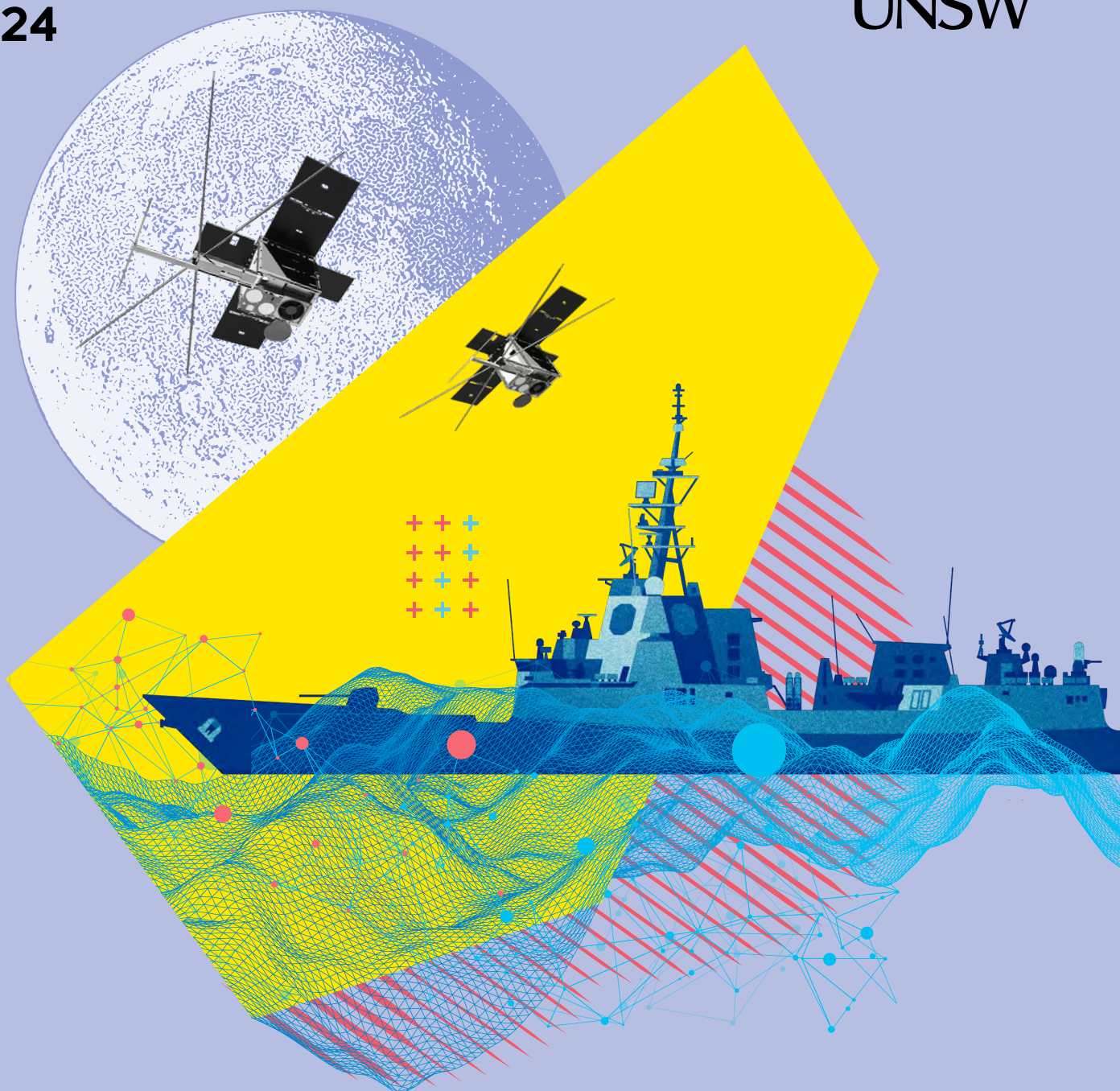


**FUTURES  
EXPO  
SERIES  
2024**



**UNSW**



# **FUTURE DEFENCE & SECURITY**

Breakthrough technologies & capabilities,  
powered by UNSW



# Future Defence and Security Expo 2024

The Future Defence and Security Expo 2024 showcases UNSW research designed to bolster national resilience and social stability, centred on five critical areas.

**Defence Human Sciences** focuses on medical and mental health, health data analytics, and chemical, biological, radiological and nuclear (CBRN) defence. Pioneering solutions to enhance the wellbeing of defence and security personnel include the Traumatic Stress Clinic's novel AI-driven program that can detect post-traumatic stress disorder (PTSD) using facial, acoustic, and speech data collected from smartphone recordings. The Creative Robotic Lab uses non-intrusive sensors to measure cognitive load in real time, with the goal of improving individual and team performance amongst UAS operator crews.

**Digital Threat Detection & Response** integrates advanced cyber techniques, electronic warfare, and autonomous systems to strengthen our defence against sophisticated antagonists, both foreign and domestic. Key UNSW projects include AI-enabled human-swarm teaming that allows for the effective command of tens to thousands of autonomous agents; OrgIntel – a threat intelligence system powered by large language models; and an AI framework created to detect and track disinformation campaigns.

**Protection & Deterrence Systems** help safeguard Australia across maritime, land, and air domains. The Advanced Optoelectronic Sensing Group merges light and nanotechnology to extend our sensing and surveillance capabilities, while the Hypersonic Vehicles Group develops experimental and numerical tools to uplift the design of hypersonic systems and countermeasures.

**Emerging Enabling Technologies** are set to revolutionise Australian defence capabilities. Additive manufacturing, secure power generation and control, quantum technologies, and nuclear engineering are areas in which UNSW research is gaining traction. In addition, spinouts such as Diraq and Silicon Quantum Computing (SQC) play a pivotal role in unlocking these capabilities to drive high-value industry transformation.

**Societal Resilience, Security & Stability** is underpinned by sovereign capability, conflict resolution, and the safeguarding of our valuable environment and resources. The Regional Ocean Prediction group combines observations and modelling to predict the ocean's subsurface – an important factor in managing the safe operation and sustainable growth of marine industries. UNSW researchers are also concerned with the economic security of Australia, advising government policymakers on a range of key interests including export, critical supply chains and the tools needed for green energy transition.

The Future Defence and Security Expo 2024 is where innovative technologies, strategic research, and industry collaboration converge to redefine Australian security. Together, we can achieve a more resilient tomorrow

**Professor Stephen Rodda**  
Pro Vice-Chancellor Industry & Innovation  
UNSW Sydney



Discuss your  
project or idea  
with UNSW



# Future Defence and Security Overview

Future Defence and Security showcases the breadth and depth of translational research and technology at UNSW driving our national resilience and security. It includes research projects, groups, programs, institutes, and facilities. It also highlights pioneering companies, including spinouts, startups, and colocating enterprises, commercialising research within the UNSW innovation ecosystem.

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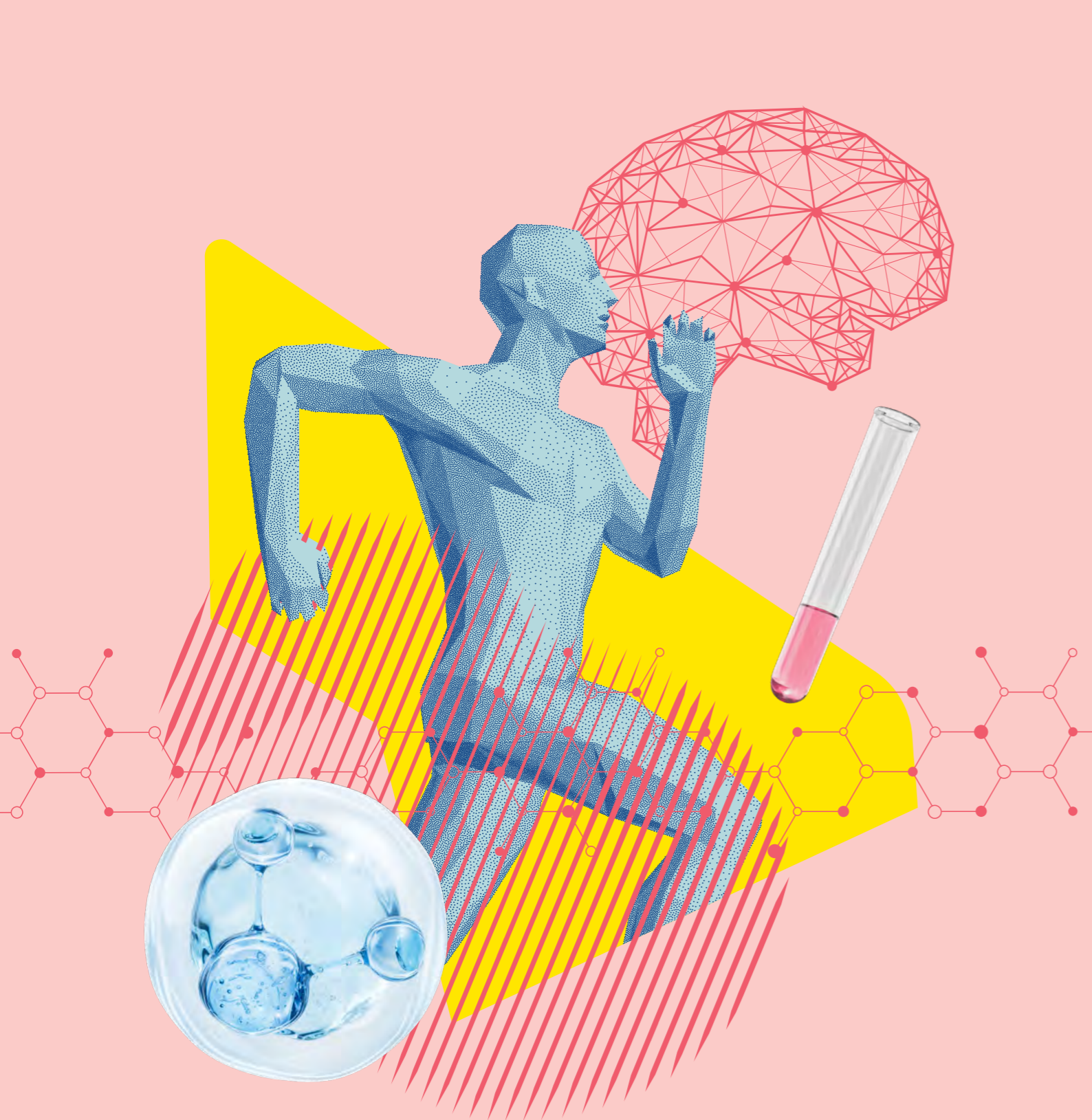
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# Defence Human Sciences



## > AI-assisted Cognitive Load Assessment for Mission Aviators

Unique system for assessing the cognitive load and situational awareness of Mission Aviators to improve training and ability to cope with complex operational situations

### Research Project

Mission Aircrew, part of the Australian Defence Force (ADF), work on a range of military aircraft, operating some of the world's most sophisticated airborne electronic systems. Often in the backseat of a fast jet, they manage various systems, which can involve surveillance and battle management, air combat, or maritime patrol and response, demanding a high cognitive load.

To enhance the safety and efficiency of each mission, CAE and UNSW are collaborating under the Defence Trailblazer initiative to replicate complex operational tasks and training scenarios. Currently, mission aviators are trained to perform tasks such as remote piloting, sensor operation, mission planning, and weapons system operation. However, they face the risk of cognitive overload and poor situational awareness during training. If not addressed, these issues can persist in actual missions. Present training heavily relies on instructor intervention and subjective assessment. This project aims to automate the assessment of cognitive load and situational awareness with AI assistance, providing objective grading and easing the workload on instructors during formative task training.

The project addresses Defence requirements to understand the training needs for operators of systems with high cognitive load and task performance risk. The introduction of Robotics and Autonomous Systems (RAS) capability in Defence is expected to play a key role in sovereign capability. Such systems will require a capable workforce to operate them, collect and interpret data, and make decisions based on the provided information. Training these operators will necessitate a complementary and intelligent training ecosystem that can monitor trainee performance and provide adaptive learning strategies. This ensures progression that suits the learner, results in uniform competency standards, and minimizes attrition in training.

The need for appropriate training for RAS use has been identified in the NAVY RAS-AI strategy 2040, the ARMY RAS Strategy V2, and the requirement planning for projects such as AIR 5428 Phase 3.



### ⚙️ Key capabilities

- > Decision-making of command-and-control personnel in complex operational environments
- > Situational awareness in complex situations
- > AI-based technology to assist with improved performance

### 💡 Differentiators

- > First prototype demonstration of key enablers technologies for next generating sensing, command, and control of fleets of RAS
- > AI-based algorithm to assist with the training of mission aviators' situational awareness and decision-making based on different levels of cognitive load
- > Project addresses Defence requirements to understand the training needs for operators of systems where there is the potential for high cognitive load and task performance risk extreme pressures

### 👥 Key customers

- > Royal Australian Air Force
- > Australian Army
- > Royal Australian Navy

### 🤝 Key partnerships

- > Defence Trailblazer
- > CAE

🌐 [dtb.solutions/cognitive-load-cae](https://dtb.solutions/cognitive-load-cae)



## > Changing Resistant Cultures: Defence Reform and Capability

### Meeting tomorrow's Defence capability needs for recruitment diversity

#### Research Project

Reforming resistant cultures is extremely difficult, even more so when the organisation has a long history of values, behaviours, and artefacts. Defence no longer has a choice but to reform if it is to meet the human capability requirements of the future. How this reform can be done successfully to enhance diverse recruitment and retention while maintaining capability and the spirit of Defence is a serious challenge.

The Royal Commission into Defence and Veteran Suicide recommendations are just one example of the significant challenges Defence faces in reforming its culture. The DVSRC extensively used this team's research to guide their findings and understanding of how culture change can be achieved. It is also explained in the just published: *Warrior, Soldier, Brigand: Institutional reform in the Australian Defence Force*.

UNSW Canberra, via the Public Sector Research Group, has a long history of researching and advising Defence on culture and reform. If Defence is serious about reforming for diversity and capability, the team is ready to partner.

#### ⚙️ Key capabilities

- > Novel solutions for the difficult problem of military cultural reform
- > Proving capability in analysing and addressing culture and behaviour

#### 💡 Differentiators

- > Different thinking and approaches are needed – academic-led research offers the only way to gain new insights and avoid tired, old consultants

#### 👥 Key customers

- > Defence People Group
- > Defence industry

#### 🌐 [unsw.to/james-connor](https://unsw.to/james-connor)

## > Cognitive Load Autonomous Advisory System (CLAAS)

### CLAAS enhances UAS operator performance and wellbeing by providing real-time feedback on cognitive load to improve efficiency

#### Research & Development Project

In collaboration with 20th Regiment, Royal Australian Artillery, a team of researchers from the UNSW Creative Robotics Lab successfully have developed an autonomous advisory system comprised of hardware and custom AI-driven software that can estimate and present an individual's real-time cognitive load using data from non-intrusive sensors (HPRnet Project 11907).

The Cognitive Load Autonomous Advisory System (CLAAS) provides critical information to improve individual and team performance and contribute to maintaining the wellbeing of Unmanned Aerial System (UAS) operator crews, through feedback on their estimated cognitive load in real time.

During 2020–2024, in a series of experiments with civilians at the National Facility for Human-Robot Interaction Research (NFHRI), CLAAS achieved a prediction accuracy of 87% in determining whether a person is under high or low cognitive load. CLAAS combined real time video, eye tracking, and voice data to generate these predictions. Novel interfaces for graphical representation of cognitive load information were also developed through two design iterations in close collaboration with 20th Regiment personnel.

CLAAS is currently at TRL 6, and ready to move from research to commercial development.

CLAAS was developed at the Creative Robotics Lab, a transdisciplinary lab that advances human-machine interaction by designing and evaluating novel human-centred technologies and tested at the National Facility for Human-Robot Interaction Research.



#### ⚙️ Key capabilities

- > Unintrusive measurement of cognitive load via an autonomous AI system
- > State-of-the-art testing with the NFHRI
- > Novel interface design and implementation

#### 💡 Differentiators

- > Novel unintrusive AI approach to cognitive load measurement
- > High accuracy (87%) cognitive load prediction
- > CLAAS deployed on UAS training simulator

#### 👥 Key customers

- > Defence - training, endurance, and team performance
- > Driving - focus detection for improved driver decision making
- > Industry - e.g., assist human performance in air traffic control environments

#### 🤝 Key partnerships

- > Australian Army
- > Defence Science and Technology Group

#### 🏆 Quality accreditations and awards

- > Initial research funding under competitive grant (HPRnet 11907)

#### 🌐 [unsw.to/creative-robotics-lab](https://unsw.to/creative-robotics-lab)



## > Dementia Prevention for Individuals and Society

**Innovative, cost-effective, accessible and evidence-based programs and tools that measure and prevent dementia and cognitive decline**

### Research Project

Dementia is Australia's second leading cause of death, and the leading cause of death for women. More than 420,000 people are estimated to be currently living with dementia, however, this number is expected to more than double by 2050. That said, dementia is not a normal part of ageing. Up to 40% of dementia cases could be prevented or delayed by small changes in lifestyle. Scientia Professor Kaarin Anstey leads a program of work developing scalable dementia risk assessment and interventions for individuals. Current projects include:

CogDRisk (Cognitive Health and Dementia Risk Assessment): a free online risk assessment tool that provides the user with an assessment of their dementia risk and a personalised report that they can discuss with their GP.

MyCoach (Connected Advice for Cognitive Health): a digitally delivered multidomain intervention for cognitive decline and risk of dementia in adults with mild cognitive impairment or subjective cognitive decline.

## > Drop Bio Health

**Remote blood testing for health monitoring and assessment of defence personnel**

### Co-locator - UNSW Sydney

Monitoring of people's health, especially during periods of prolonged stress, is critical in understanding the impact on their health and making decisions regarding their welfare. Blood testing is a critical component of health assessments, however, the process of collecting a blood sample is not viable in many situations or environments that defence force personnel encounter.

Drop Bio Health has developed Remote Control, a blood collection and transportation technology that enables simple and convenient capillary blood samples to be collected and transported. This process avoids issues associated with traditional blood collection and enables the accurate analysis of the blood sample, even when cold-chain transportation may be unavailable.

The technology is an opportunity to collect blood samples from individuals in previously unsuitable, remote or adverse situations, and for samples to be returned to a lab without sacrificing test accuracy.

### Key capabilities


- > CogDrisk uses the latest evidence to help the user understand their dementia risk profile – producing a personalised report for GPs to use for individualised care
- > MyCoach is the first multidomain dementia risk reduction intervention for people with memory concerns or mild impairment that is delivered remotely using digital technology

### Differentiators

- > Digital health tools for dementia risk reduction that are accessible and scalable
- > CogDrisk is included in GP training across Australia and will be available in different languages to reach Culturally and Linguistically Diverse (CALD) communities
- > MyCoach is the first non-pharmacological intervention for people with mild cognitive problems that is delivered online so it can reach people from regional and rural areas

### Key customers

- > Empowering communities and individuals, at any age, to make lifestyle changes that improve their dementia risk and cognitive decline
- > General practitioners, neurologists, geriatricians, and old-age psychiatrists who would like to either offer risk assessment or lifestyle modification, supplementing clinical work and practice to inform high quality care
- > Supporting government policymakers and national data agencies to better prepare for our ageing population

 [unsw.to/kaarin-anstey](https://unsw.to/kaarin-anstey)

### Key capabilities

- > Expertise in collection, transportation and analysis of capillary blood samples
- > Proprietary method to generate accurate test results from remotely collected samples
- > Laboratory infrastructure to support diverse sample testing requirement

### Differentiators

- > Proprietary Remote Control technology enabling transport of blood samples in uncontrolled environments
- > Patent pending blood sample degradation modelling to enable accurate analysis of remotely collected samples

### Key customers


- > Pathology labs looking to expand their capabilities in remote testing and access new population groups
- > Population health monitoring to enable large-scale analysis of population groups for critical health measures
- > Clinical trials to provide greater engagement and diversity by supporting at-home testing and reducing burden on patients

### Key partnerships

- > Red Cross Blood Service – LifeBlood
- > Virtus Health – IVF Diagnostics

### Quality accreditations and awards

- > Lab accreditation – ISO17025 / Quality system – ISO13485

 [dropbiohealth.com](https://dropbiohealth.com)



## > Goldys Biosensor Research Group

### Pioneering the development of non-invasive biosensors and diagnostics using cutting-edge NanoCircle CRISPR detection

#### Research Group

Rapid and accurate diagnosis is crucial to prevent infection spread in Defence environments, such as military vessels, field hospitals, quarantine at military bases, and borders. Rapid Infection Tests (RATs), with ~30% false negatives in asymptomatic individuals, are insufficiently sensitive, while PCR tests are slow and costly for mass screening at entry points. This inability to rapidly identify infectious individuals hinders outbreak control and exacerbates disease transmission.

