing a legacy of research engagement with the defence industry

Swinburne University of Technology's expertise spans a wide range of areas supporting defence research, including advanced manufacturing, materials, digital technologies and human factors. Swinburne conducts this research in collaboration with industry partners, with a strong focus on Australian SMEs, to build sovereign capability and create value for these partners.

Swinburne has leading expertise in advanced manufacturing and materials research, utilising our world-class fabrication and testing facilities, and is applying this knowledge and skills to the defence industry, with the aim to detect and protect.

With Swinburne's digital innovation research capabilities, our globally recognised researchers work closely with defence industry experts in areas such as data analytics, advanced visualisation, artificial intelligence and machine learning, and cybersecurity to support end-user applications. For example, Swinburne researchers are working with defence industry professionals and the Australian Government's Defence Science and Technology Group to understand how decisions are made in complex, fast-paced, safety-critical environments, such as operational control centres, as well as how to best present this information to operators and supervisors.

The Swinburne research ecosystem also hosts various industry-facing research entities across areas including manufacturing, data science, digital health aerospace and space technologies. These dedicated entities contribute to the relevant industry sectors as they develop their knowledge and skills to both build Australian sovereign capability and create export market opportunities.

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Additive manufacture of copper coating on a ceramic part as part of a collaboration with DSTG and SPEE3D, utilisng the Lightspee3D technology.

## SWINBURNE UNIVERSITY OF TECHNOLOGY

—

**swinburne.edu.au**

**Distinguished Professor Saeid Nahavandi**
Associate Deputy Vice-Chancellor Research and Chief of Defence Innovation

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### CAPABILITIES

- Supercomputing
- Cybersecurity
- Quantum technologies
- VR/AR/MR applications, including training and remote operations
- Advanced sensors
- Industry 4.0 Technologies including robotics, digital twins, digitisation of supply chains
- Advanced manufacturing processes
- Corrosion detection, prevention, and removal

### KEY INFRASTRUCTURE

- Space Technology and Industry Institute
- Manufacturing Futures Research Platform
- Iverson Health Innovation Research Institute
- Swinburne-CSIRO National Industry 4.0 Testlab
- Factory of the Future, focussing on digital innovation co-creation
- Digital Capability Research Platform – covering visualisation, cybersecurity, intelligent data, IoT, software systems and blockchain.
- Aerostructures Innovation Research (AIR) Hub
- Victorian Hydrogen (VH2) Hub

### TECHNOLOGY TRANSFERS

- Development of scalable, lightweight carbon composite freight drone for industry partner
- Muon research transferred to company providing intelligence on internal structures for mining and defense applications

### KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | |
| Big Data Processing & Visualisation | | Multi-Disciplinary Material Sciences | |
| Cyber & IT Security | | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | | Quantum Technologies | |
| Hypersonics & Directed Energy Capabilities | | Space Systems | |
| Integrated Intelligence, Surveillance & Reconnaissance | | Sustainment | |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | |

## SPACE TECHNOLOGY AND INDUSTRY INSTITUTE (STII)

—

**swinburne.edu.au/research/ institutes/space-technology- industry**

**Dr Rebecca Allen and Dr Andrew Ang**
Co-Directors
— STII

⊙ John Street, Hawthorn VIC 3122
✉ spaceinstitute@swinburne.edu.au

### CAPABILITIES

- Advanced data processing for large volumes of data and customised presentation
- Distributed machine learning, including deep learning, ensemble learning and transfer learning, with a focus on earth observation (EO) multi-spectral and hyperspectral imagery (e.g. change detection)
- Automating and optimising decision-making based on large-scale distributed, incomplete and imprecise data
- Optical sensor development
- Radiation hardening of electronic components, including integrated circuits (IC)
- In-Situ Resource Extraction (ISRU) technologies, including lunar regolith processing; waste to construction materials
- Microgravity research platform design and data processing (life sciences and physical sciences)
- Advanced composite and metallic alloy material development
- Advanced coatings for space & hypersonics
- High speed impact lab
- Space science and technology training

### KEY INFRASTRUCTURE

- Radiation hardening laboratory for electronics
- Advanced data visualisation laboratory
- Space instrumentation laboratory
- Observatory remote operations centre
- Composites fabrication labortaory
- Metal alloys (e.g. aluminium alloys) 3D printing capability
- Titanium laser cladding / repair capability
- High-speed impact testing laboratory
- ARC Training Centre on Surface Engineering for Advanced Material (SEAM)
- Microscopy and Advanced Analytical Facilities (MAAF)

### KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | |
| Big Data Processing & Visualisation | | Multi-Disciplinary Material Sciences | |
| Cyber & IT Security | | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | | Quantum Technologies | |
| Hypersonics & Directed Energy Capabilities | | Space Systems | |
| Integrated Intelligence, Surveillance & Reconnaissance | | Sustainment | |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | |

## DIGITAL CAPABILITY RESEARCH PLATFORM (DRCP)

swinburne.edu.au/research/platforms-initiatives/digital-capability

**Professor Yang Xiang**
Dean
— Digital Research & Innovation Capability Platform

⊙ John Street, Hawthorn VIC 3122
✉ dcrp@swinburne.edu.au

### CAPABILITIES

- Novel methods for handling and analysing large and complex data sets (e.g. unifying data; trend identification)
- Supply chain analytics: resource and process optimisation; real-time monitoring; multi-tier supply chain visibility and transparency; supply chain resilience modelling and AI-based decision making
- Human-data interaction: visual perception and cognition; interactive learning models; immersive data analysis environments (including VR); spatio-temporal visual data analysis
- Medical data analytics
- Scalable hardware and software architectures
- Data privacy architectures
- Machine learning (deep neural networks) and intelligent optimisation techniques
- High-speed data processing from sensor networks

### KEY INFRASTRUCTURE

- Swinburne Supercomputing OzSTAR Facility (high performance computing)
- Centre for Astrophysics and Supercomputing
- Social Data Analytics (SoDA) Lab
- Optical Data Storage and Laser Fabrication Lab
- Digital Innovation Lab (DIL)
- Cisco Networking Lab
- Advanced VR/AR facility with Volumetric Capture Studio

### KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | /// |
| Big Data Processing & Visualisation | /// | Multi-Disciplinary Material Sciences | |
| Cyber & IT Security | /// | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | | Quantum Technologies | |
| Hypersonics & Directed Energy Capabilities | | Space Systems | /// |
| Integrated Intelligence, Surveillance & Reconnaissance | /// | Sustainment | |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | /// |

## MANUFACTURING FUTURES RESEARCH PLATFORM (MFRP)

swinburne.edu.au/research-institutes/manufacturing-futures

**Professor Suresh Palanisamy**
Director
— MFRP

⊙ John Street, Hawthorn VIC 3122
✉ mfrp@swinburne.edu.au

### CAPABILITIES

- Advanced additive and subtractive manufacturing methods
- Model-Based Systems Engineering (MBSE) for design and prototyping
- Advanced metallic, composite, graphene and hybrid materials for multiple environments
- Surface coatings
- Bio-devices and biotechnology
- Robotics and mechatronics, including human-machine collaborative robots (cobots)
- Industry 4.0 methodology and application expertise
- Digital twins
- Business modelling and industrial automation
- Design driven manufacturing innovation
- Digitisation of supply chains, including predictive analytics and real-time monitoring

### KEY INFRASTRUCTURE

- Factory of the Future (FOF)
- Centre for Design Innovation (CDI)
- Design Factory Melbourne (DFM)
- ARC Centre for Surface Engineering for Advanced Materials (SEAM)
- 3D additive metal printing capabilities
- Swinburne-CSIRO National Industry 4.0 Testlab
- Microfabrication and microanalytical facility
- Nanofabrication laboratories
- Polymer processing and testing laboratories
- Direct metal deposition facility
- Impact Engineering Laboratory
- Microscopy & Advanced Analytical Facility
- 6G Communication Lab

### KEY PILLARS

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|---|---|---|---|
| Advanced Sensors & Processing | /// | Modelling, Simulation & Analysis | /// |
| Big Data Processing & Visualisation | | Multi-Disciplinary Material Sciences | /// |
| Cyber & IT Security | | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | | Quantum Technologies | |
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| Medical/Pharma Technologies | /// | Trusted Autonomous Systems | |

## AEROSTRUCTURES INNOVATION RESEARCH (AIR) HUB

**swinburne.edu.au/research/ platforms-initiatives/air-hub**

**Dr Adriano Di Pietro**
Director
— AIR Hub

⊙ John Street, Hawthorn VIC 3122
✉ airhub@swinburne.edu.au

### CAPABILITIES

- Advanced composite materials and manufacturing methods for complex aerospace structures
- Integrated aircraft structures (e.g. embedded cabling) for simplified part count and assembly
- Research on operations for Advanced Air Mobility (AAM) including eVTOL
- Aerospace focused accelerator and incubator program
- Model-based systems engineering (MSBE) application for aerospace component manufacture
- Hydrogen storage on aircraft and eVTOL vehicles (collaboration with VH2)

### KEY INFRASTRUCTURE

- Swinburne-CSIRO National Industry 4.0 Testlab
- High-speed impact testing laboratory
- ARC Centre for Surface Engineering for Advanced Materials (SEAM)
- 3D additive metal printing capabilities
- Victorian Hydrogen Hub (VH2)
- Swinburne Department of Aviation, including aviation training simulators
- Hub Research and Industry Partner manufacturing capabilities: Boeing, Marand, Quickstep, CableX, Furnace Engineering, ARENA 2036, CSIRO, ANSTO, Shoal

### KEY PILLARS

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|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | /// |
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| Enhanced Human Performance & Protection | | Quantum Technologies | |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | /// |

## MEDICAL TECHNOLOGY VICTORIA (MEDTECHVIC) HUB

**swinburne.edu.au/research/ platforms-initiatives/medtechvic**

**Professor Rachael McDonald**
Director
— MedTechVic

⊙ John Street, Hawthorn VIC 3122
✉ MedTechVic@swinburne.edu.au

### CAPABILITIES

- Assistive Technology (AT) product ideation and development
- Human-centred design
- MedTech manufacturing 4.0 business readiness program
- Digitalisation of manufacturing capability
- Immersive media technology for design and trials of AT (e.g. use of VR)

### KEY INFRASTRUCTURE

- Assistive Technology (AT) Living Lab
- Centre for Design Innovation (CDI)
- Factory of the Future (FOF)
- Design Factory Melbourne (DFM)
- BioMelbourne Network
- Advanced VR/AR facility with Volumetric Capture Studio

### KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | /// | Modelling, Simulation & Analysis | /// |
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| Enhanced Human Performance & Protection | | Quantum Technologies | |
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| Integrated Intelligence, Surveillance & Reconnaissance | | Sustainment | /// |
| Medical/Pharma Technologies | /// | Trusted Autonomous Systems | |

## VICTORIAN HYDROGEN HUB (VH2)

swinburne.edu.au/research/
platforms-initiatives/victorian-
hydrogen-hub

**Mr Gordon Chakaodza**
Director
— VH2

⊙ John Street, Hawthorn VIC 3122
✉ vichydrogenhub@swinburne.edu.au

### CAPABILITIES

- Development and testing of storage and transport systems for hydrogen
- Digital processes in hydrogen production as well as traceability and certification of hydrogen
- Fuel cell technology for hydrogen powered commercial vehicles
- Economic modelling for hydrogen infrastructure assessments
- Research into decarbonisation of facilities and infrastructure

### KEY INFRASTRUCTURE

- Technology Demonstration Centre
- Demonstration Hydrogen Refuelling Station
- Factory of the Future (FOF)
- Hub Research Partner capabilities: CSIRO, ARENA 2036.