The Goldys' Biosensor team develops NanoCircle technology, offering tests as accurate as lab-based PCR but with rapid, on-the-spot detection. It collaborates with commercial partners and Defence to establish a new standard for scalable infection diagnostics, which are also relevant for food industry, agriculture, and biosafety management.

NanoCircle technology could expedite rapid response to emerging pathogens. Its industrial and clinical rollout in Australia aims to leverage emerging infrastructure for RNA vaccine production.

## > Leading and Managing People in a Systems-Informed Way

### Creating different futures by learning how to analyse and leverage systems that are stuck

#### Research Group

The Defence Strategic Review shows that the ADF is currently not fit-for-purpose. It recommends a holistic approach for a more integrated and capable force.

Defence encompasses many interrelated and independent parts. It has frequently tried to fix similar problems in apparently different contexts, e.g. retention. What this has led to is repeated use of the same fixes with similar outcomes and, usually, no real system change. When the need for integration is paramount, integrating horizontally and vertically across different domains requires a system-thinking lens that considers all the interconnections, stocks, flows and feedback loops.

This research group helps organisations to identify and address systemic issues, fostering progress through systems thinking. It offers a micro-credential course on high-performance through system thinking that offers an understanding of the essentials of managing complex systems to achieve desired outcomes, emphasising horizontal and vertical integration within multi-level systems.



#### Key capabilities

- > Rapid, accurate diagnosis of pathogens using NanoCircle CRISPR detection
- > Novel biosensors detecting pathogens and other organisms by their genes
- > Compatible with test strips, sensing devices, and automated sensing systems



#### Differentiators

- > Patent-protected NanoCircles-based gene detection
- > End-user friendly replacement for the current gold-standard method, i.e. PCR
- > Established institutional partnerships with the Department of Defence, and a range of industry partners and end-users



#### Key customers

- > DF in the field of mass testing for infectious agents
- > Government instrumentalities in charge of Australian biosecurity
- > Human and veterinary health authorities and relevant industry



#### Key partnerships

- > Partnership with ADF within CADRE OCE
- > Recipients of a CRC-P funding
- > Supported by ARC, NHMRC and other agencies



[unsw.to/arc-leadership](https://unsw.to/arc-leadership)



#### Key capabilities

- > Ability to understand how complex systems work
- > Ability to identify systemic issues
- > Ability to identify leverage points



#### Differentiators

- > Published research
- > Experience in helping organisations identify systemic issues

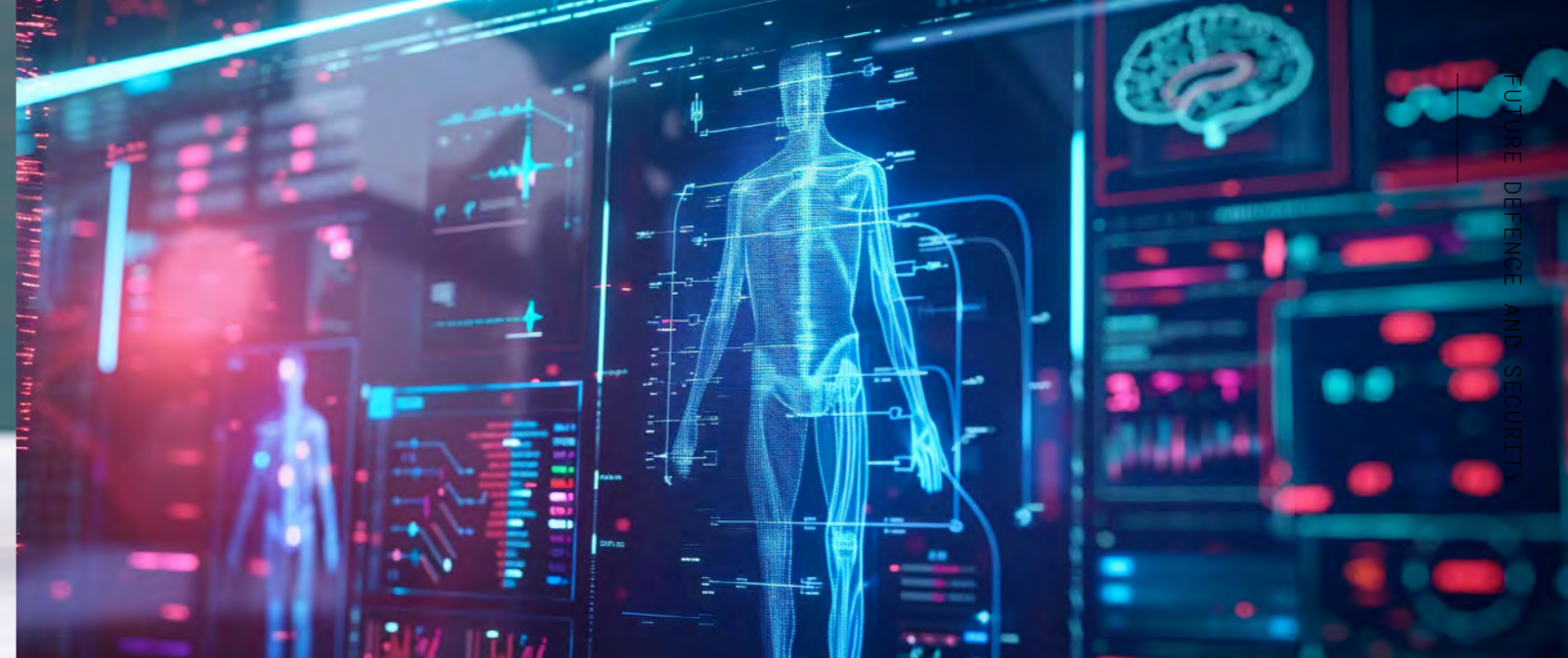


#### Key customers

- > Department of Defence and other public sector organisations
- > Organisations with systemic issues
- > Any organisation trying to change a system



[unsw.to/complex-systems](https://unsw.to/complex-systems)



## > Lifelong Learning, UNSW Canberra

Creating innovative offerings to support ongoing capability-building for individuals and organisations

### Enabler

The world of work is changing, and maintaining capability is an ongoing challenge. Whatever the role or industry, continuous learning is essential. Consequently, there is an increasing demand for accessible and flexible education that can be undertaken in shorter, stackable formats.

UNSW Canberra's microcredentials and short courses are designed to support the acquisition of new knowledge and skills to create new capabilities for the future. It offers both off-the-shelf and bespoke courses.



#### Key capabilities

- > Co-design and partnering
- > Flexible delivery



#### Differentiators

- > Stackable education
- > Range of delivery platforms
- > Offers entry pathways into Graduate Certificate and Masters programs



#### Key customers

- > Government
- > Industry partners
- > Individuals desiring to upskill or reskill



#### Key partnerships

- > Works closely across UNSW Sydney and AGSM



[unsw.to/microcredentials](https://unsw.to/microcredentials)

## > Real-Time Human Performance Assessment

Using technology to explore real-time human performance assessment of attention, biomechanics, emotion, motivation, situation awareness, and workload

### Research Laboratory/ Facility

Humans remain the custodians of accountability in systems. Assessing their cognitive performance in real-time offers commanders with real-time Human Factors Operating Picture (H-FOP) to enable re-distribution of responsibilities, continuously assess cognitive enhancement strategies, and provide AI-enabled systems with the necessary information for adaptation.

Prototypes and extensive testing have generated a wealth of tools and know-how which allows the technology to be used across different domains.

The team is continuously on the look-out for interested collaborators from industry and defence.



#### Key capabilities

- > An integrated 12-seat laboratory—using a variety of sensors including EEG, Kinect, Eye Tracker, and Physiological sensors—for cognitive and behavioural human performance measurement
- > The technology uses multiple data sources including electroencephalography (EEG), facial expressions, language, speech, keyboard, and vibrations
- > High-fidelity simulation environments including air traffic management



#### Differentiators

- > Software that allows the system to operate with any commercial, off-the-shelf system
- > A technology that works with different data sources, is robust against loss of a data source, and can integrate human states to adapt AI and automation to the human
- > Decades of accumulated experience in real-time cognitive metrics design and calculations



#### Key customers

- > Industry requiring cognitive human assessment and usability of C4ISR technologies
- > Defence Science and Technology Group, Air Traffic, UxVs, Swarm, and Space Operators



#### Key partnerships

- > Human-Performance Research Network
- > Eurocontrol



[unsw.to/hussein-abbass](https://unsw.to/hussein-abbass)

## > RNAfold.AI

### AI-assisted ribonucleic acid (RNA)-targeting drug discovery and design

#### Co-locator

RNAfold.AI addresses the significant challenge of developing RNA-targeting drugs. It is a process hindered by the complex folding of RNAs and unknown binding partners. Current methods rely on trial and error, screening thousands of compounds with limited predictive success, often leading to failures in later stages due to toxicity or lack of efficacy.

RNAfold.AI leverages cutting-edge AI algorithms to predict RNA-targeting drugs with high accuracy. By training on comprehensive structural data of target RNAs and potential drug compounds, including binding experiments and toxicity profiles, its AI models can efficiently identify promising drug leads.

The company has developed unique training datasets from databases, literature, and experimental data, resulting in an AI platform that predicts successful drugs with 100 times more accuracy. Currently in the proof-of-concept stage, RNAfold.AI aims to revolutionise RNA therapeutics by enhancing discovery, design, and development processes, targeting both out-licensing drug leads and in-house clinical development.



#### Key capabilities

- > AI
- > RNA therapeutics design



#### Differentiators

- > Unique datasets
- > Specialised AI models
- > Novel RNA-targeting drugs



#### Key customers

- > Pharma and biotech companies

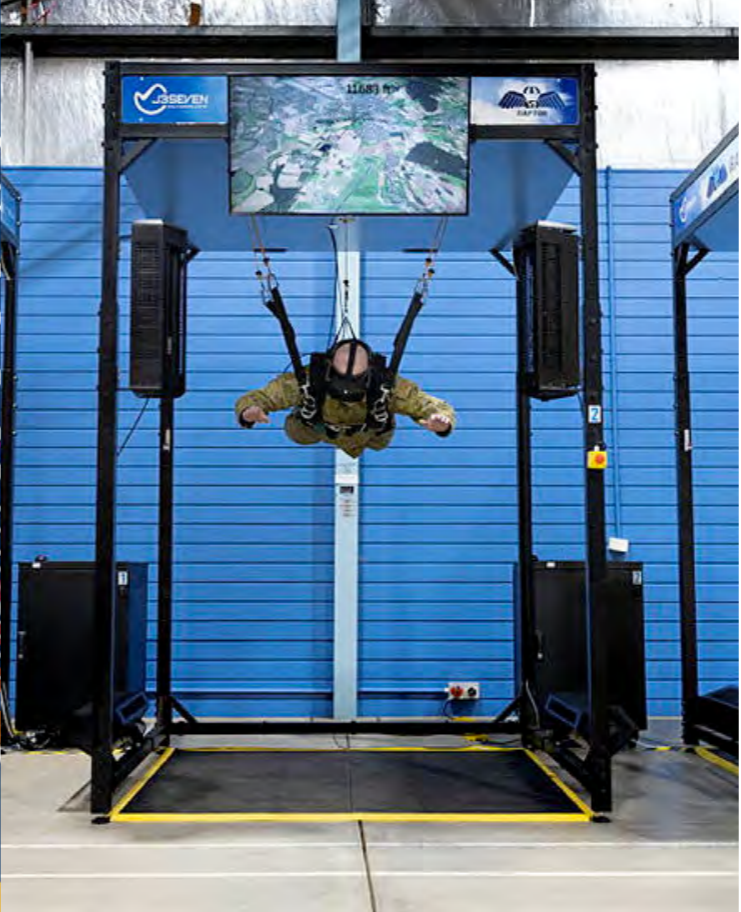


#### Key partnerships

- > UNSW RNA Institute



[rnafold.ai](https://rnafold.ai)



## > Simulation and Immersive Technology Training for Defence

### Exploring immersive technology systems for learning and how they are best deployed in the development and execution of simulation-based curricula

#### Research Project

Simulation-based education is a primary means of teaching technical and non-technical skills in many industries, particularly in safety-critical domains, such as health, civil aviation, and defence. This trend is now extending into all areas of education through the use of XR.

Veteran and new defence-industry SMEs need high-level, accredited training that can be used as recognition of prior learning (RPL) towards postgraduate study if desired, easing the path into higher qualifications and lifelong learning.

UNSW's short courses, 'Immersive Technology for Simulation-Based Educators' and 'Learning Science for Simulation-Based Educators', provide a foundation for professional simulation developers, instructional designers, and instructors. The courses help them to understand immersive technology systems for learning and how they are best deployed in the development and execution of simulation-based curricula.

The courses can be taken alone or stacked as microcredentials towards postgraduate study in the Graduate Certificate or Master of Simulation and Immersive Technology Systems.



#### Key capabilities

- > Understand how to assess and measure the effectiveness of training applications built with immersive technologies
- > Analyse the impact and integration of immersive technology in simulation-based education



#### Differentiators

- > Learn through research-informed teaching and content that is co-created with industry and global experts



#### Key customers

- > Department of Defence
- > Aviation industry



[unsw.to/msit](https://unsw.to/msit)

## > Sregen.ai

**An AI-based, talking-head generation and voice-cloning system for automatic content-media creation**

### Research Project

Sregen.ai is an innovative, online platform that helps with content augmentation, such as generation of personalised talking-head videos. It empowers users and content creators to easily deliver multimedia content, such as presentations or marketing videos, in multiple languages, including sign language.

Editing and modification of voice is complex and time-consuming. This platform uses AI to create realistic talking-head videos with a person's voice. Users provide speech, video, or text, and the system generates a video of that person speaking. It can clone voices from short audio samples and works in multiple languages.

This technology has potential in education, advertising, and social media.

Compared to competitors, this system is faster, more customisable, more ethical (it uses hidden watermarks to prevent misuse), more natural, and more secure.



### Key capabilities

- > Online platform that helps with content augmentation, such as generation of talking heads
- > Expertise in machine learning and generative AI
- > Faster: automatic creation vs one-week manual processing



### Differentiators

- > The AI model trains on local hardware for user data privacy and sovereign capability
- > Papers in top international journals: evaluations showing superior performance. Patent Pending Voice Cloning Technology (No. PCT/AU2023/050900)



### Key customers

- > Online content creators, platforms, and marketers
- > Educational technology providers
- > Graphic designers
- > Multimedia companies
- > Film Production/ Editing Software companies



### Key partnerships

- > Collaborating with [longtailai.org](https://longtailai.org) to develop a product line for multi-lingual sign-language (hearing-impaired people)



[unsw.to/sanjay-jha](https://unsw.to/sanjay-jha)

## > Sydney Thinking and Reasoning Laboratory (STAR Lab)

**Overcoming cognitive inertia by helping people to consider a broader range of options when making crucial decisions**

### Research Laboratory/Facility

Exploring one's options is crucial to making decisions about complex issues in defence, security, and other contexts. Problems in decision-making often arise through cognitive inertia - sticking with a familiar decision option when better alternatives are available.

STAR Lab's research program aims to:

- identify the learning conditions that give rise to cognitive inertia
- understand the cognitive decision processes that drive inertia
- identify individuals who may be especially susceptible to inertia
- develop ways of helping groups and individuals to overcome inertia

This will provide significant benefits by guiding better decisions in complex decision-making domains.



### Key capabilities

- > Extensive experience and capability in running behavioural studies of cognitive inertia
- > State-of-the-art mathematical modelling that provides insight into the processes that drive inertia
- > Experience in evaluating techniques for overcoming cognitive inertia



### Differentiators

- > Multiple competitive grants from the Australian Research Council
- > Large and diverse research team
- > Access to high-quality research infrastructure, e.g., eye tracking technology



### Key customers

- > Military departments, and finance and investment companies
- > Government agencies that aim to expand consumers' consideration of new products (e.g., clean-energy alternatives)



### Key partnerships

- > NSW Department of Environment, Climate Change and Water



### Quality accreditations and awards

- > Multiple competitive grants from the Australian Research Council



[unsw.to/brett-hayes](https://unsw.to/brett-hayes)

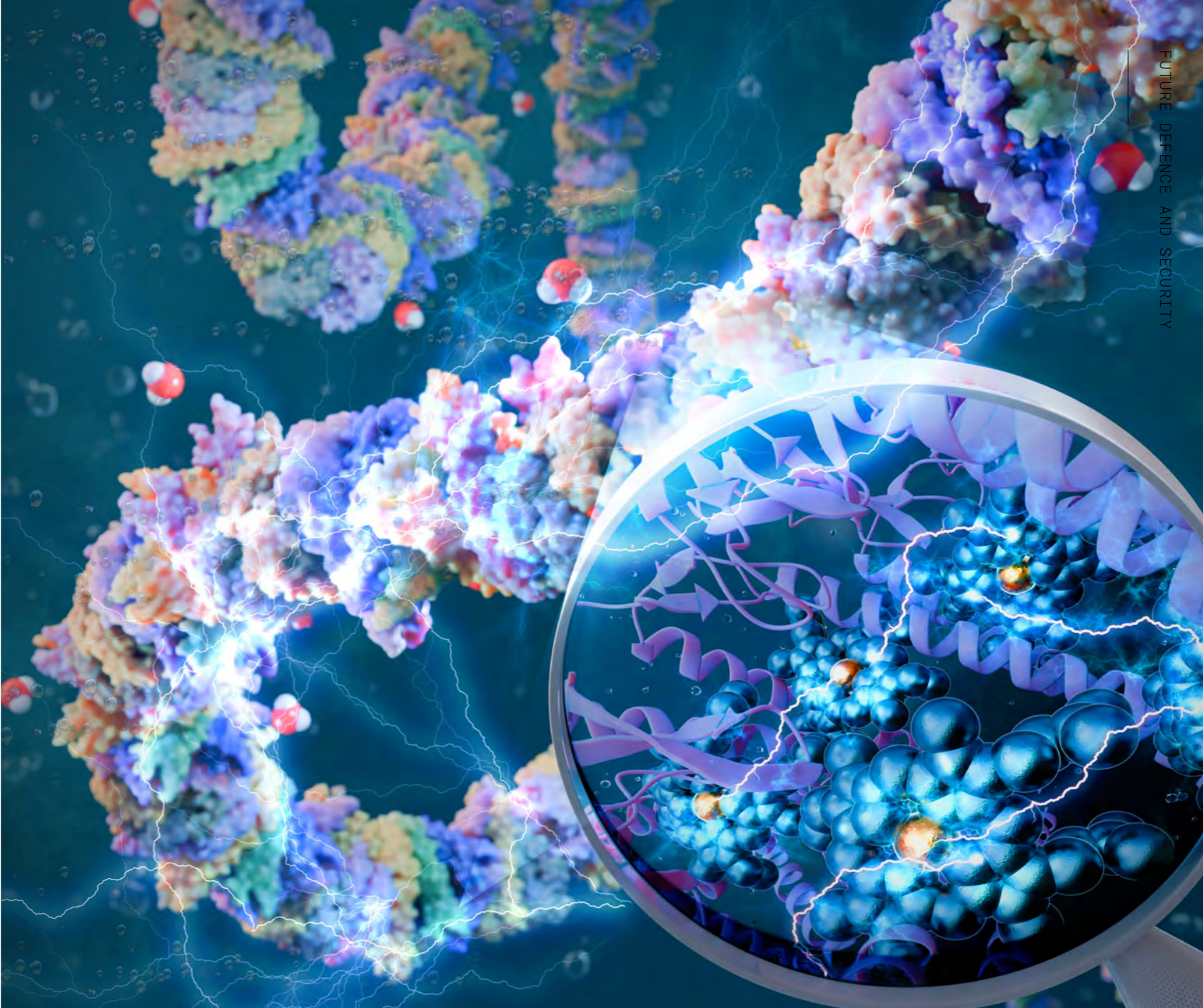
# > The Glover Lab

## Harnessing proteins to build functional biomaterials for environmental sensing and energy harvesting

### Research Group

Life has evolved to build tough materials capable of precise nanoscale assembly, self-repair, and sensitive biosensing in noisy environments. These properties are achieved through proteins that are the functional aspect of life, which can self-assemble into complex structures and perform efficient chemistry. Harnessing the self-assembly and functional capabilities of proteins may enable the development of novel systems and materials that enhance soldier protection and performance.