### KEY PILLARS

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|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | ▨ |
| Big Data Processing & Visualisation | ▨ | Multi-Disciplinary Material Sciences | ▨ |
| Cyber & IT Security | | Propulsion & Energy Storage | ▨ |
| Enhanced Human Performance & Protection | | Quantum Technologies | |
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## 6G RESEARCH AND INNOVATION LAB

swinburne.edu.au/research/
facilities-equipment/6g-research-
innovation-laboratory

**Dr Ali Yavari**
Director
— 6G Lab

⊙ John Street, Hawthorn VIC 3122
✉ 6g@swinburne.edu.au

### CAPABILITIES

- Advanced exposure testbed for radio frequency radiation studies, including health risk assessment of non-ionising radiation
- A unique integrated biological lab facility and radio frequency exposure system for measuring the impact of electromagnetic radiation on tissues, cells, and bacteria
- Design, implementation, and deployment of mobile and wireless device
- Evaluation and testing platform for assessing wireless performance
- Electromagnetic compatibility and interference assessment of drones and Internet of Things (IoT) devices
- Design and implementation of self-powered IoT devices using advanced power harvesting technologies
- Advanced computational simulation and modelling for wireless technologies, as well as the investigation of biological impacts

### KEY INFRASTRUCTURE

- Purpose-built electromagnetic-shielded anechoic chamber
- Radiation measurement and visualisation tools and software packages
- Advanced computing facility for heavy computational simulations
- Electromagnetic compatibility testing equipment
- Signal generators, amplifiers, and power meters to cover a range of communication technologies and frequencies, including radio, microwave, mmwave, and THz

### KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | ▨ | Modelling, Simulation & Analysis | ▨ |
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| Cyber & IT Security | | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | ▨ | Quantum Technologies | ▨ |
| Hypersonics & Directed Energy Capabilities | | Space Systems | |
| Integrated Intelligence, Surveillance & Reconnaissance | ▨ | Sustainment | ▨ |
| Medical/Pharma Technologies | | Trusted Autonomous Systems | |

**PRIMARY CONTACT**

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

✉ defence-technologies@unimelb.edu.au

**unimelb.edu.au**

# The University of Melbourne – Research of Scale for Defence

The University of Melbourne conducts world-leading research across many fields which enable national defence systems to succeed in an increasingly complex security landscape.

Our capabilities include advanced signals and information processing for radar, communications and sonar systems. We are developing advanced multifunction sensor capability that adapts to the environment and adversary systems. Along with our university and industry partners we are playing a leading role in the area of Influence operations and information warfare research. This sits alongside our Intelligence research which spans both defence and national security. We are leaders in autonomy and cyber research with three AusMURI programs and we lead the Centre for Advanced Defence Research and Enterprise in Operating in the CBRN Environment.

Our Agile Command and Control research includes Integrated Air Defence Systems with advanced Threat Evaluation and Weapon Assignment and techniques for asymmetric warfare in Suppression of Enemy Air Defences for mixed domain environments as well as optimised sensor/defence systems placement capability.

We have capability in autonomous systems research and expertise in swarm technologies, with large indoor test facilities. The University of Melbourne is also involved in satellite systems for earth monitoring and optical astronomy. Our research is critical to optimising the performance of maritime platform and aircraft dynamics, drag reduction, high speed aircraft control surface performance, offshore platforms, landing troops and amphibious operations, the performance of radar and sonar systems, and the through-life support of naval and aerospace platforms. We are working with industry on the DARPA Drag Reduction Challenge. We lead research in multifunction apertures for Radar and Communications.

The University of Melbourne is home to a suite of world class research facilities such as large-scale air-wave interaction tanks; wind tunnels (including a high Reynolds number tunnel); ice, wind and wave modelling; access to real-world ocean infrastructure; and high-performance computing for aerodynamic and hydrodynamic simulation and modelling.

At our new site at Fishermans Bend the University is working with Defence Science and Technology Group, defence and other industries, and collaborating universities to create one of the most advanced autonomous systems, maritime and aerospace research facilities in Australia.

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Organotronics - Functional Organic Materials Laboratory, University of Melbourne

## CYBERSECURITY

**eng.unimelb.edu.au/industry/cybersecurity**

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

📍 Parkville VIC 3010
✉️ defence-technologies@unimelb.edu.au

### CAPABILITIES

- Network security and cryptography
- Anomaly and network intrusion detection
- Authentication and authorisation
- Distributed computing and peer to peer network
- Network fault diagnosis
- Information security management
- Network auditing and accounting

### KEY INFRASTRUCTURE

- Academic Centre of Cybersecurity Excellence
- Cloud Computing and Distributed Systems Laboratory (CLOUDS)
- Spartan High Performance Computing-Cloud Hybrid System

### KEY PILLARS

| Pillar | | Pillar | |
|---|---|---|---|
| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | ▨ |

## MARITIME SYSTEMS

**eng.unimelb.edu.au/industry/defence-technologies**

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

📍 Parkville VIC 3010
✉️ defence-technologies@unimelb.edu.au

### CAPABILITIES

- Metocean modelling
- Spectral wave modelling and prediction
- Fluid-structure interactions
- Floating ice-wave-ship interactions
- Airflow over ships and structures
- Environmental modelling and monitoring
- Gas turbines for land/sea/air
- Diesel engines and alternative fuels

### KEY INFRASTRUCTURE

- Comprehensive metocean databases
- World's largest wave-air water tank
- Diesel engine test rigs
- Octane rating engine
- Constant volume chamber
- Wind tunnels
- Ice-wave-air tank

### TECHNOLOGY TRANSFERS

- Reduced drag on bio-fouled ships
- Parametric hurricane models for off-shore industries
- Optimised submarine engine performance for DSTG

### KEY PILLARS

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|---|---|---|---|
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| Enhanced Human Performance & Protection | | Quantum Technologies | |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | |

# AEROSPACE

**eng.unimelb.edu.au/industry/defence-technologies**

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

⊙ Parkville VIC 3010
✉ defence-technologies@unimelb.edu.au

## CAPABILITIES

- Experimental and numerical studies of complex aerodynamics and turbulent flows
- Flow control, drag reduction strategies, aero-acoustic control
- Swarming of UAVs, multi-agent dynamics, networked dynamic systems, data-driven control
- Computational modelling for the design of lightweight alloys by additive manufacturing
- Optimal diesel engine and gas turbine engine performance
- Turbulent boundary layers - simulations, measurements and control
- Alternative fuels in gas turbines
- Interaction of ocean waves and structures

## KEY INFRASTRUCTURE

- Large-scale wind-tunnel facilities with flow diagnostic capabilities
- UAV swarm test facility
- High pressure combustion rigs, with detailed laser-based flow, temperature and combustion species diagnostics
- Air-sea interaction (tow tank) facility
- Proven in-house computational aerodynamics, aeroacoustics, aerothermal and combustion simulations
- Ice-air-sea interaction facility
- Optical engine
- Constant volume engine chamber test facility

## TECHNOLOGY TRANSFERS

- Measuring and analysing vortex dominated flows for wings of fixed wing aircraft and helicopters
- Flow control for drag reduction
- Autopilot design for high-speed air borne vehicles for defence
- Distributed UAV control for Defence

## KEY PILLARS

| Pillar | | Pillar | |
|---|---|---|---|
| Advanced Sensors & Processing | ▨ | Modelling, Simulation & Analysis | ▨ |
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| Enhanced Human Performance & Protection | ▨ | Quantum Technologies | |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | ▨ |

# COMPUTER ASSISTED REHABILITATION ENVIRONMENT (CAREN)

**eng.unimelb.edu.au/industry/defence-technologies**

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

⊙ Parkville VIC 3010
✉ defence-technologies@unimelb.edu.au

## CAPABILITIES

- Replicate and measure real life movement within a range of applied scenarios
- Measure real-time physical consequences of sensory inputs and outputs preceding intended and unexpected movement
- Analyse cognitive and physical impacts of equipment design
- Test and improve equipment to avoid injuries

## KEY INFRASTRUCTURE

- Multi-sensor and multi-sensory stimulating biomechanical laboratory
- Electromyography (EMG), electroencephalography (EEG) and functional near-infrared spectroscopy (FNIR)
- Immersive virtual reality-based environment

## KEY PILLARS

| Pillar | | Pillar | |
|---|---|---|---|
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| Enhanced Human Performance & Protection | | Quantum Technologies | ▨ |
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# MEDICAL COUNTERMEASURES

eng.unimelb.edu.au/industry/defence-technologies

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

⊙ Parkville VIC 3010
✉ defence-technologies@unimelb.edu.au

## CAPABILITIES

- Public health preparedness and emergency response
- Epidemiology for disease surveillance and management
- Basic research to product
- Clinical research and international health
- Vaccines, drug discovery, drug delivery and diagnostics
- Environmental modelling and monitoring
- Synthetic and systems biology

## KEY INFRASTRUCTURE

- Significant databases of pathogens and genetic information
- Containment facilities
- Several research based hospitals

## TECHNOLOGY TRANSFERS

- Significant contributions to international bodies such as WHO
- Addressed several tropical diseases - including malaria
- 35 clinical trials for viral infections - including HIV, Hep B, Hep C and cytomegalovirus
- Developed polymer based drug for antimicrobial resistant pathogens

## KEY PILLARS

| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | /// |
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| Enhanced Human Performance & Protection | /// | Quantum Technologies | |
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# MULTIDISCIPLINARY MATERIALS

eng.unimelb.edu.au/industry/defence

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

⊙ Parkville VIC 3010
✉ defence-technologies@unimelb.edu.au

## CAPABILITIES

- Integrated computational materials and engineering
- Blast protection materials
- Advanced diamond science
- Drag reduction surfaces
- Ceramics, polymers and metals
- Biofunctional, nano-medicine and medical implant materials
- Auxetic, meta and nano-photonic materials
- Organic electronic materials

## KEY INFRASTRUCTURE

- Materials characterisation and fabrication platforms
- Clean-room nano and micro device fabrication
- Melbourne Advanced Microscopy including electron and biological optical platforms
- Advanced fluorescence imaging
- Advanced instrumentation, analysis and characterisation
- Melbourne Trace Analysis for chemical, earth and environmental sciences
- Bio21 Magnetic Resonance Platform
- Informatics, Melbourne Computation

## TECHNOLOGY TRANSFERS

- Ceramic powder based rotors
- Ceramic armour for personal protective systems
- Blast protection modelling for defence environments
- 3-D printing of polymers, metal alloys and biomaterial

## KEY PILLARS

| Advanced Sensors & Processing | | Modelling, Simulation & Analysis | /// |
| Big Data Processing & Visualisation | | Multi-Disciplinary Material Sciences | /// |
| Cyber & IT Security | | Propulsion & Energy Storage | |
| Enhanced Human Performance & Protection | /// | Quantum Technologies | |
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| Medical/Pharma Technologies | /// | Trusted Autonomous Systems | |

## MELBOURNE INFORMATION, DECISION & AUTONOMOUS SYSTEMS LABORATORY (MIDAS)

**eng.unimelb.edu.au/industry/ defence-technologies**

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

- Parkville VIC 3010
- defence-technologies@unimelb.edu.au

### CAPABILITIES

- Networked dynamical systems
- Human centric autonomous systems
- Legal and societal implications for autonomous systems
- Sensor and information processing

- Control system design and implementation
- Advanced sensor design - nano and micro sensors
- Robust communications and sensor networks
- Threat Evaluation and Weapon Assignment

### KEY INFRASTRUCTURE

- Swarm land and UAV laboratories
- Multi-modal robotics
- Robotic manipulators (Hand)

### TECHNOLOGY TRANSFERS

- Optimal platform and controller designs for defence industry
- World first web mapping system
- Mine planning algorithm for world's largest iron ore mine

- Radar on chip technology
- Integrated Air and Missile Defence planning tools
- Radar and Sonar Tracking

### KEY PILLARS

| | | | |
|---|---|---|---|
| Advanced Sensors & Processing | ▨ | Modelling, Simulation & Analysis | ▨ |
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| Medical/Pharma Technologies | | Trusted Autonomous Systems | ▨ |

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## QUANTUM INFORMATION

**physics.unimelb.edu.au/research/ By-Area/quantum-information**

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

- Parkville VIC 3010
- defence-technologies@unimelb.edu.au

### CAPABILITIES

- Quantum computing and information processing
- Quantum device modelling and algorithms
- Quantum electronics (including dots and arrays.)