The Glover Lab at UNSW is focused on engineering proteins into functional biomaterials that can transfer or harvest energy to power nanodevices, or monitor and respond to cell behaviour and damage. Recently, the lab has demonstrated the assembly of proteins into nanoscale wires that can interface biological systems with electronic devices for biosensing, biocatalysis, and biocomputing applications. These nanowires can harvest and store energy for defence applications while being a sustainable and non-toxic material.



### Key capabilities

- > Protein engineering
- > Functional biomaterials
- > Bionanotechnology



### Differentiators

- > Unique biomaterials



### Key customers

- > Materials for performance

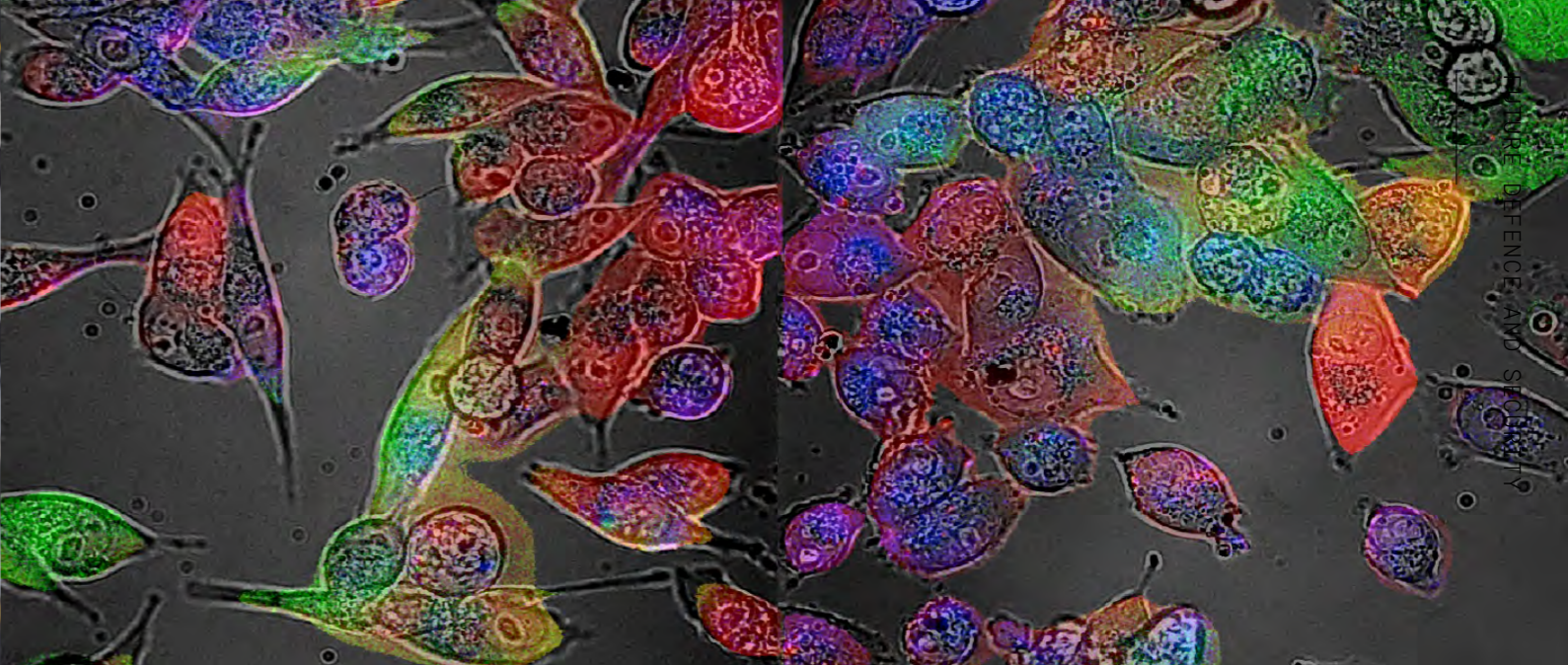


### Key partnerships

- > United States Office of Naval Research Global (ONRG)
- > United States Air Force Office of Scientific Research (AFOSR)
- > Defense Advanced Research Projects Agency (DARPA)



[unsw.to/dominic-glover](https://unsw.to/dominic-glover)



## > The UNSW Recombinant Products Facility (RPF)

### Producing and purifying biologics for biomedical innovation

#### Research Laboratory/Facility

RPF is a leading destination for biologics services. The RPF specialises in the production, purification, and analysis of diverse biologics, including proteins, antibodies, DNA, and phage, which form the basis of many current and emerging therapies as well as diagnostic tools.

In operation since 2008, the facility has 100m<sup>2</sup> of dedicated laboratory space, a skilled technical team, and ISO 9001 accreditation. The RPF supports researchers from across academia, medical research institutes, and diverse industry sectors.

As an approved provider for Therapeutic Innovations Australia (TIA), it is included in the Pipeline Accelerator scheme that offers subsidised access to capabilities for therapeutic development projects. The facility also delivers industry training modules focused on Bioprocessing.

Recent achievements include contributing to the publication of high-impact research, in a 2024 Nature paper on HIV capsid proteins. The RPF also played a crucial role in supporting the production of therapeutic bacteriophage for collaborators at Westmead Hospital.



#### Key capabilities

- > Recombinant protein expression, purification, and analysis
- > Biologics production and purification
- > Workforce training



#### Differentiators

- > ISO9001 accreditation
- > Delivery of industry training modules



#### Key customers

- > Biotechnology industry, from start-ups to listed companies
- > Researchers needing access to expertise in the development and production of biologics
- > Consulting and expert advice in bioprocessing and biomanufacturing



#### Key partnerships

- > Therapeutic Innovations Australia
- > Westmead Institute of Medical Research
- > Viral Vector manufacturing facility at Westmead



#### Quality accreditations and awards

- > ISO9001 certification



[proteins.unsw.edu.au](https://proteins.unsw.edu.au)



#### Key capabilities

- > Non-invasive cell and tissue imaging for disease diagnostics disease
- > Analysis and interpretation of data by using AI
- > Development of specialised software



#### Differentiators

- > Sensitive detection of harmful agents aligned with the 'human as a sensor' paradigm
- > Dual-use technology supported by a range of clinical and commercial partnerships
- > Nationally recognised technology (Eureka Award)



#### Key customers

- > Defence sector in the area of human performance
- > Specialised clinics in the areas of ophthalmology, neurology, urology and reproduction
- > Drug manufacturers



#### Key partnerships

- > Macquarie University Hospital



[unsw.to/arc-leadership](https://unsw.to/arc-leadership)

## > Translational Biomedical Diagnostics

### Innovation of non-invasive diagnostic tools using hyperspectral autofluorescence imaging technologies

#### Research Group

Measuring the morphological and biochemical features of tissue is crucial for disease diagnosis and surgical guidance, as it provides clinically significant information related to pathophysiology. Hyperspectral imaging techniques capture both spatial and spectral features of tissue without the need for labelling molecules and offer rich data for improved disease diagnosis and treatment.

The research group is internationally renowned for developing and applying advanced imaging techniques to biomedicine. The group's innovations in non-invasive autofluorescence imaging techniques have led to the development of novel diagnostics methods for eye diseases, cancer, neurodegenerative disorders, and more.

The team is able to analyse image data, create software, and develop specialised optics hardware. Its projects are supported by the Australian Research Council, Centre of Excellence and Linkage schemes, National Health and Medical Research Council, Juvenile Diabetes Research Foundation, Motor Neuron Disease Research Institute of Australia, and private companies.

# > UndaTech

Enhancing the performance and protection of our frontline workforce by addressing inadequate PPE for women in high-risk workforces

Start-up

Historically, resource supply chains have focused primarily on the male workforce, resulting in Personal Protective Equipment (PPE) that does not cater to women's anatomical needs. This can affect comfort and performance on the frontlines. UndaTech is developing fire-safe, ergonomically female-focused products that integrate seamlessly with PPE for women operating in dynamic and diverse, high-risk environments.

The company has initiated comprehensive research into ADF female duty requirements, as well as the interaction between standard-issued equipment and women's health needs. It has also initiated the prototype development of optimised bras and period-proof briefs for physically demanding conditions.

UndaTech will soon begin prototype testing with the Royal Australian Navy, using direct feedback from active-duty personnel to refine designs, and meet the real-world demands of servicewomen.



Key capabilities

- > Engineered fire-safe undergarments without compromising support, comfort and function



Differentiators

- > User-led innovation with 30 years of combined service in the ADF
- > Capable of adapting and developing products to specific workforce requirements
- > Collaborative product development with Australia-based manufacturer



Key customers

- > Australian Defence Force (Navy, Army, Airforce)
- > Emergency Services (Fire Service, Police, Ambulance)
- > High-risk workforce (Border Force, aviation, mining, electrical, etc.)



Key partnerships

- > Royal Australian Navy
- > UNSW Founders
- > Defence Trailblazer



Quality accreditations and awards

- > Chief of Navy's Innovation and Excellence Award
- > Finalist in Royal New Zealand Navy's Innovation Awards



[undatech.com.au](https://undatech.com.au)





## > UNSW Business Insights Institute

Working with business, government and civil society organisations to address the most complex challenges and advance policy

### Research Institute

The UNSW Business Insights Institute (BII) leverages world-class business expertise to help its partners overcome their challenges and build brighter futures.

The team translates academic knowledge into practical considerations and conducts research that brings the evidence needed to clarify complex business challenges.


Its aim is to work with businesses on co-designing and implementing solutions that deliver the best outcomes.

### Key capabilities

- > Leadership in complex systems, military combat team dynamics, and decision-making in the field
- > Creating positive and enabling cultures, including organisational design reviews and understanding talent profiles
- > Enabling evidence-based talent management

### Key partnerships

- > Australian Defence Force
- > Woodside Energy
- > Teaminvest Private Group (TIP)
- > The George Institute for Global Health
- > Queensland Public Service
- > NSW Health

 [unswbusinessinsights.com.au](https://unswbusinessinsights.com.au)

## > UNSW RNA Institute

Development and pre-clinical manufacturing of ribonucleic acid (RNA) therapeutics to address medical needs and biosecurity threats

### Research Institute

The UNSW RNA Institute links multidisciplinary teams in RNA chemistry, biology, and medicine with clinical experts and services. Its work is underpinned by the pilot-scale RNA Accelerator production facility, Australia's first ISO 9001 certified facility for the pilot-scale manufacture and design and development of new processes for RNA-based therapeutics and other products for pre-clinical studies.

The research arm of the Institute includes experts in the development of RNA therapeutics and products, including:

- mRNA vaccines against infectious diseases
- short interfering RNA for anti-viral treatments
- guide RNA for CRISPR-based gene therapies
- delivery vehicles (including lung and nasal delivery)
- sensing and analytics for diagnostics

The RNA Accelerator facility supports industry partners and academia to fast-track RNA therapeutics from early-research stage through to pre-clinical studies. It promotes sovereign capability to address existing and emerging medical needs and biosecurity threats.

### Key capabilities

- > Synthetic RNA for anti-virals and gene therapy
- > Delivery expertise (targeted, different modalities)
- > Cleanroom production of RNA therapeutics

### Differentiators

- > Synthetic RNA production
- > Analytical and validated QC methods for characterisation of RNA therapeutics
- > ISO 9001 certification

### Key customers


- > Department of Primary Industries
- > Tiba Biotech
- > Kirby Institute
- > Children's Cancer Institute

### Key partnerships

- > Department of Primary Industries
- > NSW RNA Production and Research Network
- > Therapeutics Innovation Australia

### Quality accreditations and awards

- > ISO 9001 certification

 [rna.unsw.edu.au](https://rna.unsw.edu.au)



# > UNSW Traumatic Stress Clinic

## Harnessing AI to measure PTSD and suicide risk in military personnel

### Research Project

Post-traumatic stress disorder (PTSD) and suicide are major problems facing the Australian Defence Force. The ADF faces major challenges in identifying personnel with these conditions. The Royal Commission will be highlighting the need for marked improvements in how these conditions are identified.

Headed by Professor Richard Bryant, the UNSW Traumatic Stress Clinic has worked with software developers to refine innovative AI-derived programs to detect PTSD using facial, acoustic, and speech data derived from brief smartphone recordings. These advances build on decades of emotion research but use the latest developments in machine learning to detect psychological conditions.

Rigorous testing has shown that beta versions of this software can detect PTSD with 83% accuracy. Improvements to this technology have led to the potential for improved early detection of PTSD and suicide risk, thereby opening up new opportunities to reduce suicide in the ADF.



### Key capabilities

- > World-leading psychological expertise in PTSD and suicide risk
- > AI and machine learning to detect psychological conditions
- > Experience in military and veteran mental health



### Differentiators

- > One of the few centres to test software to extract facial/acoustic data to detect PTSD
- > Close collaboration with companies that have developed and are updating relevant software



### Key customers

- > Australian Defence Force
- > Department of Veterans' Affairs
- > The issue of PTSD and suicide will be top priority following the recommendations of the Royal Commission into Defence and Veteran Suicide



[unsw.to/richard-bryant](https://unsw.to/richard-bryant)



### Key partnerships

- > Worked closely with ADF and DVA for 15 years
- > Professor Bryant is a member of the ADF Mental Health Wellbeing Advisory Group, advising on mental health
- > Work closely with New York University and Brooklyn Health, the developer of the software used in this research. Relevant personnel hold adjunct positions at UNSW



### Quality accreditations and awards

- > Prof Bryant has received the Companion of Order of Australia for research in PTSD, as well as more than 30 national and international research awards
- > UNSW Traumatic Stress Clinic has completed more than 800 publications in PTSD research, and is the most successful PTSD research centre in Australia

# Digital Threat Detection and Response



## > Envision Systems

**AI and radio sensing for real-time hazard detection in diverse environments**

### Spin-out

Envision Sensing Systems holds two pending patents. Safetytech Accelerator, backed by Lloyd's Register, evaluated this technology for its Cargo Fire and Loss Initiative (CFLI), supported by nine leading shipping companies responsible for 53% of global container cargo. Out of 200 technologies evaluated, Envision's was among the top three most disruptive, advancing to the second phase for independent testing.

Envision's sensor systems offer numerous advantages for maritime safety:

- Reduces detection time to under one second, compared to 30 minutes with current systems
- Precisely identifies exact fire locations, a feature not available in existing systems
- Provides data on object movement and vibrations, unavailable in current systems
- No retrofitting and extremely low maintenance cost

Envision Systems aims to revolutionise maritime safety and extend these solutions to road transportation and underground mining.

### Key capabilities

- > Fire detection and localisation
- > AI-enabled sensing
- > Non-invasive autonomous intrusion detection using WiFi signals

### Differentiators


- > Two innovative methods of predicting and detecting fire events, and the localisation of these events (two patents pending)
- > Exclusive rights to commercialise the intellectual property developed by the founders at UNSW as well as a research services agreement that will allow further UNSW research to be conducted

### Key customers

- > Safetytech Accelerator, established by Lloyd's Register, UK
- > DP World, Australia
- > Trantek MST Pty Ltd

### Key partnerships

- > Maritime and ships
- > Road or tunnels
- > Underground mining

 [envision-sys.com](https://envision-sys.com)

## > Generating Organisational Threat Intelligence

**OrgIntel: a novel threat intelligence system to meet the needs of organisations**

### Research Project

In today's rapidly evolving cyber landscape, organisations face an unprecedented variety of threats, from malware to sophisticated state-sponsored attacks. Traditional threat intelligence systems often fall short in providing timely and relevant insights tailored to specific organisational needs, leaving gaps in security defences.

The OrgIntel system addresses this critical issue by leveraging advanced large language models (LLMs) to retrieve and analyse data from global threat repositories. It customises the intelligence to fit the unique profile of each organisation, ensuring that security teams receive the most pertinent and actionable information.

Currently, OrgIntel is in the proof-of-concept stage. Investments to this system will refine the technology and bring its solutions to market, empowering organisations to proactively defend against the ever-changing threat landscape.



### Key capabilities

- > Natural language processing (NLP)
- > Data integration and API development



### Differentiators

- > Advanced large language models (LLMs)
- > Tailored threat intelligence



### Key customers

- > Financial institutions
- > Government agencies



[unsw.to/jiaojiao-jiang](https://unsw.to/jiaojiao-jiang)



### Key capabilities

- > Transdisciplinary research
- > Agility, co-design
- > Delivering real-world impact



### Differentiators

- > Collaborative
- > Innovative
- > Transdisciplinary



### Key customers

- > National Intelligence Community
- > ADF
- > DFAT



[unsw.to/ifcyber](https://unsw.to/ifcyber)

## > Institute for Cyber Security (IFCyber)

**A transdisciplinary research hub solving real-world cyber security problems and delivering impact**

### Research Institute

The Australian Cyber Security Strategy (2023-2031) demonstrates the importance of cyber security for national prosperity as well as the complexity of the cyber security ecosystem. Such complexity requires innovative and agile research methods, and a focus on impact.

IFCyber is a transdisciplinary research institute focused on delivering real-world solutions to cyber security problems. It brings together skills and knowledge in law, privacy and identity, cryptography, narrative, diplomacy, logics, wargaming and simulation, hardware and cyber physical systems, and human behaviour.

The Institute has experience of working with national security and defence, as well as critical infrastructure organisations. It also works globally to develop and share its expertise.

Its current research addresses the use of active cyber defence and cyber deception technology, operationalising machine learning models, and cyber security as statecraft.



## > Interactive Visual Media Processing (IVMP) Group

Providing highly efficient and responsive access to huge reconnaissance sources over challenging communication channels

### Research Project

Headed by Professor David Taubman, the Interactive Visual Media Processing (IVMP) Group at UNSW develops coding, estimation, and post-processing technology for visual media, including imagery, video, multi-view, hyper spectral and volumetric content.

This work has a strong focus on interactive visual communications for remote browsing of large media sources, and allows for transmission, processing, and caching of only what is needed, when it is needed, and with minimal latency. These attributes are all highly relevant to defence imaging, which can involve very high-resolution sources, potentially with many spectral planes, together with challenging, potentially hostile, communication environments.



#### Key capabilities

- > Internationally recognised experts in scalable media compression
- > Extensive experience in media analysis algorithms for depth, motion and related metadata
- > Professor Taubman has led 9 ARC Discovery projects and collaborated closely with DSTG



#### Differentiators

- > Deeply engaged with international standards organisations (ISO/IEC, SMPTE, IETF)
- > Engaged with major stakeholders in geospatial intelligence, medicine and professional media and entertainment industries
- > Closely linked to spinout company, Kakadu Software Pty Ltd, which has commercial implementations of the relevant compression and communication standards
- > Satellite-born defence imaging systems, including surveillance drones



[unsw.to/david-taubman](https://unsw.to/david-taubman)



#### Key capabilities

- > Developing machine learning algorithms to extract evidence from encrypted IoT traffic
- > Building an IoT device signature database for forensics applications
- > Conducting systematic empirical study to characterise information for forensic evidence



#### Differentiators

- > A web-based dashboard that provides interactive info-graphical representation of devices in monitoring
- > Passive monitoring and identification of IoT devices from encrypted traffic
- > A database of IoT devices containing encrypted IoT traffic flows and signatures corresponding to different device activities and behaviours



#### Key customers

- > Law enforcement agencies can use this prototype/method to passively monitor a building space and track devices belonging to a person of interest
- > Defence, government or law enforcement do not require network admin or ISP corporation or credentials to risk detection



#### Key partnerships

- > DSTG
- > AFP
- > University of Sydney



#### Quality accreditations and awards

- > Research paper accepted in 49th IEEE Conference on Local Computer Networks (LCN), 2024, France
- > Demo paper accepted in 38th ACM Special Interest Group on Data Communication (SIGCOMM), 2024, Sydney



[unsw.to/rahat-masood](https://unsw.to/rahat-masood)

## > IoT Network Forensics using Encrypted Traffic Analytics

A unified framework for encrypted traffic analytics (ETA) to extract useful forensic evidence from IoT devices

### Research Project

By 2025, it is estimated there will be more than 30 billion smart devices embedded in the physical world. This network of smart devices, known as the 'Internet of Things' (IoT), is driving new services and applications across many disciplines.

IoT devices often lack user interfaces, making them hard to access. Their miniaturised nature and infrequent communication make them difficult to locate. The diverse and unregulated market means analysts often encounter unfamiliar devices.

Despite end-to-end encryption, passive forensic evidence collection is possible. This research project has developed a new passive WiFi device-type identification method that uses features from probe request frame bodies. This approach creates device signatures that are unaffected by MAC address randomisation.

Extensive testing revealed an average accuracy of 99% in device-type identification. The proposed method outperforms deep learning methods with significantly less training data, achieving a 92% F1 score with only one training sample per device type.

# > Kestra

Exploring defence-ready, AI-enhanced data search, collection, and dissemination for secure, efficient information and operational intelligence

Co-locator/Launch

Kestra is a software engineering company focussed on large- scale information processing and analytical systems using search engines, natural language processing, and machine learning.

Its software offers comprehensive, inter-operable modules that are purpose-built for information aggregation, analysis, triage, publishing, dissemination, and business intelligence in specialist use cases.

Designed for both cloud and air-gapped deployments, modules include pre-build data connectors, and processing pipelines for both structured and unstructured sources, including content enrichment and named entity recognition, machine translation, and geolocation.

These modules sit atop a tech stack that includes a multipurpose AI server, ElasticSearch as the underlying search engine, and a complete attribute and role-based security model (ABAC/RBAC) enforcing granular security controls which incorporate nationality, location, security clearance, code words, and ECIs over all queries and analytics.

Integral security and auditing enable effective security monitoring and granular traceability of user activities, including detailed analytics and system reporting.



Key capabilities

- > Search engines and analytics
- > Natural language processing
- > AI



Differentiators

- > Attribute-based access control (ABAC) over very large data sets
- > Security-aware data analytics and data intelligence



Key customers

- > Australian Federal Government agencies
- > Australian Department of Defence



Key partnerships

- > ElasticSearch



[kestra.ai](https://kestra.ai)

# > Microwave and Millimetre Wave (MMM) Laboratory

**Harnessing the electromagnetic energy for wireless communications for security and defence applications**

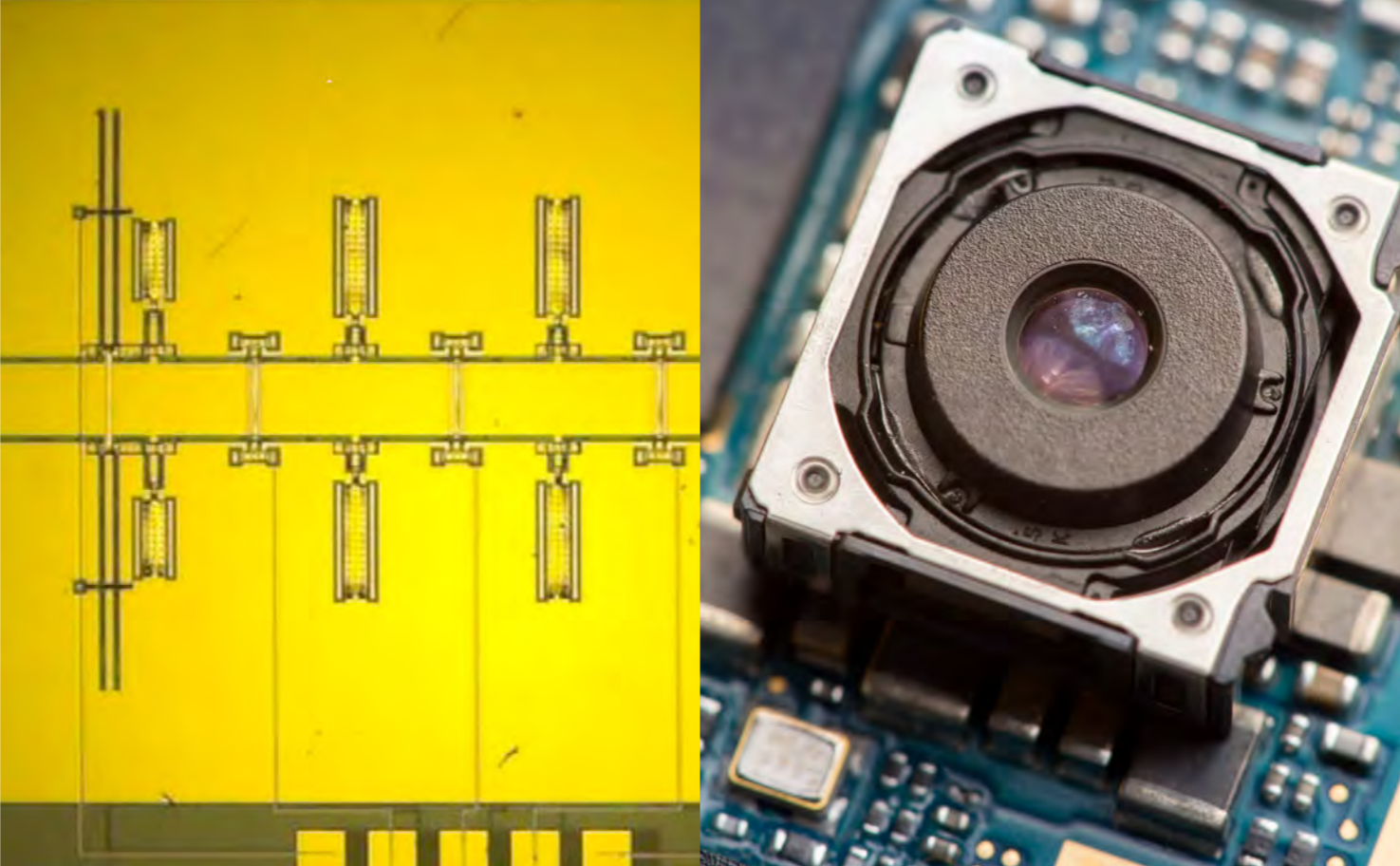
**Research Project**

Following the global trend, Australians rely on wireless communication daily. Due to spectrum congestion, communication industries continuously encounter drastic market, security, and regulatory demands in both the commercial and defence sectors. MMM laboratory can bring advancements in devices that respond to these demands, relying on unprecedented technological development.

The UNSW lab commercialises ground-breaking technologies that allow optimised modern microwave and millimetre-wave devices enabled by combinations of metal and dielectrics never before possible. The laboratory uses state-of-the-art design models, artificial intelligence, and mathematical techniques to determine the optimised devices for precision and higher frequency utilisation for larger bandwidth and interference immunity.

Extensive trials revealed that the MMM prototypes achieve consistent size, volume, and cost reductions for performant improved electrical responses, potentially increasing the features of the defence & security products and their deployment anywhere and anytime.

MMM laboratory develops market-ready, fully integrated prototypes of high-performance systems that are waiting to be field-experienced in applications.



**Key capabilities**

- > Passive microwave and millimetre wave devices, such as switches, switch matrices, filters, and antennas for wireless communications in different technologies



**Differentiators**

- > Radio Frequency Micro Electromechanical technology-based microwaves and millimetre wave devices



**Key customers**

- > Wireless communications, commercial and defence sectors



[unsw.to/rodica-ramer](https://unsw.to/rodica-ramer)



**Key capabilities**

- > Micro/nano piezoelectric fabrication skills and innovative thick film fabrication technology



**Differentiators**

- > The technology is protected by patents



**Key customers**

- > Smart phone manufacturers and start-up companies



[unsw.to/aron-michael](https://unsw.to/aron-michael)

# > Piezoelectric Micro-actuator for Next Generation Smart Phone Camera

**Developing novel, on-chip piezoelectric sensors and actuators to enable compact, low-power, fast, next-generation smart-phone cameras**

**Research Group**

The dominant actuator technology in smartphone cameras is based on Voice Coil Motor (VCM). While VCM technology is advanced, it is also power-intensive, slow, and has limited potential for further miniaturisation. Additionally, its image stabilisation mechanism relies on separate inertial sensors.

This research aims to overcome these drawbacks by developing novel, on-chip piezoelectric micro-actuators and inertial sensors, and integrating them with flat (meta) lenses and complementary metal-oxide semiconductor (CMOS) sensors.

There is a significant commercial demand for smartphone cameras that are more power-efficient, compact, and faster, with potential for further miniaturisation. This research also has applications in medical devices.

A micro-lens piezoelectric actuator has been developed, and an on-chip control system has been implemented. Integration of the actuator with the CMOS sensor is underway, including packaging to create a complete camera module.



## > Psychology-Empowered Disinformation Detection and Campaign Tracking

### An AI framework to detect and track disinformation campaigns

#### Research Project

The modern information landscape is complex and extremely dynamic, making the identification of disinformation extremely important. This team hopes to develop computational models to track what messages containing misinformation are more likely to be spread, locations/ platforms that are potential origins of misinformation, how messages spread across connections, and the extent of potential information spread.

First, it will develop advanced computational methods to detect false or deceptive messages. This involves understanding synthetic media, identifying deceptive traits, and creating effective models.

Second, it will track the spread of disinformation across networks. By analysing message origins and communication channels, it aims to quantify how information propagates. Its AI framework will view individuals as nodes connected through communication channels, with varying rates of spread across different platforms.

Through this project, the team will strive to mitigate the impact of disinformation and promote the dissemination of accurate information.

#### Key capabilities

- > Unique, interdisciplinary team
- > Expertise on the psychology of misinformation and its message encoding
- > Experience working on multi-year projects with Defence (DSTG)

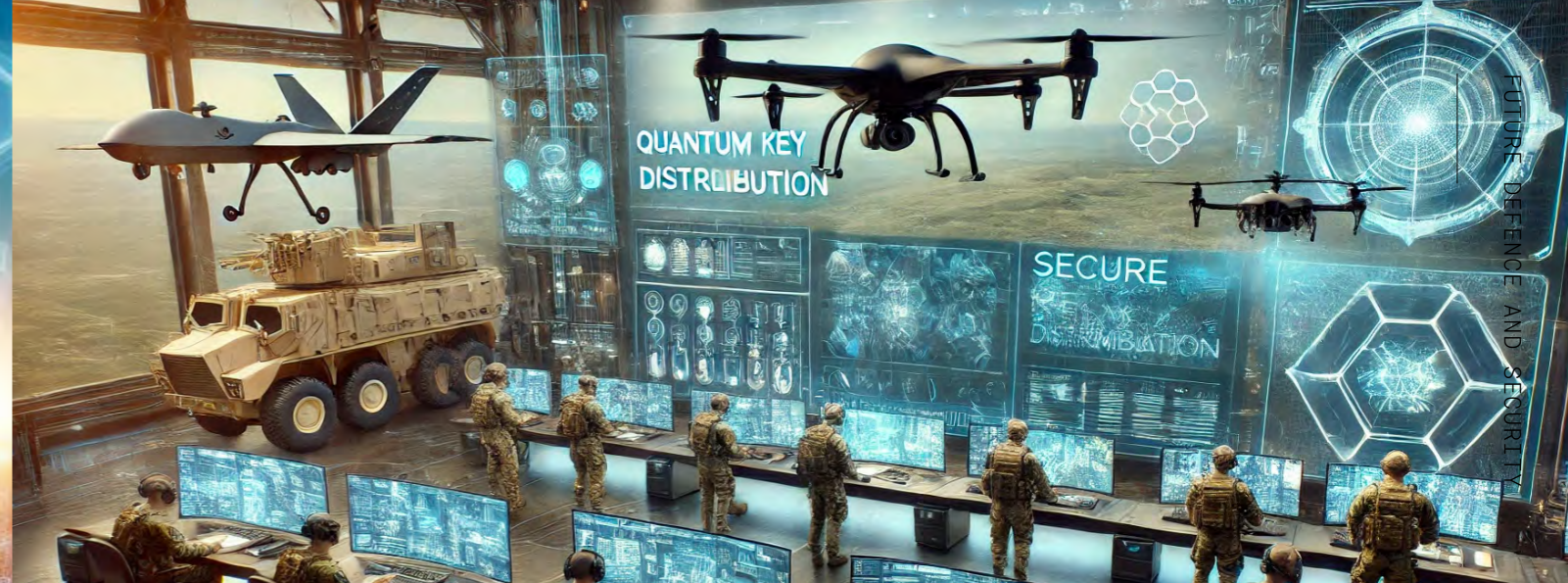
#### Differentiators

- > World-leading researchers in AI/ML, signal processing and psychology
- > In-house AI models implementing a range of AI/ML algorithms
- > Large and talented pool of AI researchers and students

#### Key customers

- > Defence
- > Government agencies
- > Industry working with Defence and Government

[unsw.to/simi-lab](https://unsw.to/simi-lab)



## > Quantum Secure Communication for Remotely Operated Defence Vehicles

### Quantum key distribution to ensure secure communication channels for remote operation of vehicles in high-risk defence scenarios

#### Research Project

This project addresses the critical need for secure communication channels in the operation of remote defence vehicles, including drones, tanks, and armoured transport vehicles. As cyber threats grow more sophisticated, ensuring the integrity and confidentiality of command-and-control communications is critical.

The team leverages quantum key distribution (QKD) to create unbreakable encryption, significantly enhancing security against cyber-attacks.

The project is a collaboration between a leading quantum technology company (QNU Labs) and one of the largest interactive vehicle simulation labs in Australia (UNSW TRACSLab). With this, a prototype system integrating QKD into defence communication networks will be developed.

Currently, the project is in the proof-of-concept stage, demonstrating the system's effectiveness in controlled environments. The next steps involve policy adjustments and system development for wider deployment.

The team is actively seeking investment to scale up and field-test the solution, aiming for market readiness in the near future. The project team is also looking to explore further applications of this highly secured Quantum communications channel.

#### Key capabilities

- > Quantum technology
- > Secure, unbreakable communication
- > Remote operation of combat vehicles

#### Differentiators

- > Unbreakable encryption with quantum technology for secure communication
- > Supported by technologies from a leading quantum technology company
- > Collaboration with one of the largest interactive vehicle simulator labs in Australia

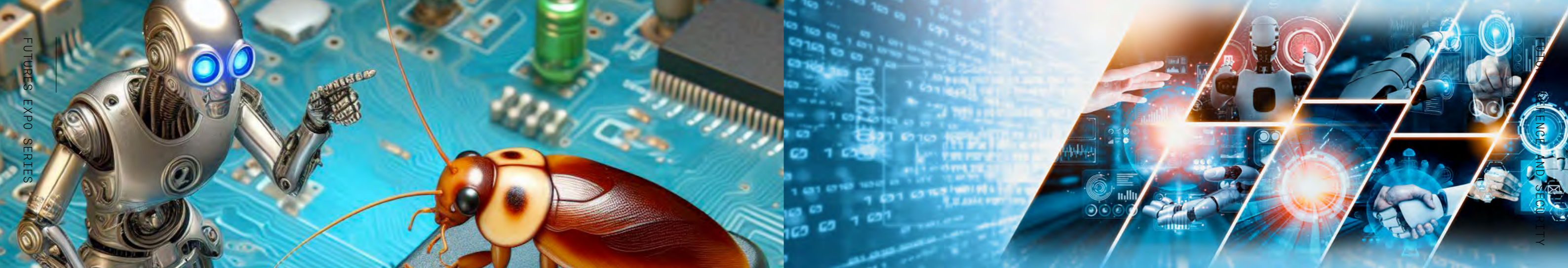
#### Key customers

- > Potential market for Australian Airforce and Army
- > Potential market for use of autonomous vehicles for border surveillance and patrol operations, where secure communication is crucial to maintain the integrity of data transmission and prevent unauthorised access or manipulation by smugglers or other malicious actors

#### Key partnerships

- > QNU Labs: a leader in quantum-safe cryptography products and solutions
- > TRACSLab@UNSW: one of the largest interactive vehicle simulation labs in Australia
- > VRCity: a UNSW spin-off company that specialises in developing Virtual Reality vehicle simulator for industry applications

[unsw.to/vinayak-dixit](https://unsw.to/vinayak-dixit)



## > Rationative Systems

### Key capabilities

- > Automated verification of systems models with respect to specifications about knowledge and time
- > Counter example game debugging interface
- > Automated synthesis of implementations from knowledge based programs

### Differentiators


- > Broad spectrum of verification algorithms: BDD, bounded model checking, explicit state model checking
- > Best of breed system for automated verification of information theoretic properties

### Key partnerships

- > Pathology labs looking to expand their capabilities in remote testing and access new population groups
- > Population health monitoring to enable large-scale analysis of population groups for critical health measures
- > Clinical trials to provide greater engagement and diversity by supporting at-home testing and reducing burden on patients

### Quality accreditations and awards

- > Australia's Economic Accelerator grant 2024-25

 [unsw.to/mck](https://unsw.to/mck)

**Automated verification of the security and correctness of computer software hardware designs**

#### Start-up

Software errors can have catastrophic consequences, particularly in critical domains such as defence, where human life and national security are at stake. They can also adversely affect financial systems, where there is a risk of large financial losses.

MCK is a unique software verification system developed at UNSW that automatically analyses software models with respect to specifications of correctness and security. It automatically identifies errors and provides a guarantee that there are no errors. This capability will help programmers and code auditors to avoid catastrophic software errors by providing assurance of system correctness and security.

MCK can automatically analyse systems, not just with respect to how the system changes over time, but also the information carried by the systems' components.

The team is working on initial commercial application to blockchain smart contracts, distributed autonomous systems, and computer hardware security.

## > Secure and Trustworthy Machine Learning

**Improving the robustness and security of machine learning technologies**

#### Research Project

Recent advances in machine learning, particularly deep neural networks and large language models, are transforming the design and implementation of decision-making systems. However, due to their black-box nature, brittleness, and lack of safety guarantees, significant challenges remain in their adoption in potentially high-payoff applications, such as autonomous systems and critical technologies.

The research conducted by the Information Security and Privacy Research Group at UNSW Sydney has uncovered novel attacks in existing and emerging machine learning models and across the entire machine learning production lifecycle, including training and testing. The team has also proposed a range of novel defences for improving the security and resilience of machine learning models.

This work has wide applicability for traditional machine learning and federated learning and graph neural networks across several areas, including transportation, social networks, recommendation systems, Internet traffic, and many more.

### Key capabilities

- > Expertise in state-of-the-art machine learning concepts, e.g., adversarial learning, generative models, transfer learning, etc.
- > Expertise with multiple application domains.

### Differentiators

- > Unique work on studying the robustness of graph neural networks
- > Proposed a range of novel attacks on federated learning systems
- > Novel strategies for improving security of deployed machine learning models

### Key customers


- > Any organisation (government, defence, industry) that uses machine learning technologies within their operational ecosystem

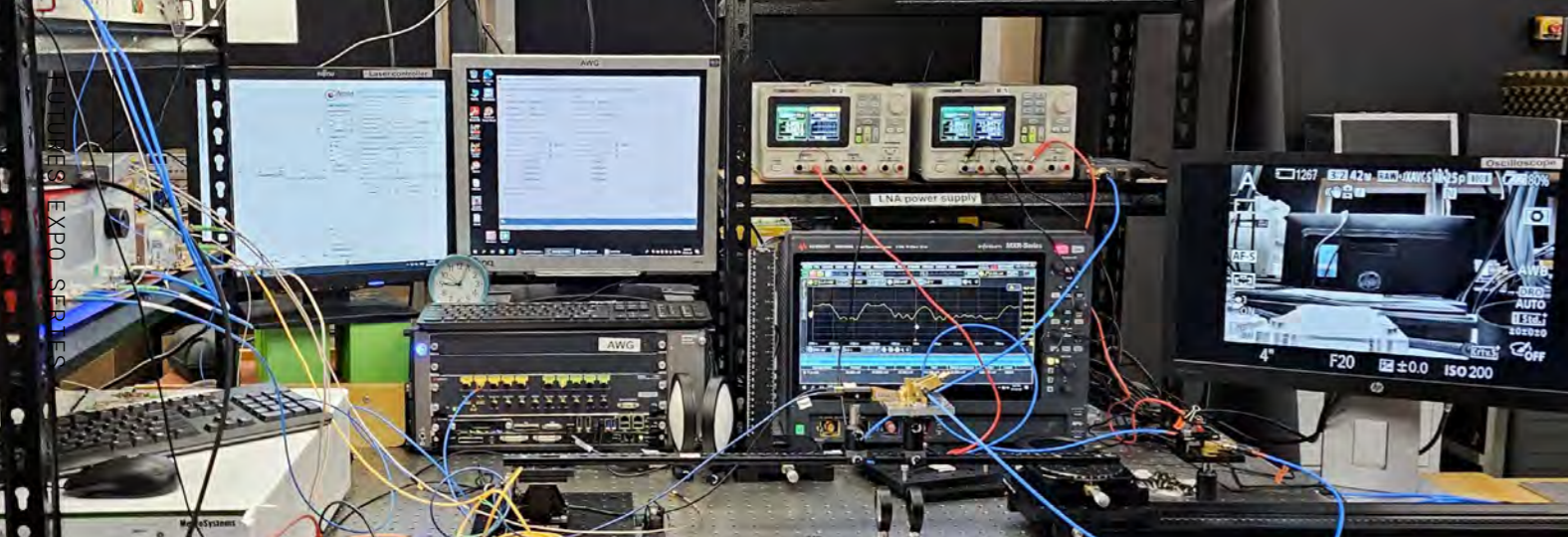
### Key partnerships

- > DSTG
- > CSIRO

### Quality accreditations and awards

- > Numerous papers published at top security and machine learning conferences
- > Artefact Badges that confirm the veracity of the developed code base

 [unsw.to/salil-kanhere](https://unsw.to/salil-kanhere)



#### Key capabilities

- > Terahertz Time Domain Spectroscopy system for non-destructive sensing and imaging
- > D-band (6G) ultra-wide bandwidth and ultrahigh rate communication system
- > A large team of academic and higher degree research students



#### Differentiators

- > Polymer interconnects for next-generation, high-capacity communication systems
- > Single chip terahertz backscattering device for high-resolution and single-shot localisation
- > AI-enabled terahertz imaging for agricultural and health care applications



#### Key customers

- > Ericsson Sweden
- > Keysight
- > Meat & Livestock Australia



#### Key partnerships

- > Australian Research Council
- > Office of National Intelligence
- > Defence Innovation Network



#### Quality accreditations and awards

- > 2024 Zhenyi Wang Award for Excellence of outstanding contributions to the Science of Infrared, Millimeter, and Terahertz Waves



[unsw.to/terahertz](https://unsw.to/terahertz)

## > Terahertz Innovation Group

Solving real-world problems with cutting-edge technology for next-generation, high-speed communications (6G and beyond), non-invasive imaging, sensing, and localisation

### Research Group

Terahertz Innovation Group at UNSW Sydney aims to solve real-world problems with cutting-edge research by partnering with industry partners. The team comprises researchers with multidisciplinary experiences in terahertz, photonics, signal processing, telecommunication, localisation, sensing, imaging and computer networks.