- Quantum probes and sensing
- Quantum optics and imaging
- Quantum electrodynamics

### KEY INFRASTRUCTURE

- ARC Centre of Excellence for Quantum Computation & Communication
- Low-energy, nanometre-depth ion implanter (0.01 - 15 keV)
- MeV Ion Beam facilities - NEC 5U Pelletron (charging potentials up to 5 MV)
- Optical quantum measurement system

- Electron beam (EBL) and photolithographic processing facilities
- Orsay Physics focused ion beam system with crossed e-beam SEM unit
- Leiden Cryogenics closed-cycle, cryogen-free dilution refrigerator
- Optical quantum measurement system

### KEY PILLARS

| | | | |
|---|---|---|---|
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| Medical/Pharma Technologies | ▨ | Trusted Autonomous Systems | |

# INFORMATION WARFARE AND INTELLIGENCE

**Professor Len Sciacca**
Enterprise Professor
— Defence Technologies

Parkville VIC 3010

defence-technologies@unimelb.edu.au

## CAPABILITIES

- Mis and Disinformation research
- Influence
- Intelligence analysis

## KEY INFRASTRUCTURE

- Information warfare testbed (under development)

## TECHNOLOGY TRANSFERS

- Information warfare

**PRIMARY CONTACT**

**AMC Search Ltd**
Consultancy Division of the
Australian Maritime College

✉  amcs.business@utas.edu.au

**utas.edu.au**

# University of Tasmania – Distinctive, Nationally Significant Maritime Capabilities

The University of Tasmania is an established provider of maritime domain research, consultancy, and test and evaluation services to the Defence enterprise, primarily through its specialist institute, the Australian Maritime College (AMC).

AMC is consistently ranked in the top echelon of the International Association of Maritime Universities, with pillars of expertise being Maritime Engineering and Hydrodynamics, Seafaring, Port and Terminal Operations, and Maritime Business and International Logistics.  Multi-disciplinary expertise in Geospatial Science, Oceanography, Information Technology, Mechanical Engineering, Food Science, and in Medical, Psychological, and Health Sciences can be drawn upon within the university by AMC through the Defence and Maritime Innovation and Design Precinct (DMIDP) in Northern Tasmania.

Co-developed with the Defence Science and Technology Group (DSTG), the suite of unique research facilities at the DMIDP is founded upon the AMC's existing Centre for Maritime Engineering and Hydrodynamics. It aims to provide a national centre of excellence for collaborative maritime domain research, test and evaluation, and sovereign industry enabler for Naval Shipbuilding, through the following capabilities:

- Physical testing, simulation, and computational modelling for behavioural prediction of seakeeping and manoeuvring characteristics; structural vulnerability to damage and environmental degradation; power and energy distribution and management; and cavitation and turbulent flows.

- Addressal of technical challenges for deployment and operation of Autonomous Maritime Systems.

- Modelling and simulation for assessment of port design with respect to pilotage and berthage and associated human factors.

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**www.amc.edu.au/research**
**www.utas.edu.au/research**
**www.amc.edu.au/industry**
**www.amc.edu.au/facilities**

AMC Tow Tank scale model testing and modelling for vessel predicted manoeuvring behaviour.

## UNIVERSITY OF TASMANIA (UTAS)

**utas.edu.au/research**

**Professor Anthony Koutoulis**
Deputy Vice-Chancellor
— Research

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▯ +61 3 6226 2737
✉ defence.projects@utas.edu.au

### CAPABILITIES

- Maritime Domain - Maritime Engineering and Hydrodynamics
- Geospatial Info & Intel - Space Geodesy, Terrestrial Remote Sensing, Oceanography, Data Analytics
- Space Services - Tracking, Communications, and Precision Navigation
- Cyber - AI/ML, encryption/decryption, Smart Systems and Cyber Resilience

- Security - Separation Science - portable analytical methods for explosive residue detection
- Logistics - Food Safety and Innovation - specialised shelf stable foods, and supply chain resilience
- Estate & Infrastructure - Asset Management; Port Development; On & Offshore Renewable Energy

### KEY INFRASTRUCTURE

- Towing Tank/Test Basin, Cavitation Lab, Underwater Collision Test Rig, Computational Fluid Dynamics
- Centre for Renewable Energy and Power Systems; Real-Time Power HIL Simulator
- Centre for Food Innovation - Microwave Assisted Thermal Sterilisation

- Human Interface Technology Lab; Centre for Maritime Simulations
- Maritime AUV/USV/ROV Suite; Coastal Support Vessel
- Radio Telescopes - AuScope Array
- Central Science Lab; Centre for Research on Separation Science

### TECHNOLOGY TRANSFERS

- GreyScan ETD-100 Inorganic Explosive Detector (Grey Innovation and ACROSS)
- Microwave Assisted Thermal Sterilisation (MATS) for long shelf life fresh foods

- Long-term fluid dynamics collaborative research program with DSTG for maritime platforms

### KEY PILLARS

| Advanced Sensors & Processing | ▨ | Modelling, Simulation & Analysis | ▨ |
|---|---|---|---|
| Big Data Processing & Visualisation | ▨ | Multi-Disciplinary Material Sciences | ▨ |
| Cyber & IT Security | ▨ | Propulsion & Energy Storage | ▨ |
| Enhanced Human Performance & Protection | ▨ | Quantum Technologies | |
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↑ Professor Roger Stanley applying 3D printing technology to food production at the Centre for Food Innovation (CFI).
The CFI focusses on value addition to primary produce, such as the production of high quality shelf stable foods that retain nutritional and sensory quality under extremes of time and temperature.