The team develops products including interconnects for short- to medium-range, high-capacity communication systems. The team is also working on high-resolution backscattering devices for single-shot localisation and sensing using a frequency smart antenna. These products will pave the way for innovative terahertz technology applications that can advance multiple industries – from telecommunications to agriculture – for a smarter, more connected world.

## > Trusted AI-Enabled Human-Swarm Teaming

Designing effective and efficient command and control for tens to thousands of autonomous agents and the associated information domain

### Research Group

Consider an eco-system made of many humans and many swarm systems, with each swarm containing tens to thousands of autonomous agents. How is an effective and efficient information domain for this eco-system designed? What AI agents are needed to manage information flow, interactions, adaptive interfaces, dynamic allocation of functions, swarm guidance, resource allocation and decisions, machine learning with limited resources, and explainability and trust assurance for humans?

The research group is working across conceptual, architectural, and algorithmic levels to provide problem-specific solutions while integrating the individual components in smart-system-of-smart-systems solutions.

It offers multi-disciplinary skills in swarm guidance, cognitive engineering, multi-modal interaction, and interfaces with AI. Other skills include machine learning and optimisation algorithms, quantum AI, and robotic technologies to innovate in the human-swarm teaming command and control space.



#### Key capabilities

- > Swarm metaverse laboratory with physical and virtual UxVs, diverse sensors, and interaction devices



#### Differentiators

- > Integration skills that bring together machine learning, optimisation, human factors, and quantum computing
- > Test and evaluation with multi-disciplinary team covering algorithmic, technical cyber, and societal risks



#### Key customers

- > Defence industry
- > Defence organisations in Australia and its allies



#### Key partnerships

- > Australian DoD
- > USA DoD



[unsw.to/hussein-abbass](https://unsw.to/hussein-abbass)

# > UNSW AI Institute

## UNSW’s flagship institute in AI, machine learning and data science

### Research Institute

UNSW AI has extensive expertise in AI development, application, and translation, including its impact on the defence sector. It is driven by various objectives, including the facilitation of interdisciplinary collaborations in teaching and research, active engagement in public dialogue on AI, and the promotion of research commercialisation.

UNSW AI is recognised as world leader in the development of AI as a safe, reliable and ubiquitous technology for global benefit.

Its goals include the following: promote research excellence in AI; foster interdisciplinary connections; promote and participate in public dialogue on the benefits and issues relating to AI; play a role in co-ordinating AI standards activities; provide an easy to find front door for external bodies and individuals (academic, industrial, government, not-for-profit) to engage with UNSW in AI related areas; and drive the commercialisation and realisation of its research outcomes.



### Key capabilities

- > Diverse network of researchers with expertise in machine learning, ethics in AI, navigation and control of autonomous vehicles and developmental robotics
- > Large scale high-performance computing facilities
- > Critical mass of over 300 researchers across multiple faculties including engineering, science, business, medicine and health, defence and security

### Differentiators


- > Australia's largest AI Institute, bringing together multi-disciplinary research skills centred around AI, machine learning, and data science
- > Long-standing and deep ties with Defence
- > Outstanding facilities for simulation and robotics

### Key customers

- > Air Force Office of Scientific Research
- > DSTG
- > US Office of Naval Research

### Key partnerships

- > Defence Innovation Network
- > Defence Trailblazer Program

 [UNSW.ai](https://www.unsw.edu.au/ai)

“ AI is revolutionising the future of defence and security by enhancing decision-making, automation, and threat detection. Its integration is critical in maintaining a strategic advantage and ensuring national security in an increasingly complex global landscape. ”

Professor Michael Thielscher  
Director, UNSW AI Institute

# Protection and Deterrence Systems



## Advanced Optoelectronic Sensing

Merging light and nanotechnology to advance sensing and surveillance

### Research Group

Surveillance and detection of threats can save lives. Early detection of threats can lead to a rapid and efficient response. The combined expertise of UNSW and the University of Western Australia (UWA) brings extensive experience on the development of sensors, such as:

- Photodetectors that convert light into electrical signals. Some of the devices are at TRL5 and work from the ultraviolet to mid-infrared wavelengths.
- Gas and Rydberg sensors to detect toxic gases and avoid adversarial communications that can lead to rapid response to threats. The sensors combine materials, physical phenomena (e.g., exceptional points) and quantum sensing (e.g., Rydberg atoms) (TRL3).
- Night vision sensors that use nanotechnology (metasurfaces) to produce compact night vision devices (TRL3).

The research group combines different materials and techniques to produce high performance sensors and opto-electronic devices for surveillance, signature detection, navigation and threat detection.



### Key capabilities

- > Material growth by molecular beam epitaxy
- > Extensive experience in the fabrication of opto-electronic devices
- > Optical (ultraviolet to mid-infrared) and electrical characterisation of devices

### Differentiators

- > UWA is one of only two universities in the world working on HgCdTe infrared detector technology.
- > Four laser labs covering the ultraviolet to mid-infrared wavelengths.
- > Access to nano-fabrication facilities and a wide range of simulation tools: quantum expresso, Lumerical FDTD software, COMSOL Multiphysics, Gaussian software package and other specialised software.
- > Work with specialised materials, such as transition metal carbides and borides, which can work at high temperatures and under harsh conditions.
- > Fabricate organic and hybrid organic/semiconductor flexible devices

### Key customers

- > Defence and civilian companies
- > Government agencies
- > Universities

### Key partnerships

- > UNSW, UWA, UTS, ANU and other Australian universities
- > MIT (USA), Johns Hopkins University (USA), Riken (Japan), Ecole Centrale de Lyon (France), The University of Glasgow (UK), Unicamp (Brazil)
- > IEE (Luxembourg), Leidos, Seeing Machines (Canberra)
- > UXOTRACKS (Canberra)

### Quality accreditations and awards

- > SII23.01.02 Heterogeneous Robot Teaming and Sensor Enhancements for Active CBRN Threat Modelling

[unsw.to/haroldo-hattori](https://unsw.to/haroldo-hattori)



## > Bootstrapping Ad Hoc Robot Swarms

### Enabling greater effectiveness of robot swarms

#### Research Project

Robot swarm formations offer efficient movement, a level of protection for the group, and potential for human guidance of a single swarm organism comprising many autonomous vehicles.

Robot swarms are suited for tasks including, but not limited to, surveillance, transport, search, exploration, mapping, sorting, communication and resource controlling. In the past, swarm robotics required significant human input to configure usable formations for different tasks.

This team's algorithms permit ad hoc formation of swarms from available units for new missions. It has developed multiple swarm-robot prototypes to demonstrate proof of concept – from swarms small enough to carry in a suitcase, to heavy duty, ground-vehicle swarms suitable for use outdoors.

#### Key capabilities

- > Developmental robotics
- > Swarm intelligence

#### Differentiators

- > Self-tuning and self-evaluating swarms
- > Able to predict mission time and/or meet time constraints
- > Harnessing the developmental robotics paradigm for multi-robot swarms

#### Key customers

- > Defence
- > Transport
- > Agriculture

#### Key partnerships

- > Australian Research Council
- > Defence Science and Technology Group

 [unsw.to/kathryn-kasmarik](https://unsw.to/kathryn-kasmarik)

## > Breaker

### Building robots that act like humans

#### Start-up

The war in Ukraine has underscored the critical role of autonomous systems in modern warfare. It has also revealed significant limitations in current solutions offered by major providers. These solutions are not scalable, requiring extensive networks, bulky equipment, and numerous skilled operators. Breaker addresses these challenges with CRUX OS, an autonomous platform enabling systems to make human-like decisions that previously required human operators.

CRUX OS understands the mission context, allowing task distribution aligned with mission objectives. It also enables operators to communicate with systems using natural language over the radios they already carry.

CRUX OS is at TRL 6, with prototypes demonstrated in operational environments and purchased by international special forces. In addition, it has been showcased with USSOCOM, Australian SOCOMD and the US Army.

Breaker is actively delivering on customer contracts, adding features, and welcoming demonstrations.

#### Key capabilities

- > Natural language interface allows interaction via existing radios, eliminating laptops and smartphones
- > Pre-mission briefing allows for complex and autonomous decision-making
- > Leads and delegates tasks to other autonomous systems

#### Differentiators


- > Single operator command: Control multiple systems while engaged or mobile
- > Electronic warfare resilience: No continuous telemetry, resistant to electronic warfare
- > Edge decision-making: Makes complex decisions, communicates as if human

#### Key customers

- > Special Forces groups
- > Police and Border Force
- > Public and private security groups

#### Key partnerships

- > UNSW Founders
- > US Special Operations Command
- > Australian Special Operations Command

 [breakerindustries.com](https://breakerindustries.com)

# > CRUISE Lab

## Trustworthy, multimodal machine-learning and explainable agents in complex environments

### Research Laboratory

CRUISE Lab addresses the need for transparency and adaptability in AI systems. The behaviour of machine-learning (ML) models needs to be properly understood. However, high-quality training data is often not available. In such cases, training a deep learning model requires a new data-efficient learning paradigm, without the need for high volumes of labelled data.

This team specialises in developing trustworthy ML techniques and models. The team has investigated a novel framework that uses GNN-based visualisation to explain the learning process of an agent in a complex environment.

Additionally, the team has developed a robust framework for continuous improvement of pretrained models, such as for question answering with multimodal data and for video-language tasks, in a continual learning setting. ViLCo-Bench, the first benchmark for video-language continual learning, which leverages memory efficient architecture, enables faster model training and more robust model evaluations.

The team has developed prototypes of both frameworks. Its work is at the proof-of-concept stage, and it is seeking collaboration and investment to refine these solutions and integrate trustworthiness in AI and machine learning.



### Key capabilities

- > Multimodal machine learning
- > Trustworthy machine learning (explainable, robust, fair)
- > Situational awareness and spatiotemporal intelligence



### Differentiators

- > Deep understanding of multimodal sensor fusion, robustness, and/or biases inherent to machine learning models and their implications
- > Expertise in a broad suite of technologies, including deep learning, interpretable machine learning, reinforcement learning, robustness, and benchmarking
- > Experience in building state-of-the-art AI algorithms and research solutions that have been adopted by many industry partners



### Key customers

- > Government agencies
- > Defence industry



### Key partnerships

- > US Department of Defence
- > US Airforce Research Laboratory



[cruiseresearchgroup.github.io/expo](https://cruiseresearchgroup.github.io/expo)



## > Environmentally Friendly, Functional Hybrid Coatings for Defence Applications

**A scalable technique for hybrid polymer stealth coatings**

### Research Project

Stealth coatings are crucial for the defence industry as they significantly reduce the radar, infrared, and other detection signatures of military assets. By making aircraft, ships, and vehicles harder to detect and track, stealth coatings provide a strategic advantage in both offensive and defensive operations.

UNSW researchers have developed the ability to fabricate environmentally friendly, aqueous-based, hybrid polymer coatings containing nanofillers. These are exemplified by graphene nanosheets and magnetic nanoparticles, thereby conferring properties such as electrical conductivity.

A key aspect is adopting an emulsion polymerization-based approach, which enables unprecedented control over the distribution of nanofillers within the polymer matrix. The coatings can be applied to large structures via spray coating and are suitable for Defence and industry applications. These coatings can be used as stealth coatings and are specifically designed for use in electromagnetic interference shielding.

### ⚙️ Key capabilities

- > Aqueous emulsion polymerisation
- > Control of nanofiller distribution
- > Large-scale fabrication and application

### 💡 Differentiators

- > Environmentally friendly
- > Suitable for scale-up on an industrial level
- > Able to fine-tune coating properties

### 👥 Key customers

- > Australian defence industry
- > Office of National Intelligence (ONI)
- > The coatings industry

### 🤝 Key partnerships

- > Office of National Intelligence (ONI)

🌐 [unsw.to/professor-zetterlund](https://unsw.to/professor-zetterlund)



## > iFire

**Visualising extreme and unpredictable fire scenarios**

### Research Centre

The iFire program connects global researchers and 3D systems in the world's first AI-immersive environment that visualises the unpredictable behaviour of extreme wildfires.

The 3D systems are networked across a range of platforms, using software that enables users to interact with each other by sharing the same 3D setting in real-time, no matter their platform. These platforms range from mobile 3D cinemas, 3D virtual production volumes, 3D LED walls, and 3D head-mounted displays, to laptops and tablets, providing simultaneous interaction for multiple users. It is underpinned by an AI framework that analyses, learns from, and responds to individual and group behaviour in real time.

Collaborators include UNSW iCinema Centre, UNSW Climate Change Research Centre, University of Melbourne, CSIRO/Data61, Australasian Fire & Emergency Service Authority Council, Fire Rescue NSW, and San Jose State University.

### ⚙️ Key capabilities

- > 360-degree, full-body AR and VR platforms
- > Interface for seamless communication between physical and virtual worlds
- > Ultra-high-definition fixed and mobile 2D/3D scanning systems

### 💡 Differentiators

- > World-leading expertise in AR, VR, mobility, and robotics
- > Global network of cutting-edge research and industry partners
- > Multidisciplinary research integrating advances in the creative arts, engineering and science

### 👥 Key customers

- > Fire Rescue New South Wales
- > China Coal Technology & Engineering Group, Fushun
- > Australian Broadcasting Corporation

### 🤝 Key partnerships

- > Australasian Fire Emergency Services Authorities Council (AFAC)
- > San Jose State University
- > CSIRO/Data61

### 🏆 Quality accreditations and awards

- > 2009: International Design Excellence Award (IDEA) Gold Medal for iCASTS
- > 2010: Finalist for the Design Award of the Federal Republic of Germany for AVIE
- > 2011: Gold MUSE Award for Museum Media and Technology for Volcanic 3D

🌐 [unsw.to/ifire](https://unsw.to/ifire)

# > Impact Dynamics Laboratory, UNSW Canberra

## • Novel materials and structures for enhanced shock and impact resilience

### Research Group

The Impact Dynamics Laboratory at UNSW Canberra develops novel materials and structures that are tested to withstand extreme loading conditions. Using advanced diagnostics, the team can launch projectiles to a distance of several km/s, and shock materials to extremely high pressures. The team is expert when it comes to protection, and has worked with a wide range of clients, including Mitsubishi Heavy Industries, Defence, DSTG, CSIRO, HighCom Armor, Bisalloy Steels Pty Ltd., and many others.

Recent examples of projects, many of which have led to patentable ideas, include:

- Development of a novel helmet for Defence by the integration of nanoparticles into a composite structure.
- Design, development, and testing of Triply Periodic Minimum Surface (TPMS) lattice structures for energy absorption in automotive applications.
- Development of armour by using auxetic porous structures.
- Bio-inâspired structures for energy absorption.
- Concepts for improving the ballistic performance of ceramic-faced armour.



### Key capabilities

- > Subjecting materials and structures to extreme dynamic loads
- > Applying finite element techniques to design resilient structures
- > Team of academics with experience in additive manufacturing, hypersonic technologies, material science, engineering, and computational modelling



### Differentiators

- > A unique facility that can stress materials and structures to a range of different loading scenarios and rates
- > Able to launch projectiles to hypersonic velocities
- > The only lab in Australia with the ability to shock materials to extreme pressures

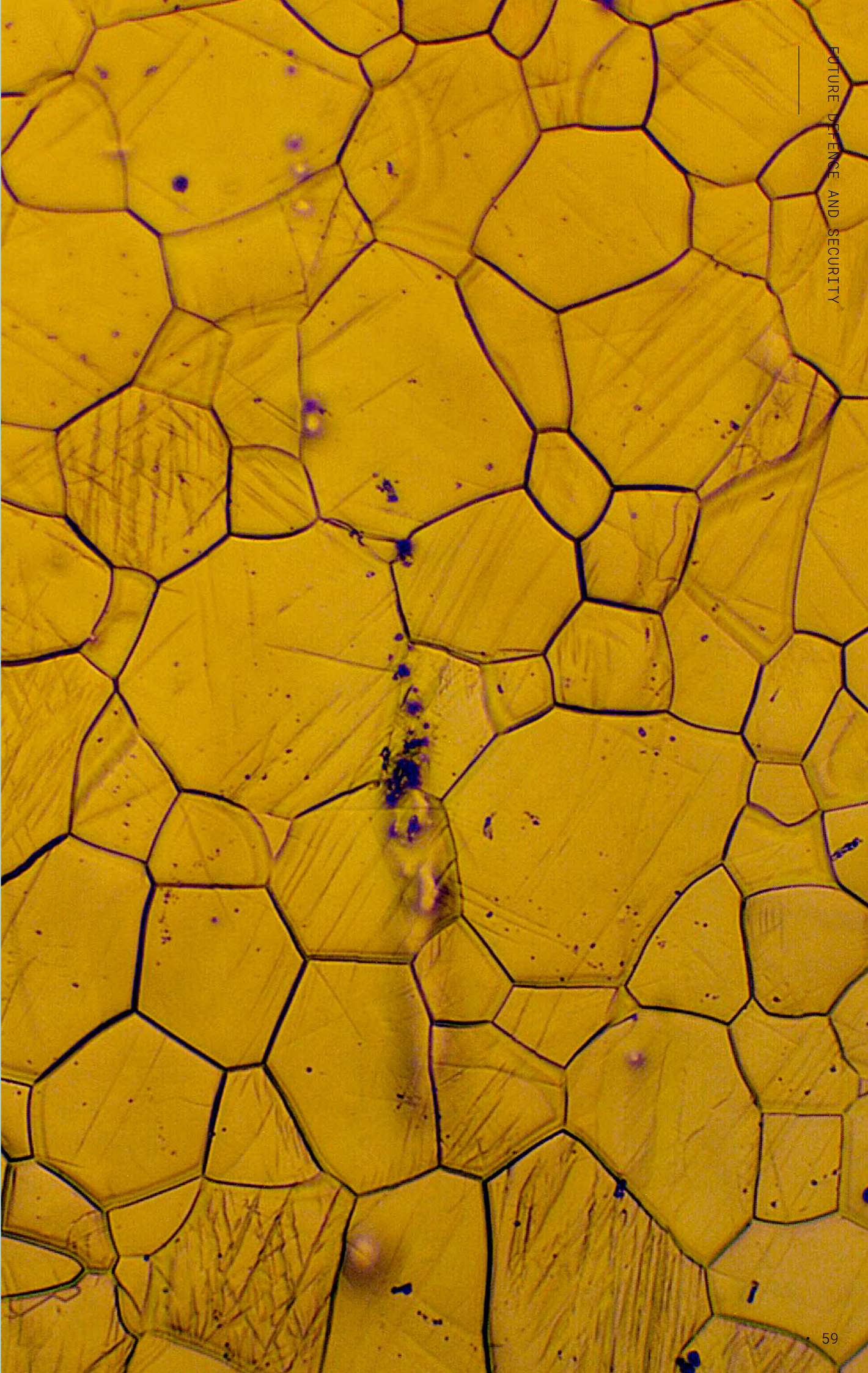


### Key customers

- > Defence industry



[unsw.to/impact-dynamics](https://unsw.to/impact-dynamics)





## > Machine Learning and Computer Vision (MLCV) Group

**Improving visual analytics via automated, multimodal understanding across the electromagnetic (EM) spectrum**

### Research Group

MLCV has broad expertise in automated image understanding. It works on challenging visual problems, such as automated video analysis, behaviour analysis, object detection, segmentation, object tracking, and automated search in natural disasters.

The team works toward automating many repetitive, laborious tasks to augment geospatial analysts, specialist physicians, and other professionals in their decision-making and improve system robustness.

In remote sensing, it has developed techniques based on crowdsourcing and deep learning for detection of visual change due to disasters, such as bushfires, using remotely sensed optical images, SAR and geomaps. The granularity of changes ranges from whole buildings and land cover to the pixel level with accurate quantification.

The team has deep experience in analytics for biomedical radiology datasets and other clinical data. Its expertise can be transferred to many security-related problems, including video surveillance, facial recognition, behavioural analysis, and automated vehicles.



### Key capabilities

- > Imaging across the EM spectrum
- > Inspired R&D
- > GPU-based machine and deep learning



### Differentiators

- > 2023 Telstra Brilliant Women in Digital Health Award for Research
- > 2019 Winner of Urban Prediction Contest, Joint Urban Remote Sensing Event (JURSE)
- > 2019 (Matt Gibson, PhD Student in Sowmya's Group)
- > Westpac Cadetship – Upul Senanayake (2017–2020)
- > Arathy Satheeshbabu (2018–2021), PhD students in Sowmya's Group



### Key customers

- > Transport NSW and shopping centres (focussing on surveillance and behaviour analytics)
- > MRFF Grant with St George Hospital (focussing on data analytics for rare cancers)
- > Public hospitals in NSW (focussing on automated, multimodal medical image analysis (Ingham Medical Research Institute (Liverpool Hospital), St George Hospital, Prince of Wales Hospital)



### Key partnerships

- > Ingham Medical Research Institute (Liverpool Hospital)
- > Black Dog Institute
- > NSW Transport
- > Prince of Wales Hospital



[unsw.to/arcot-sowmya](https://unsw.to/arcot-sowmya)



### Key capabilities

- > Complex agent-based population simulator
- > Self-contained operation
- > Integrates current models for human interaction, social media usage, and disinformation diffusion



### Differentiators

- > A simulator, not an emulator: nothing is pre-scripted
- > Provides ground-truth: measures of effectiveness for influence campaigns can be directly measured
- > Does not rely on existing social media datasets: original data is generated from AI systems in real-time



### Key customers

- > Used as a defence training tool, and to understand when and how to apply techniques in this domain



### Key partnerships

- > Defence Science and Technology



### Quality accreditations and awards

- > Winner of the 2024 Australian Cyber Security Professional of the Year – Technology, Media & Telecommunications



[unsw.to/benjamin-turnbull](https://unsw.to/benjamin-turnbull)

## > Neonraven

**Integrating AI populations into news and social media for wargaming to provide integrated understanding**

### Research Project

Modern conflict is multifaceted and increasingly involves the rapidly evolving terrain of online social media. Neonraven is a social media and news simulator, underpinned with AI-enabled synthetic populations that are constructed with personalities, friends, family, moods, and opinions. Fake news, conspiracy theories and mis/disinformation flow through these networks, influenced by player actions. Players can interact with this population directly, but they also read the news and message each other. Succeeding needs to involve an element of overt or covert online actions that mirror real-world capabilities and past events.

Neonraven teaches much more than the importance of social media and news in modern conflict. It also shows the tactics, techniques, and procedures that are used offensively and defensively, and their effectiveness. This technology has been tested in multiple DST wargames since 2022.



## > Peroxide Deactivation Lab

### Safe deactivation of improvised peroxide base-explosives

#### Research Laboratory/Facility

A safe way to deactivate improvised peroxide-based explosive has been an outstanding issue for more than two decades. These materials are used by terrorists and nefarious actors and pose a risk to defence personnel, security, law enforcement, and first responders. This issue is also of international significance.

Laboratory trials have demonstrated the efficacy of a catalytic method on analytical scale, for which a provisional patent has been filed. The next phase requires real-world field trials, to verify the technique. At the successful conclusion to this phase, protocols for use and a kit would be developed.

Investment would help secure industry partners.



#### Key capabilities

- > Experienced chemistry researcher and team
- > Equipped research laboratories and state-of-the-art analytical equipment



#### Differentiators

- > Australian Patent Application No. 2023903650



#### Key customers

- > Defence personnel
- > Security
- > Law enforcement
- > First responders



#### Key partnerships

- > Red Team
- > Defence Science Technology group



[unsw.to/anthony-day](https://unsw.to/anthony-day)



#### Key capabilities

- > Expertise in energetic and reactive materials



#### Differentiators

- > Demonstrated track record with Defence and industry



#### Key customers

- > Defence Prime Contractors



[unsw.to/nicholas-kanizaj](https://unsw.to/nicholas-kanizaj)

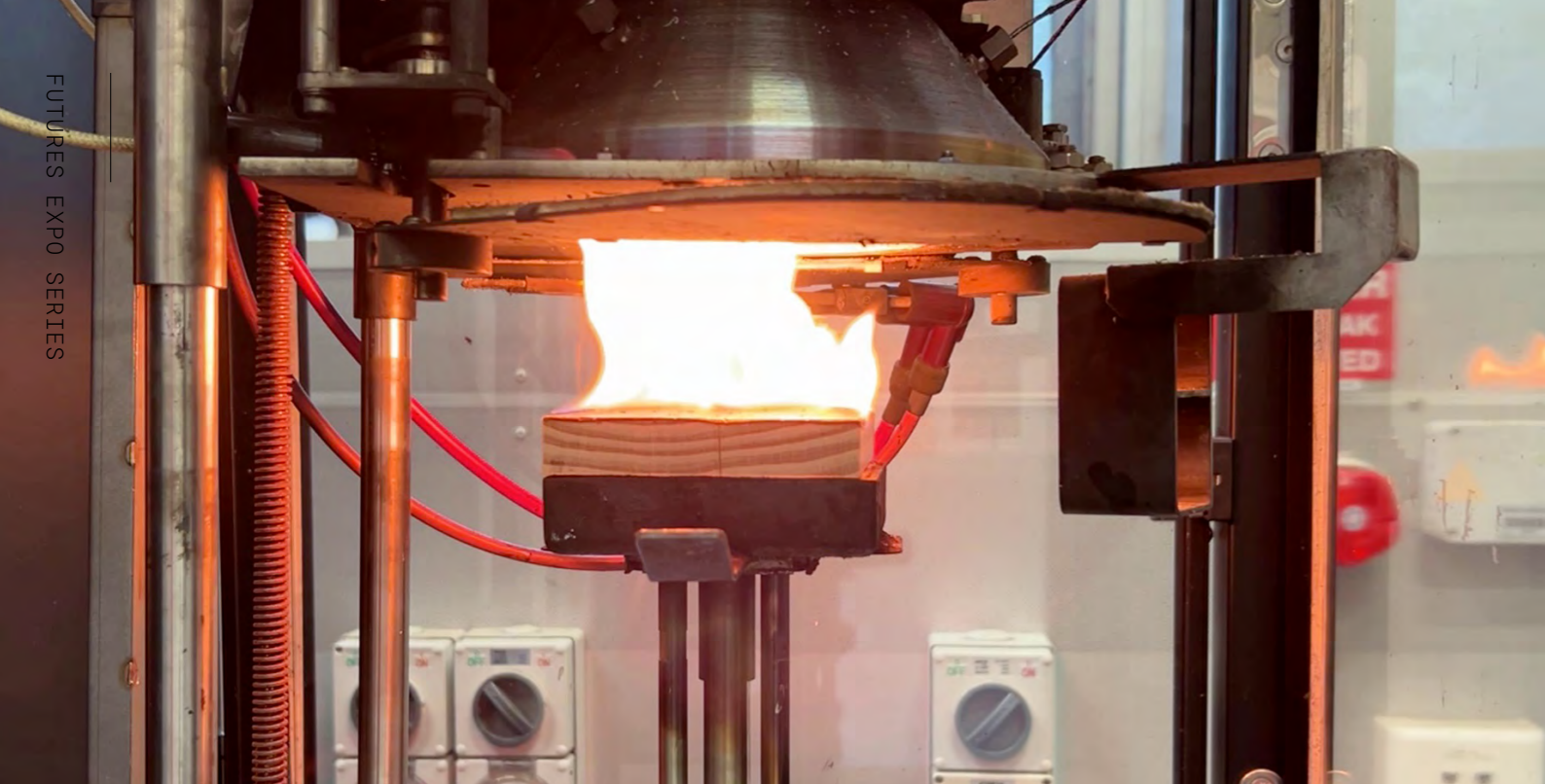
## > Propellant Manufacture

### Novel process for manufacturing key materials and propellants for solid rocket motors

#### Research Group

Solid rocket motors underpin tactical and strategic missile capabilities. Broadly speaking, their propellants are composed of fuel, binder and oxidiser.

Targeting national resilience, this research group is developing new processes for the in-country manufacture of strategic oxidiser materials that would otherwise require importation via vulnerable international supply chains.



## > Protecting Critical Assets/Infrastructure using Bushfire-Resilience Technologies



### Key capabilities

- > Expands upon heat exposure to provide insulation and prevent heat penetration
- > Developed and produced fire protection technologies
- > Usable on timber, aluminium, steel, concrete, plasterboard, and brick



### Differentiators

- > Proprietary intumescent paint technology
- > Exclusive manufacturing by Flame Security International in Australia
- > Available at Bunnings stores



### Key customers

- > Government agencies for safeguarding public infrastructure
- > Construction industry for fireproofing buildings and structures
- > Homeowners in bushfire-prone areas for protecting residential properties



### Quality accreditations and awards

- > FSA FIRECOAT won the People's Choice Award through the participation of Professor Guan Heng Yeoh in the 2024 Shaping Australia Awards



[bunnings.com.au/brands/f/firecoat](https://bunnings.com.au/brands/f/firecoat)

Developed an intumescent paint for fire protection, to safeguard assets and infrastructure in bushfire-prone areas

### Research Centre

Australia's vulnerability to extreme weather conditions and the frequency of devastating natural and man-made fires are major risks to new and existing assets and infrastructure in bushfire-prone areas. The research group, in partnership with government entities and companies, has developed innovative fire protection and suppression technologies that will safeguard and minimise exposure to fire threats.

The team has developed an intumescent paint that expands due to heat exposure, providing insulation and preventing heat penetration. The paint produces a thick layer of char, which offers an insulating barrier and effectively deflects the fire's heat.

This new paint technology is commercially branded FSA FIRECOAT. It is manufactured locally by Flame Security International (FSI) and on sale at select Bunnings stores. It can be applied to a variety of surfaces, including existing render, timber, aluminium, steel, concrete, plasterboard, and brick.



## Seitec

Delivering the first near real-time unexploded ordnance detection system in the world

### Industry Partner

Up to 5% of ordnance deployed on weapons ranges fail to explode. These unexploded ordnances (UXO) are a safety risk and, if lost, can incur search costs exceeding \$10M. Up until now, no system in existence has been able to solve this problem.

The solution? UXOTrackS. It was invented by a member of Defence (and ADFA alumni) who, in late 2021, spun out of Defence and founded Seitec. Using custom seismic sensors with edge compute, UXOTrackS can localise bomb impacts in near real-time and detect occurrence of UXO.

Seitec's most recent test at Woomera used 12 deployable sensors across 40 square kilometres to localise bomb explosions to 4m, and simulated UXO to less than 40m. The system also successfully delineated and localised three simultaneous explosions. This is the first fielded example of this technology in the world.



### Key capabilities

- > Proprietary Edge AI capabilities
- > Advanced DSP algorithms
- > Internally developed, low power, ultra-low noise, fused FPGA and AI accelerated microcontroller electronics



### Differentiators

- > UXOTrackS is a first-of-type system using leading edge algorithms
- > A proven ability to understand and use seismic waves to create situational awareness, (patent pending)



### Key customers

- > Military weapons ranges for UXOTrackS, Intelligence, Surveillance, and Security (for a derivative product, Nightingale, which tracks footsteps)
- > Mining (for a derivative product, Sandpiper, that aids in Ambient Noise Tomography)



### Key partnerships

- > Secure Bits

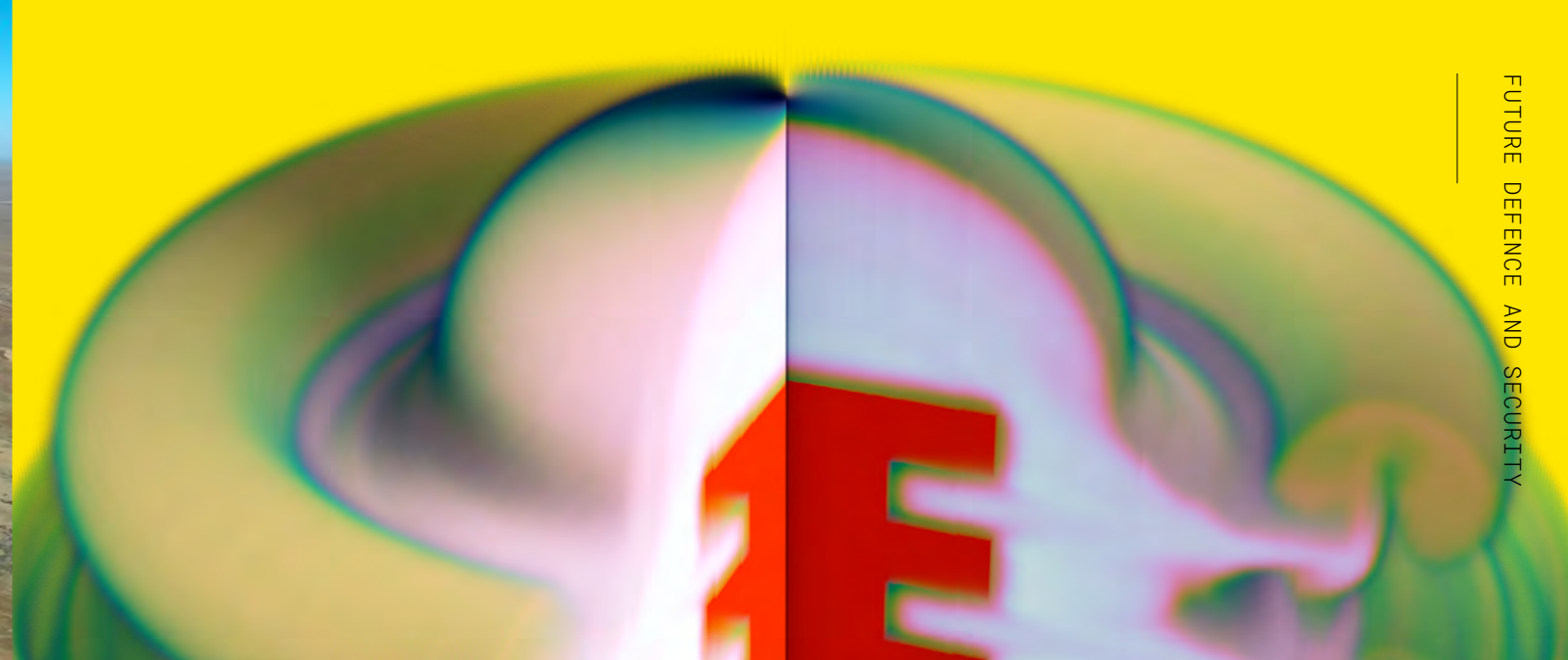


[seitec.com.au](https://seitec.com.au)





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## > UNSW Hypersonic Vehicles Group

### Developing numerical and experimental methods to design and evaluate hypersonic systems and countermeasures

#### Research Group

It is still relatively early days in the design and operation of high-speed vehicles for applications – from reusable space launch to high-speed transport to defence missions, including long-range strike and counter hypersonics. While vehicles in all these classes have been successfully flown in some form, these designs need significant improvement to their performance and efficiency to decrease their cost of manufacture and operation. The goal is to make them more practical for the missions they are intended to perform under extreme flight conditions.

The UNSW Hypersonic Vehicles Research Group works closely with key government and industry partners to develop and test numerical and experimental tools and approaches to improve the design and evaluation of hypersonic systems and countermeasures. These systems range from subcomponents and onboard systems to materials and structures to complete vehicle.



#### Key capabilities

- > High-speed flying testbed for the research, design, testing, and evaluation of hypersonic systems and countermeasures
- > Multi-fidelity numerical frameworks for the design and evaluation of hypersonic vehicles
- > Design, manufacture, and evaluation of functionally graded airframe structures



#### Differentiators

- > Unique research, design, testing, and evaluation infrastructure
- > Unique modelling capabilities
- > Close collaborations with key industry and government partners



#### Key customers

- > Industry integrators and startups
- > SMEs seeking to evaluate and demonstrate their on-board and off-board technologies
- > Government agencies



#### Key partnerships

- > Defence Trailblazer
- > US University Consortium for Applied Hypersonics



[unsw.to/hypersonics](https://unsw.to/hypersonics)



#### Key capabilities

- > Modelling geometry-dependent kinetics
- > Multi-phase modelling, including embedded wires
- > Shape optimisation



#### Differentiators

- > Unique GPU-accelerated codes
- > Atomistic and continuum models
- > Customised modelling ecosystem



#### Key customers

- > Australian Department of Defence
- > Any geometry-dependent solid-fluid kinetics



#### Key partnerships

- > DSTG



[unsw.to/terry-frankcombe](https://unsw.to/terry-frankcombe)

## > UNSW Kinetics Group

### Reactive and energetic system modelling for designed propellant burn profiles and weapon effects

#### Research Group

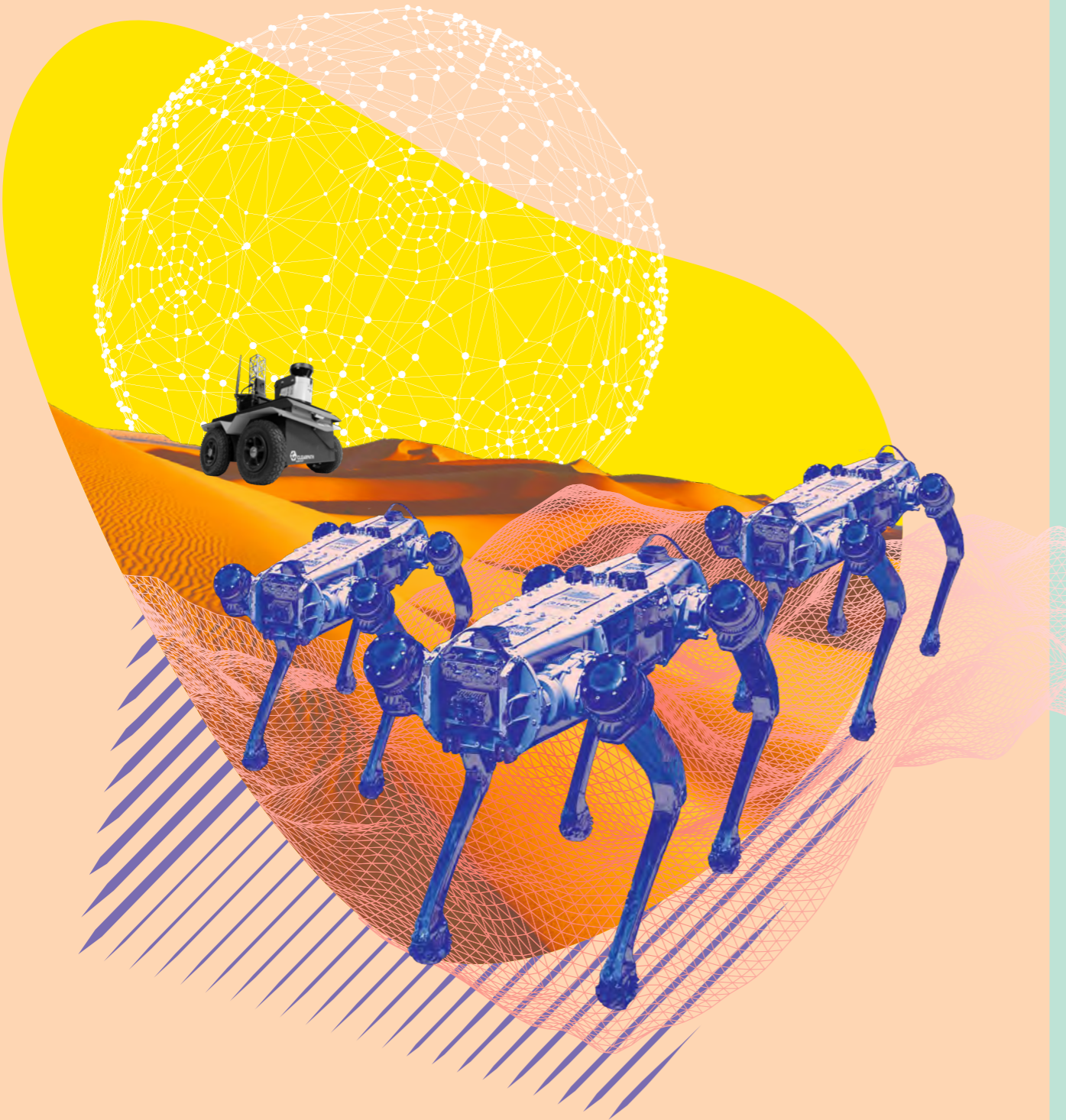
The shape of burning propellants has a significant effect on the rate at which they burn, and how that burn rate changes during combustion. Similarly, the configurations of the interfaces of reacting materials have a strong impact on the reaction rate, peak temperatures reached, and even the products of the reaction.