# MARITIME ENGINEERING AND HYDRODYNAMICS

—

**amc.edu.au/research**

**Dr Megan Dean**
Project Manager (Research)
— Australian Maritime College

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▯ +61 2 6324 4452

✉ megan.dean@utas.edu.au

## CAPABILITIES
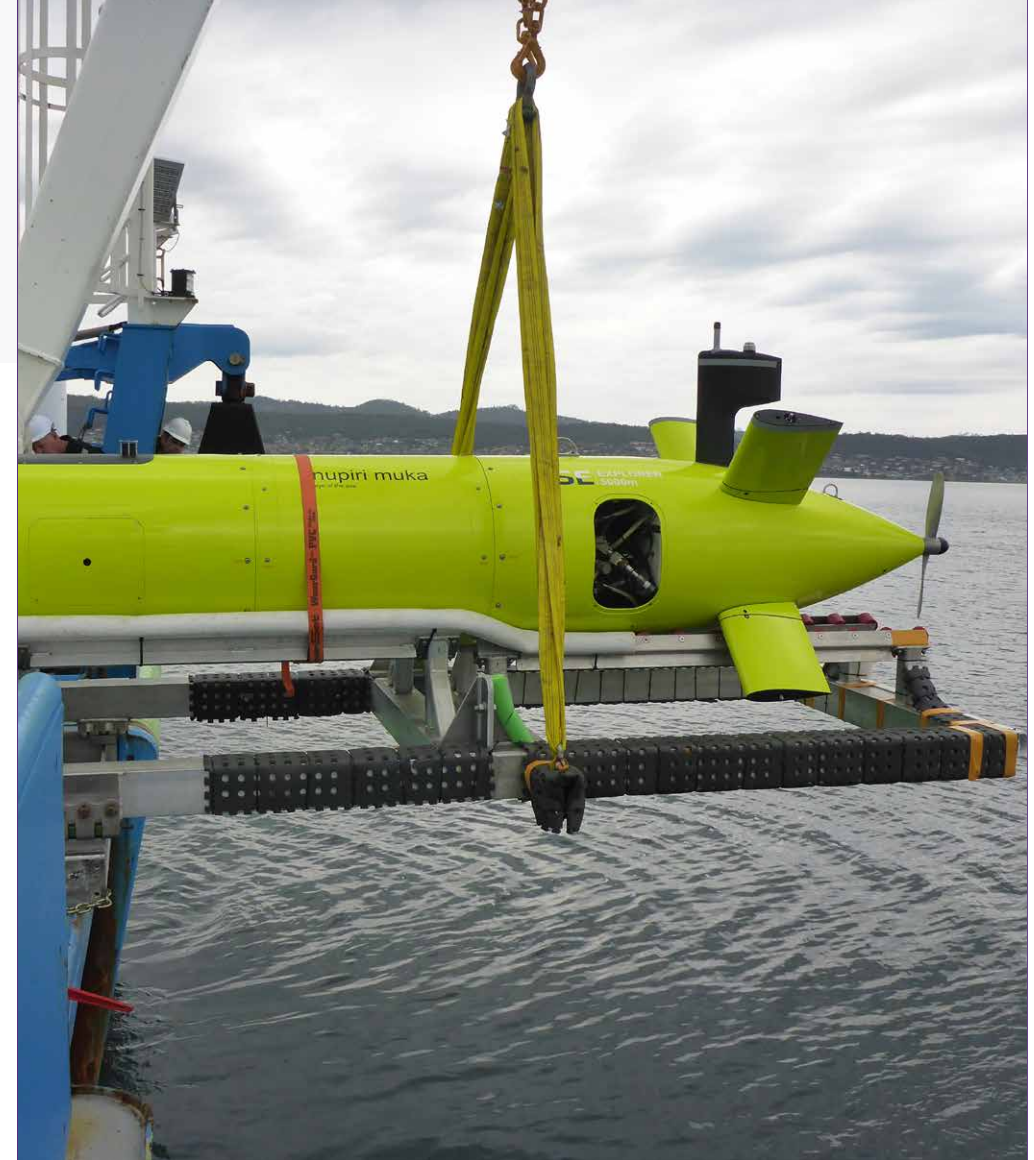
- Seakeeping and Stability: Vessel dynamic motion prediction
- Manoeuvring: Vessel behavioural prediction from hydrodynamic interactions
- Cavitation and Turbulent Flows: characterisation of phenomena and effects (eg. broadband noise, wake)
- Structural Integrity: stress prediction due to wave-induced and extreme (collision, shock, blast) loads

- Structural Integrity: prediction of resilience and environmental degradation
- Power & Energy: predicting demand, supply, distribution; optimising engine performance/emission reduction
- Autonomous Systems: deployment and performance optimisation
- Bespoke Training - compliant with AMSA, IMO, Polar Code

## KEY INFRASTRUCTURE

- Towing Tank and Wave Basin: physical model testing in variable waves and motions
- Cavitation Lab: Variable pressure water tunnel and precision bubble population control to characterise cavitation & wake
- Underwater Collision Research Facility: vertical drop rig, Split Hopkinson bars, universal test rig, & materials characterisation test equipment to study crashworthiness
- Environmental Lab: includes ion/gas chromatography, spectrophotometry, corrosion measurement

- Real-Time Power Simulator with hardware in the loop for system modelling
- Centre for Maritime Simulations: full mission bridge & two integrated tugs, with advanced hydrodynamics & motions modelling & realism
- Autonomous Maritime Systems Lab: fleet of small UUV/USV/ROV, large UUV, support vessels, mission simulator & workshop
- Common User Facility (in development): secure collaborative environment with networking capability compliant with Physical Security Zoning

## KEY PILLARS

| | | |
|---|---|---|
| Advanced Sensors & Processing | Modelling, Simulation & Analysis | ▨ |
| Big Data Processing & Visualisation | Multi-Disciplinary Material Sciences | ▨ |
| Cyber & IT Security ▨ | Propulsion & Energy Storage | ▨ |
| Enhanced Human Performance & Protection | Quantum Technologies | |
| Hypersonics & Directed Energy Capabilities | Space Systems | |
| Integrated Intelligence, Surveillance & Reconnaissance | Sustainment | ▨ |
| Medical/Pharma Technologies | Trusted Autonomous Systems | ▨ |



↑ The Explorer class nupiri muka is a large modular AUV capable of operating in some of the most difficult conditions on earth, including beneath floating ice shelves.