The Kinetics Group, led by Terry Frankcombe at UNSW Canberra, is developing ways to simulate and understand these dependencies.


Together with the Department of Defence, it has modelled the combustion of propellant grains of hundreds of thousands of different 3D shapes through its highly efficient GPU-accelerated codes and flexible shape descriptors. Reactive materials have fundamentally different reaction characteristics depending on the 3D structure.


The group is now applying its expertise to shape-dependent kinetics.


# Emerging Enabling Technologies





- 
**Key capabilities**
- > Advanced materials that exhibit tuneable excitation-emission properties, in the UV, visible and near-infrared domains, resulting in light based, uniquely identifiable signatures
  - > Robust materials well suited for harsh conditions, capable of withstanding temperatures more than 200°C
  - > High versatility, capability to mark metals, textiles and plastics

- 
**Differentiators**
- > Exclusive innovation: Our materials are unique inventions, protected as a trade secret, ensuring they cannot be reproduced or copied
  - > Expertise: Our team has over 20 years experience in chemistry, forensic science and engineering
  - > Multi-use: Ideal for a wide variety of use cases including IFF, supply authentication, certification and low-profile asset tracking

- 
**Key customers**
- > Defence Industrial Base and Defence Contractors: Enhance security of supply chain, resulting in improved operational reliability and safety for defence personnel, protection of corporate image and supply contracts
  - > Defence Strategic and Operational: Development of improved IFF capabilities and covert / clandestine asset tagging and tracking
  - > Luxury goods suppliers: Counterfeit products ultimately undermine brand value. Our materials provide a unique capability to provide authenticity assurance, resulting in reduced counterfeiting and increased customer trust

- 
**Key partnerships**
- > UNSW
  - > IPAS, University of Adelaide
  - > Defence Trailblazer

- 
**Quality accreditations and awards**
- > ISO 9001 - Commitment to Quality Assurance (working towards)
  - > ISO 27002 - Information security, cyber security and privacy protection-information security control (working towards)
  - > ISO 17034 - Reference materials producers (working towards)

 [auroramaterials.com.au](http://auroramaterials.com.au)

## > Aurora Materials Pty Ltd

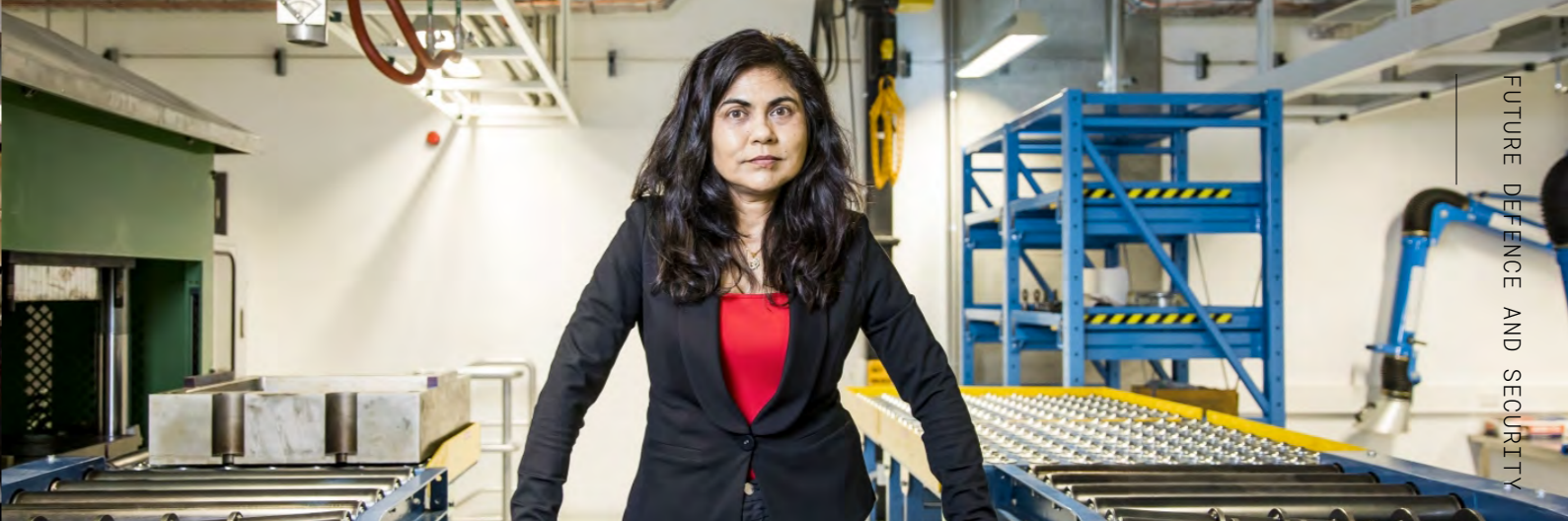
Creating advanced materials that emit unique light-based signatures to enable secure identification and authentication of mission-critical supplies and assets

### Spin-out

The US military estimates that up to 15% of all replacement electronic parts for its weapons systems, vehicles, and equipment may be counterfeit, increasing the risk of dangerous malfunctions and resulting in the loss of operational capability. In 2020, F-16 pilot Lt. David Schmitz (USAF) was killed in a landing accident due to counterfeit chips found in his ejection seat. These counterfeit electronics pose a credible threat to our armed forces.

Aurora Materials, a UNSW-based spin-out, addresses this issue with proprietary fluorescent markers to identify and authenticate assets in military supply chains. Its markers emit light-based signatures in the UV, visible and near-infrared domains, tailored towards mission requirements. By embedding its materials into plastics, metals and textiles, it effectively authenticates components, mitigating the threat of counterfeit electronics.

Aurora Materials is seeking investment opportunities to leverage various match-funding grants to help improve and scale its manufacturing, detection and tagging capabilities.



## > Automated Fibre Placement for Next-Gen Composite Manufacturing (AMAC)

Promoting integrated innovation in automated composite manufacture – from material design to product realisation

### Research Centre

There is a growing demand from the defence and security sectors for lightweight, high-strength materials that enhance performance and safety while reducing costs. AMAC at UNSW Sydney addresses this need for advanced composite materials, focusing on automated fibre placement (AFP) and smart composites.

AMAC's four key pillars include: materials enhancement, process-properties optimisation, simulation and performance prediction, and design integration and optimisation. These pillars allow the team to integrate advanced elements like graphene-treated polymers and carbon nanotubes to develop superior composite materials. The team is also exploring ways to refine manufacturing processes for maximum efficiency and quality, and uses advanced tools to forecast manufacturing outcomes and material behaviour. Finally, the team is streamlining the incorporation of AFP into industrial applications.

Current activities range from proof of concept to prototype development. The project aims to foster sector growth and productivity, and to advance defence and security technologies.

### Key capabilities

- > Manufacture of complex, high-tolerance, high-strength composite structures
- > Manufacture using dissimilar (metal/composite) and hybrid materials
- > Embedded and surface-mounted sensing, material characterisation

### Differentiators

- > AFP-based manufacturing of composites
- > Large structures testing and structural health monitoring
- > Full-scale testing capabilities for static to fatigue loading

### Key customers


- > Defence Science and Technology Group (DSTG)
- > Quickstep Technologies
- > Transport for New South Wales (TfNSW)

### Key partnerships

- > Omni Tanker Pty Ltd
- > Quickstep Technologies
- > SDI Ltd

### Quality accreditations and awards

- > JEC Innovation Award 2019 for shape- adaptive composite marine propeller with sensing

 [advanced-composites.co](http://advanced-composites.co)

### Key capabilities

- > High-temperature processing facilities
- > Materials characterisation facilities
- > Mechanical, chemical, and electrochemical performance-measurement facilities

### Differentiators

- > Achieved more than AUD 60M funding for waste recycling and transformation
- > Academic excellence (more than 60 PhD completions) and commercial research transformation excellence (Green steel™, Green Ceramic™, MICROfactorie™)

### Key customers

- > Government Departments, such as the Department of Climate Change, Energy, the Environment and Water
- > Councils and local government, e.g. Shoalhaven City Council
- > Australian Research Council

### Key partnerships

- > Industry, e.g. Kandui Technologies and Renew IT
- > Government supported Programs
- > Not-for-Profit Organisations, e.g. Planet Ark

### Quality accreditations and awards

- > 2022 NSW Australian of the Year, Laureate Professor Veena Sahajwalla
- > 2022 Clunies Ross Innovation Award winner, Laureate Professor Veena Sahajwalla
- > 2022 Eureka Prize, Laureate Professor Veena Sahajwalla

 [smart.unsw.edu.au](http://smart.unsw.edu.au)

## > Centre for Sustainable Materials Research & Technology

Hybrid layering of nano ceramics on low-cost steel surfaces by high-temperature transformation of waste materials

### Research Centre

The UNSW SMaRT Centre, led by Laureate Professor Veena Sahajwalla, addresses the critical issue of waste materials by remanufacturing waste into valuable materials through innovative Microrecycling science and MICROfactorie® technologies. This approach converts materials like glass, textiles, and plastics into new value-added materials and products such as Green Ceramics and 3D printing filament, thus reducing landfill waste and promoting a circular economy.

The SMaRT Centre's "Green Steel" process, commercialised and adopted both Australia and internationally, uses waste rubber and plastics as a coking coal alternative, diverting millions of passenger vehicle tyres from landfill in Australia. Currently, The Centre is the host of the National Environment Science Program Sustainable Communities and Waste Hub, researching ways to reduce the effects of plastic, support sustainable people-environment interactions and minimise the impacts of hazardous substances. The SMaRT Centre is at the forefront of integrating waste into green manufacturing, building a stronger and more sustainable economy.



## > Cognitive Advantage

**Creating private 5G wireless networks that enable secure, reliable, mobile communication for defence, emergency services, and public safety**

### Co-locator/Launch

Overwhelmingly, military forces, emergency services organisations, and public safety agencies use legacy voice-radio systems for mission-critical communications. Rapid advances in civil wireless technologies, such as 5G and beyond cellular and Starlink or other low-earth orbit satellite constellations, offer massive asymmetric advantages to agile adversaries. However, these have not been widely adopted by the Australian Defence Force.

The key limitation of commercial 5G networks is not technology, but business model. Commercial telcos naturally invest in building cell towers where most of their civil customers live and work, not in remote and sparsely populated regions where militaries prefer to fight. Cognitive Advantage is solving this problem by building portable 5G small cells that users can rapidly self-deploy to deliver instant wireless connectivity exactly where, and when, they need it.

Cognitive Advantage is in the alpha prototyping stage of its Tactical 5G Network project. UNSW is currently providing research support to its project.

## > Computer Aided Design of Quantum Devices

**A software tool for designing quantum electronic devices using an atom-to-material approach**

### Research Group

Sophisticated computer-aided design (CAD) tools have greatly contributed to the rapid progress and miniaturisation of solid-state devices over the past 40 years. However, such tools are inherently semi-classical, and cannot be used to design the next generation of computing and electronic devices that operate with quantum mechanical principles. To accelerate the development cycle of quantum devices from concepts to experimentation and eventually to large-scale manufacturability, new CAD tools are needed. These tools must be fully quantum mechanical in their methodology and adopt an atom-to-material simulation approach.

Based on 20 years of research and development, such a quantum CAD tool is at its inception at UNSW. This software tool has been calibrated and tested against state-of-the-art experiments in silicon and III-V material-based quantum computing and electronics. With the multi-billion-dollar investments in quantum technologies worldwide, such a tool can potentially accelerate technology development for military and industrial applications.



### Key capabilities

- > An idea-to-prototype lifecycle that can be as short as six weeks
- > A veteran-led business that deeply understands the problems it solves
- > Domestic and international supplier network share cutting-edge technologies



### Differentiators

- > Customer-focused innovation
- > Lean business model
- > Supports customers anywhere, anytime, to assure customer success



### Key customers

- > ENSW Telco Authority
- > Advanced Strategic Capability Accelerator
- > Mining industry



### Key partnerships

- > UNSW Canberra: Dr Faycal Bouhafs leads the research team supporting the Tactical 5G Network project



### Quality accreditations and awards

- > Defence Industry Security Program



[edgespark.io](https://edgespark.io)



### Key capabilities

- > Exploration of device geometry, material stack, control parameters, and performance
- > Quantifying the role of material disorder and noise sources in device operation
- > Based on advanced numerical methods and high-performance computing



### Differentiators

- > Capability to solve wave functions and charge densities over realistic length-scales of 20+ million atoms
- > Multi-scale (atomistic to continuum) and multi-physics (electronic, phonon, spin) simulations
- > Simulation of band structure, relaxation/decoherence times, and current-voltage response in a variety of materials



### Key customers

- > Solid-state quantum computing industry
- > Nano-electronic and opto-electronic device development in the military and industry
- > Energy industry across photovoltaics, solid-state lighting and nanoscale transistors



### Key partnerships

- > Silicon quantum computing, SQC
- > Centre of Excellence for Quantum Computer & Communication Technology
- > Diraq



[quantum.physics.unsw.edu.au](https://quantum.physics.unsw.edu.au)

# > Defence Trailblazer

A collaborative partnership between the University of Adelaide and UNSW, supported by the Australian Government’s Department of Education

Research Alliance

The Defence Trailblazer works closely with partner universities, Defence and the defence industry to strengthen Australia’s sovereign defence industrial capabilities. Its work involves the commercialisation of new technologies and solutions, and the development of specialised knowledge and skills for the current and future workforce.

By removing barriers for university-industry collaborations, the Defence Trailblazer will drive long-term impact by:

- accelerating the commercialisation of research for the Australian Defence Force
- developing education and training pathways to address current skills gaps and emerging defence industry workforce needs
- fast-tracking entrepreneurs and innovators' ideas to commercialisation
- enhancing collaboration between industry, government and academia.

To date, the Defence Trailblazer has had:

- \$200M+ investment to accelerate and grow Australian defence capability
- 70+ industry-academia projects underway
- 55+ industry partners, including start-ups, SMEs and defence primes

It has also supported and funded 32 innovators through entrepreneurship programs and awarded 43 students with higher-degree research scholarships and internship opportunities to date.



Key capabilities

- > R&D programs aligned to AUKUS Pillar II and Sovereign Defence Industrial Priorities (SDIPs)
- > Upskilling programs for the current and emerging defence industry workforce
- > Enablement programs to foster Australian defence innovations
- > Institutional reform initiatives to enhance industry-academic collaborations



Differentiators

- > \$50m grant from the Department of Education, and the only Trailblazer with a focus on defence sovereign capability under the Trailblazer Universities Program
- > Strong ties to defence capability and innovation, science and technology organisations
- > Strong connections to the technology investment community



Key customers

- > The Australian Defence Force (ADF), particularly Capability Groups and Service Innovation Units (end-users)
- > Australian defence industry (partners)
- > Current and emerging academics

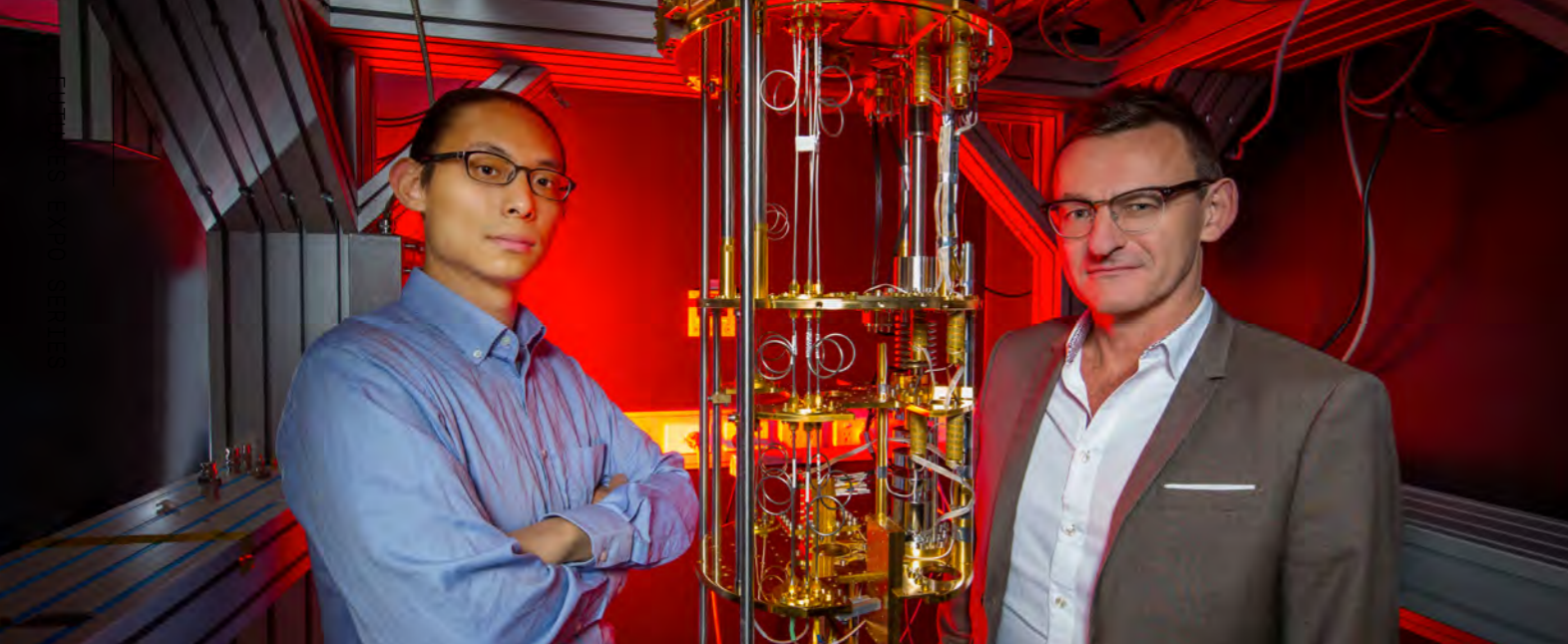


[dtb.solutions](https://dtb.solutions)



Key partnerships

- > Links to 55+ defence industry partners, and growing
- > Academic ties with two leading Australian universities (UNSW and the University of Adelaide), supported by the Australian Government Department of Education
- > Robust links to the Australian Defence sector through board representation and strong working relationships with key defence and national security agencies



#### Key capabilities

- > Deep research expertise in silicon 'quantum dot' quantum computing
- > Proprietary qubit control and measurement methods
- > Nanofabrication and cryoelectrical characterisation



#### Differentiators

- > Extensive patent-capability in 'quantum dot' quantum computing
- > Large technical team with deep engineering expertise
- > Strong partnerships with international foundries, commercial organisations and research institutions



#### Key customers

- > Significant potential applications in cryptography, cyber and security
- > Potential development of new materials in defence application (quantum chemistry)
- > Optimisation applications in complex logistics management



#### Key partnerships

- > Imec
- > GlobalFoundries
- > US Army Research Office



#### Quality accreditations and awards

- > US Army Research Office (ARO) Grant - Partnering with the University of Sydney, HRL Laboratories, and Q-CTRL
- > US Air Force Office of Scientific Research (AFOSR) Grant
- > NSW OSCE Quantum computing commercialisation fund (QCCF) Recipient



[diraq.com](http://diraq.com)

## > Diraq

### Developing full-scale, fault-tolerant quantum computers using silicon quantum dot technology

#### Enabler

Diraq's value proposition is to deliver quantum computing systems that are free of errors, via spin qubits – the only technology dense enough to fit millions of qubits into a single chip. As well as being compatible with Complementary Metal-Oxide-Semiconductor (CMOS) technology, silicon offers a highly advantageous environment for qubits, with relatively low noise and demonstrated high-fidelity operations – with a recent record control accuracy of 99.9% for a qubit manufactured at imec.