This vehicle has flexible payload options and can dive to 5000m and travel at speed between 1.0-2.0 m/s.

# GEOSPATIAL INFORMATION AND INTELLIGENCE - SPACE SERVICES

**utas.edu.au/research**

**Professor Erik Wapstra**
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— College of Sciences and Engineering

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## CAPABILITIES

- Very Long Baseline Interferometry - astronomical PNT techniques and GNSS/GPS geodetic reference frames improvement
- Environmental Space Geodesy: measurement of ice-sheet/sea-level change, earth crustal deformation, polar dynamics
- UAS Land and Cryosphere Survey: Integrated visible, multispectral, hyperspectral, thermal, and LiDAR sensors
- Satellite Remote Sensing: detection of environmental events, e.g., bushfires, deforestation, land degradation

- Physical Oceanography: Observation through deployed instrumentation, moorings, autonomous systems; ocean modelling
- Geo-physical Oceanography: ocean basin exploration - canyons, hydrothermal vents, ridges and sea-floor volcanism
- Cryospherics: sea-ice biogeochemistry, sea ice-ocean interactions, ice-shelf dynamics, ice shelf-ocean processes
- Autonomous Maritime Systems - sensor integration; mission planning; deployment in remote and extreme environments

## KEY INFRASTRUCTURE

- 5 Radio Telescopes (TAS, WA, SA, NT) - VLBI Array
- Earth Observation Group - TerraLuma Team (UAS Survey) and Environmental Space Geodesy Team
- Oceans and Cryosphere Centre
- Large ISE Polar Explorer AUV - 5000m depth, 40 hour endurance, modular hydrographic/oceanographic sensors

- Medium and Small (REMUS 100) AUV; Small ROV; Small USV; Mission Planning System
- 35m Vessel 'Bluefin' - 20 pax, 56 sq metre Free Working Deck, marine science modular systems deployment

## TECHNOLOGY TRANSFERS

- International Earth Rotation and Reference System Service (IERS); International VLBI Service (IVS)

- Algorithms for joint development with an industry partner of 3D Earth Models

## KEY PILLARS

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Exploring the night sky at the Greenhill Observatory, Bisdee Tier.

The observatory building has a rotatable dome housing the new telescope and associated spectrograph, computer and control rooms. A second building serves as quarters for observers and provide facilities for students, researchers and visitors.
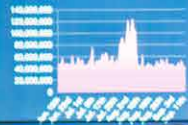
ICT researchers utilising the Live Cyber Threat Map

## SPACE CONTROL - INFORMATION AND CYBER DOMAIN

**utas.edu.au/research**

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### CAPABILITIES

- Space Tracking and Communications - Antennas for comms and mission support from LEO to deep space
- Space Domain Awareness - Accurate tracking and orbit determination
- Data Analytics and Visualisation: optimisation of decision-making and production/logistics processes efficiency
- AI Techniques: application of machine learning enabling network intrusion-detection
- Data focused systems leveraging blockchain technologies; cloud-based computing optimisations
- Digital information encryption and decryption
- Advanced Human-Computer Interface technologies (VR/MR); neural nets/deep learning to optimise image processing

### KEY INFRASTRUCTURE

- National Radio Telescopes Network (TAS, WA, SA, NT) - VLBI Array and Satellite Altimeter Calibration
- Human Interface Technologies Lab (HITL)
- Tasmanian Partnership for Advanced Computing (TPAC) - data analytics and visualisation

### TECHNOLOGY TRANSFERS

- AuScope Array support and management under the NCRIS with Geoscience Australia
- High precision tracking and scientific collaboration for multiple international Space Missions

### KEY PILLARS

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| Medical/Pharma Technologies | | Trusted Autonomous Systems | |

## LOGISTICS, ESTATE AND INFRASTRUCTURE, SECURITY

**utas.edu.au/research**

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— Australian Maritime College

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### CAPABILITIES

- Food Innovation: development of fresh-like, shelf-stable foods, and specialised foods for high performance
- Separation Science - portable analytical methods applicable to explosive residue detection
- Maritime Infrastructure Management - prediction of environmental degradation and maintenance requirements
- Port Development - design evaluation via hydrodynamic and environmental modelling and simulation
- Onshore and Offshore Renewable Energy

### KEY INFRASTRUCTURE

- Centre for Food Safety and Innovation - Microwave Assisted Thermal Sterilisation
- Central Science Lab; AUS Centre for Research on Separation Science (ACROSS)
- MarIIne Lab: ion and gas chromatography, spectrophotometry, corrosion measurement
- Towing Tank and Model Test Basin: physical model testing in variable waves and motions complemented by CFD
- Centre for Maritime Simulations: shiphandling suite with advanced hydrodynamic modelling and motion accuracy
- Centre for Renewable Energy and Power Systems (CREPS)

### TECHNOLOGY TRANSFERS

- Microwave Assisted Thermal Sterilisation (MATS) for long shelf life fresh foods - DSTG and CSIRO
- GreyScan ETD-100 Inorganic Explosive Detector (Grey Innovation and ACROSS) for Airport, Defence, Event Security

### KEY PILLARS

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**VICTORIA UNIVERSITY**

**PRIMARY CONTACT**

**Professor Andy Hill**

Deputy Vice-Chancellor Research and Impact (DVC-RI)

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**vu.edu.au/research**

# Human-centric Research at Victoria University (VU)

Victoria University is leading human-centric research with capabilities ranging from micro-level cells research to the psychological, physiological and biomechanical characteristics of everyday tasks. The fully equipped technologically advanced laboratories at Western Centre for Health Research and Education at Sunshine Hospital, a collaboration with the University of Melbourne, is primed for biological research with work focused on development and testing of vaccines and drugs for chronic diseases from cells, animals to translational clinical research. A Sport and Exercise research and development facility at Footscray Park houses laboratories to support biomechanics, motor control, exercise science and genetics. Further facilities include environmental chambers and an altitude hotel that provide specialist capabilities for longitudinal investigations of human performance in various temperature, humidity and durational conditions. The $1.2 billion Western Health hospital opposite the Footscray Park campus will provide integration with biomedical research focused on chronic diseases and disorders. In late 2025, VU will open a research building on the hospital campus providing further opportunities for health-related research and partnering.

VU is building extensive networks with Australian defence research organisations, having successfully delivered projects in exoskeletons and other assistive devices for minimising injuries during heavy load carrying and manual handling tasks, genetics for future generation soldiers, and fire protection in submarines. The intrinsic focus on humans means that VU is well poised for collaborative research projects. VU has a close association with Defence Science Institute (DSI), Defence Science Technology Group (DSTG) and Department of Jobs, Skills, Industry and Regions (DJSIR).

Biomechanical and physiological evaluation of heavy load carrying.

# TECHNOLOGY-AUGMENTED HUMAN PERFORMANCE

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**vu.edu.au/research**

**Professor Rezaul Begg**
Chair
— Program in Assistive Technologies Innovation (PATI)

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## CAPABILITIES

- The Biomechanics and Physiology Laboratories form part of the purpose-built, world-leading human movement research institute
- World-class researchers with expertise in physiological and biomechanical evaluation of civilian and military personnel
- Capabilities to evaluate exoskeletons and other motion-assisting devices that enhance soldier mobility
- Artificial intelligence applications to biomechanical data classification and real-time motion prediction
- State-of-the-art analysis methods to understand how to optimise training and nutrition to improve health and performance

## KEY INFRASTRUCTURE

- A very large data capture volume of 436 m2 with a 10-m ceiling for overhead filming and a safety harness system
- Motek High-Performance M-Gait System
- Kinetic measurement apparatus (19 in-ground force plates, Pedar system, AMTI force plate-integrated treadmill)
- Motion capture systems (60-camera Vicon and 10-camera Theia markerless)
- Muscle activity measurement (EMG) and muscle oxygenation evaluation
- Environmental chambers (to manipulate temperature and altitude)
- Metabolic carts and ergometers to assess metabolism
- Analysers to measure changes in metabolites, hormones, and markers of inflammation in blood, saliva, and muscle

## TECHNOLOGY TRANSFERS

- Augmented feedback rehabilitation technology
- AI-controlled manual-handling exoskeleton to protect workers from back injuries
- Gait correcting insole technology with application to gait remediation
- Smart shoe technology for navigation assistance

## KEY PILLARS

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| Medical/Pharma Technologies | Trusted Autonomous Systems | |

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# FIRE SAFETY

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**vu.edu.au/fire-research-group**

**Professor Maurice Guerrieri**
Head
— VU Fire Research Group

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▢ +61 3 9919 8041
✉ Maurice.Guerrieri@vu.edu.au

## CAPABILITIES

- Specialist facilities, including a NATA accredited fire testing facility, form part of the institute's fire research capability
- Structural fire performance of tunnel lining infrastructures
- Development and testing of new technologies for suppression of fires
- Solid propellants non-steady combustion modelling - ZN theory and CFD methods
- Solid propellant combustion testing - performance of existing and new propellant formulations
- Development and testing of water mist based suppression systems for fires involving aviation fuels
- Development and testing of suppression systems (water mist based and others) for protection of aircraft engines

## KEY INFRASTRUCTURE

- 4x3x3 Structural Fire Testing Furnace (NATA accredited)
- Comprehensive range of small scaling testing equipment for thermal and combustion properties of solid propellants
- Large scale high pressure (100 bar ) water mist fire suppression system
- 3 MW Cone Calorimeter and ISO room for fire testing

## TECHNOLOGY TRANSFERS

- Low pressure water mist fire suppression technologies
- Fire risk assessment for future submarine
- Smoke detector locations & effective notification via their interconnection

## KEY PILLARS

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# INSTITUTE FOR HEALTH AND SPORT (IHES)

**vu.edu.au/institute-for-health-sport-ihes**

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## CAPABILITIES

- Mechanisms of health disorders and developing appropriate interventions
- Developing clinical and community well-being programs
- Impact of human behaviour, social and policy changes that contribute to changes in health
- Techniques to enhance human sport performance in training, competition and business

## KEY INFRASTRUCTURE

- Biomechanics laboratory for human movement testing and measurement
- Biochemistry laboratory for tissue biopsies and gene testing
- Motor control laboratory for human performance testing
- Environmental chambers for human performance testing under pressure, temperature and humidity variation
- PCR capabilities for food, drug and DNA testing

## KEY PILLARS

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# INSTITUTE FOR SUSTAINABLE INDUSTRIES & LIVEABLE CITIES (ISILC)

**vu.edu.au/institute-for-sustainable-industries-liveable-cities-isilc**

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## CAPABILITIES

- Counter terrorism research focused on human behaviour and techniques to detect violent extremism
- Cryptography and artificial intelligence for improved cybersecurity
- High frequency wireless RF measurement and characterisation capabilities eg 3G/4G/5G
- Thin film fabrication and testing for water membrane and various sensor technologies

## KEY INFRASTRUCTURE

- RF measurement and characterisation into 60 GHz region
- Thin film sensor fabrication and characterisation
- Materials analysis equipment including XRD, FTIR, TGA/DSC, porosimetry, surface change, particle size

## TECHNOLOGY TRANSFERS

- Technology for membrane integrity monitoring
- Membrane processes for containment removal from waste water
- Image processing for abnormal prediction

## KEY PILLARS

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