The only competing qubit platforms with similar levels of high-fidelity operation are ion traps, photonic systems, and superconducting systems. These technologies are limited to a maximum of thousands of qubits per chip, meaning scaling to the millions of qubits required for commercial algorithms is a major challenge.

Diraq's commercially valuable, fault-tolerant quantum computer is anticipated to reach the logical qubit count needed to solve very high commercial value problems (expected market \$450B – \$800B). With thousands of logical qubits performing tens of billions of operations, these computers will revolutionise chemistry, cybersecurity, medical sciences, and many other fields.

## > Electrical Machines and Drive Systems

### Pushing beyond the limits of electric motors for a more sustainable electrified future

#### Research Group

The development of high-speed motors is a major trend driving the transition to an electrified future. This is because they allow electric drive systems to achieve higher power density, improved efficiency, and reduced use of critical materials. However, the mechanical and electrical stresses induced by the rotation also increase with the speed. This has been the major obstacles for high-speed motors.

To push beyond the speed and performance limits of electric motors, this UNSW team developed novel motor topologies, multiphysics modelling techniques, and genetic-algorithm-based optimisation programs. These technologies enabled the team to develop multiple advanced motors that can achieve:

- a record-breaking high-speed of 100,000 rpm with a power density of 7 kW/kg
- wide constant power speed range demanded by EV applications
- low noise and vibration, and
- fault-tolerant operating ability.

These designs can be re-optimised to provide high powers of 100-300 kW for EV and industry servo applications.



#### Key capabilities

- > Advanced electric motor design and optimisation
- > Advanced control techniques for the motor drives
- > Wide-band gap inverters for the motor drives



#### Differentiators

- > Mechanical robustness to achieve speeds up to 100,000 in an interior type of PM motors without any sleeve
- > Compact and requires fewer rare earth magnets
- > High efficiency



#### Key customers

- > Electric vehicles
- > Large drones
- > Machine tools
- > Compressors



[unsw.to/ev-magnet-machines](http://unsw.to/ev-magnet-machines)



## > Empirical Research on Evolving Patterns of Drone Warfare

Investigating the changing character of warfare and its consequences, with a focus on drones and global order

### Research Project

This project develops and advances research-led, strategic policy for the national and global regulation of drone warfare. Specifically, it investigates the trade-offs imposed by drone warfare on global order.

Drone warfare imposes contradictions with regard to the structure of international society, the diffusion of military capabilities, and the sovereign equality of states and laws of armed conflict.

This project presents a typology of contradictions that threaten the legitimacy of global order. This framework also suggests a confounding consequence of drone warfare that academics and policymakers have not yet fully explored, i.e., that drone warfare can sometimes strengthen global order.

The project proposes a research-informed policy agenda to reconcile the complex and often counter-intuitive impacts of drone warfare.



### Key capabilities

- > Develops research-led strategic policy for the national and global regulation of AI and drone warfare



### Differentiators

- > Filling the gap by contributing to a 'fourth wave' of literature concerned with the trade-offs imposed by drone warfare for global order



### Key customers

- > Government agencies including security and defence departments
- > Policymakers across government agencies involved in security and defence
- > Early and mid-career defence personnel who are undertaking academic studies



[unsw.to/srinjoy-bose](https://unsw.to/srinjoy-bose)



### Key capabilities

- > Electron microscopy and atom probe microscopy
- > Macro-to-micro mechanical testing and high-temperature mechanical testing
- > Processing via melt metallurgical routes and metal 3D printing



### Differentiators

- > Experts in up-scaling of findings to real-world processing plants
- > Processing-structure-property via multi-scale microscopy, mechanical testing and modelling
- > Strong track record in specialty alloys, refractory metals and automotive steel processing



### Key customers

- > Aerospace Manufacturers
- > Defence Departments
- > Society and consumers through more accessible transportation and reduced environmental impact



[unsw.to/engineering-microstructures](https://unsw.to/engineering-microstructures)

## > Engineering Microstructures

Exploring next-generation aero-engine materials to unlock performance

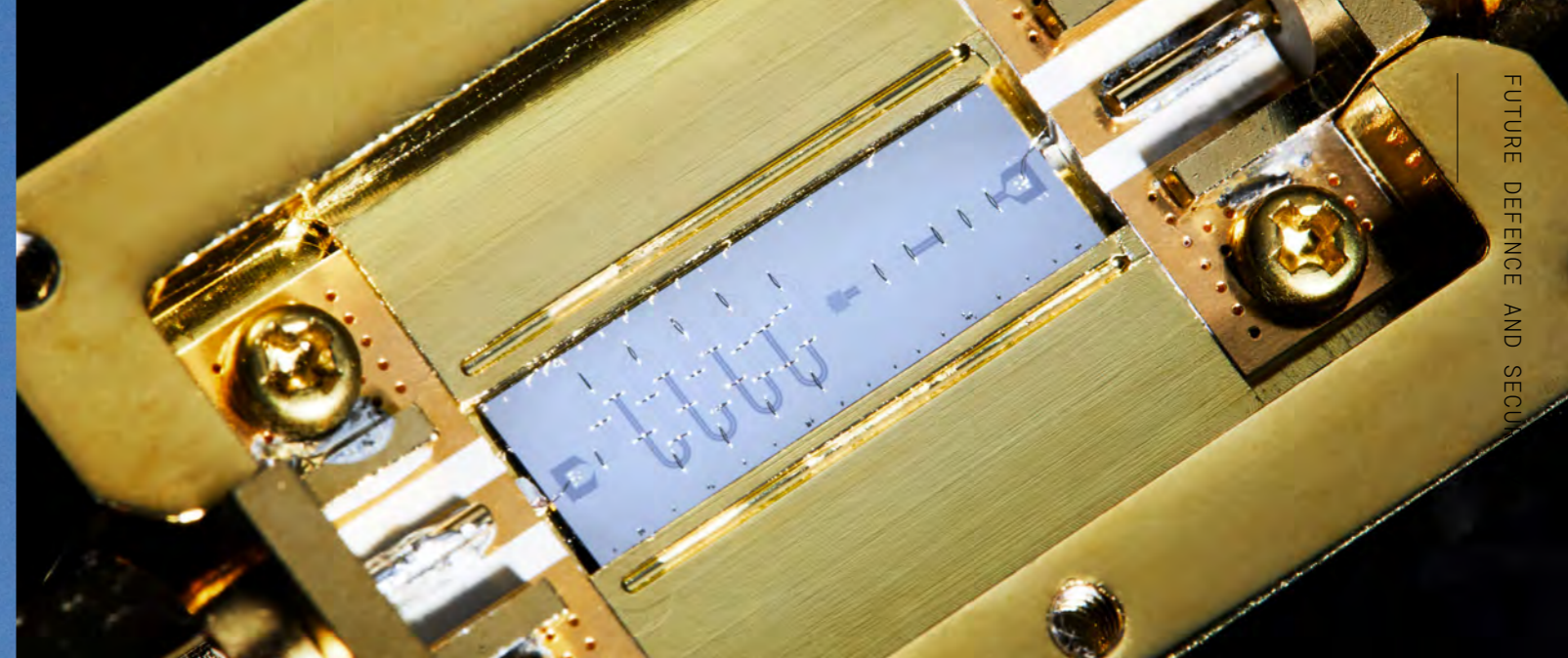
### Research Group

The Engineering Microstructures Group aims to unlock superior superalloy performance for aerospace, automotive, defence, and others by advancing their processing-structure-property relationships.

Current limitations in alloy performance reduce higher-temperature applications. Engineering Microstructures' solution involves optimising the microstructure through advancements in processing, such as thermo-mechanical routes to control nanoscale strengthening phases. This results in significant increases in high-temperature strength.

Practical steps include developing a novel manufacturing process and systematic testing of optimised superalloys. Results have been successfully implemented by aerospace part-manufacturers and underpinned by through-process modelling. This highlights the importance of bridging the gap from discovery to application, demonstrating a significant impact on scientific understanding and industrial practices.

Advancements have led to a 12% improvement in design-critical properties and mitigation of heterogeneities in engine components. This may result in shorter flights, longer distances, and safer, more fuel-efficient air travel.



## > Mechanical Properties and Material Failure Prevention Laboratory

Understanding and preventing material failures by fracture, fatigue crack propagation, creep, and deformation

### Research Laboratory

Defence systems routinely encounter conditions of high mechanical stress in aggressive environments, such as temperatures ranging from cryogenic to well over 1000°C, along with oxidising and/or corrosive conditions.

To prevent unexpected failures by mechanisms, such as fracture, fatigue crack propagation, creep, and deformation, the Mechanical Properties and Material Failure Prevention Laboratory enables end-users to understand and quantify how materials will perform in real-world situations.

The laboratory has extensive experience in the development of bespoke failure and lifetime prediction models that can be used in the design and maintenance of critical defence systems aggressive environments.



#### Key capabilities

- > Testing and understanding complex material-failure behaviour in aggressive environments
- > Development and application of bespoke failure and lifetime prediction models
- > Development and implementation of novel materials for demanding mechanical applications



#### Differentiators

- > Three decades of experience in mechanics of materials research
- > Design and fabrication of in-situ mechanical testing apparatus for aggressive environments



#### Key customers

- > Defence Science and Technology Group & DMTC Limited
- > Additive manufacturing industry (SPEE3D, Titomic, Heraeus, etc.)
- > US Department of Energy



#### Key partnerships

- > Australian Nuclear Science and Technology Organisation (ANSTO)



[unsw.to/jay-kruzic](https://unsw.to/jay-kruzic)



#### Key capabilities

- > Low noise microwave amplifiers
- > Quantum technologies
- > Masers



#### Differentiators

- > Patents
- > Superior performance



#### Key customers

- > Quantum computing industry
- > Military/Defence
- > Research



[unsw.to/jarryd-pla](https://unsw.to/jarryd-pla)

## > Microwave Quantum Technologies Group (MQT)

Quantum technologies for detecting ultra-faint signals at microwave frequencies

### Research Project

Many modern technologies rely on the ability to detect very small signals that oscillate at microwave frequencies (i.e. in the gigahertz). Examples include satellite communication, radar, radio astronomy, and spectroscopy. One of the most important components used in these systems is the amplifier, which boosts weak microwave signals. Amplifiers also unavoidably add noise to signals and the amount of noise added often dictates important performance properties, such as sensitivity and range.

The MQT group at UNSW is developing microwave amplifiers that can boost signals whilst adding the minimum amount of noise required by quantum mechanics. These can substantially improve the performance of technologies used to detect faint microwave signals.

The team has produced quantum amplifiers that are made from superconducting circuits that operate at cryogenic temperatures, as well as diamond-based amplifiers that function at room temperature. Its prototype amplifiers cater to a range of applications and environments, from quantum computing to radar and communications.



## > Modularised Logistics Distribution System (MLDS)

**Advanced modelling and simulation to assess and optimise complex logistics systems for Defence**

### Research Centre

The UNSW Canberra team, including the School of Systems and Computing and the Capability Systems Centre (CSC), partnered with the Land Mobility and Support Program (LMSP) within Army Headquarters to assess and optimise the use of different logistics systems.

UNSW Canberra supported LMSP with high-impact decision support analysis regarding a new distribution method, clearly quantifying optimum value for Defence.

This project included modelling and simulation of varied and complex scenarios to enable superior requirements and decision superiority. This work leveraged the CSC's hierarchical based modelling (HBM) software and extensive experience in systems engineering and decision support. HBM is a novel computational modelling architecture for configuring and generating composable models to support evidence-based decision-making in an agile manner. This culminates in a system for simulation and a framework for assessment of the logistics system.



### Key capabilities

- > Computational modelling architectures
- > Digital engineering
- > Decision Support



### Differentiators

- > Hierarchical-based modelling tool
- > Mission engineering techniques



### Key customers

- > Army Headquarters - Land Mobility and Support Program



[unsw.to/csc](https://unsw.to/csc)



### Key capabilities

- > Solid-state, thin-film micro battery development
- > Advanced characterisation of degradation phenomena in batteries
- > Materials to full device integration



### Differentiators

- > Ability to use a variety of characterisation tools to understand materials and devices
- > New electrode developments with higher energy densities than used in current lithium-ion batteries



### Key customers

- > Start-up companies
- > Small-to-medium enterprises



### Key partnerships

- > Orica
- > United Energy



[unsw.to/neeraj-sharma](https://unsw.to/neeraj-sharma)

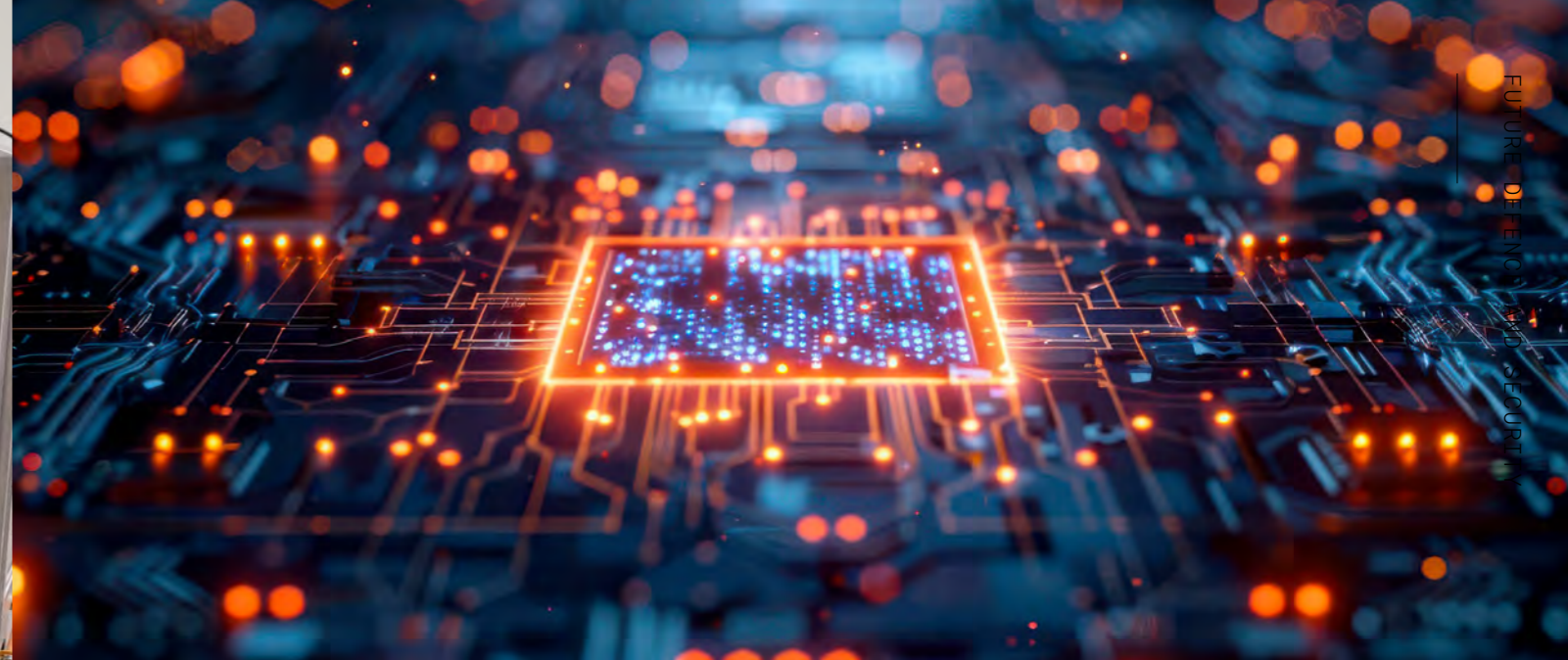
## > Novel Battery Architectures and Solutions

**Creating optimal batteries for diverse applications**

### Research Group

Energy is crucial for both lifestyle and defence-based applications. Batteries that store energy and deliver power as needed are essential for communications gear, drones, and vehicles. The research group seek to understand the chemistry and functionality of battery materials. This knowledge allows them to design materials tailored to meet specific energy and power requirements. They also develop materials and build complete devices.

This research pushes the boundaries of battery technology, including inherently safe, thin-film all-solid-state batteries, and new materials for larger-scale, solid-state batteries. Collaborating with industry, the team identifies battery degradation causes and suggests modified use conditions or complementary energy storage technologies.



## > Pyrometric Fire Testing Lab

### Developing fire-retardant polymer-based composites for aeronautical applications

#### Research Laboratory/Facility

Materials used in aviation should be designed with a fire-safety approach to prevent fires that might occur during flight or after an accident. It is critical that aircraft manufacturers ensure all materials used aircraft design meet airworthiness standards. The biggest limitation of using fiber-reinforced polymer composites is their high flammability. To increase the thermal resistance of these composites, flame retardant chemicals are necessary. However, these chemicals can have harmful effects on the environment and human health.

The Pyrometric Lab at UNSW is dedicated to developing cost-effective, environmentally friendly fire retardants for cleaner polymer composites in the aviation industry.

Extensive testing has revealed that the simultaneous use of a few fire-retardant materials with an optimised ratio improves the thermal resistance of fiber-reinforced epoxy composites. It also reduces the heat-release rate by more than 55% and reduces the toxic smoke and gas emissions released under thermal exposure.



#### Key capabilities

- > Developing fire retardant epoxy-based laminates for aeronautical applications
- > Fire protection in armoured vehicles
- > Customised fire suppression for the military



#### Differentiators

- > Expertise in developing environmentally friendly polymer-based composites for maritime infrastructure
- > Expertise in developing flame-retardant reinforced epoxy resin composites for aviation, focusing on reducing smoke toxicity



#### Key customers

- > Defence
- > Aviation industry



[unsw.to/pyrometric-laboratory](https://unsw.to/pyrometric-laboratory)



#### Key capabilities

- > Quantum computing
- > Quantum materials
- > Quantum sensors



#### Differentiators

- > Extensive nanofabrication, packaging and materials analysis capabilities
- > Low noise cryogenic measurement facilities
- > Patented technologies for high-performance superconducting microwave generators and detectors



#### Key customers

- > Quantum computing companies
- > Advanced technology companies utilising quantum sensors



[unsw.to/maja-cassidy](https://unsw.to/maja-cassidy)

## > Quantum Materials and Devices Laboratory

### Enabling future quantum technologies

#### Research Group

The Quantum Materials and Devices Laboratory is an experimental research group at UNSW Sydney that focuses on developing new technologies that will be integrated into future quantum computing and sensor systems.

The group is led by Dr Maja Cassidy, an ARC DECRA Fellow, UNSW Scientia Fellow and Senior Lecturer in the School of Physics. Current projects include novel qubits, qubits based on levitating electrons on noble gases, quantum superconducting photon generators and detectors spanning the microwave and terahertz regimes. It also focuses on understanding new, high-temperature, superconducting materials.

The group partners with quantum computing companies and resource exploration companies to develop new enabling capabilities that utilise quantum technologies.

# > Silicon Quantum Computing (SQC)

**SQC is the only company in the world that can manufacture with atomic precision and leads the world in quantum computing using high quality atom qubits in silicon**

**Spin-out / Co-locator**

Quantum computers have the potential to solve complex computation problems across every industry within a useful time frame that are beyond the reach of classical computers. Every nation is racing to build the world's first error corrected quantum computer and SQC's proprietary atomic precision manufacturing technology places them at the very forefront of this race.

Formed in 2017, SQC has secured over A\$135 million in funding from the Commonwealth Bank of Australia, Telstra Corporation Australian, the Commonwealth Government, UNSW Sydney, and the NSW Government. SQC is one of the few vertically integrated full stack companies globally and the only one that manufactures its complete hardware and software stack within Australia.

SQC operates a world first atom-scale foundry on the UNSW Sydney campus with nine different specialist facilities. With a team of 70+ scientists, engineers and a dedicated corporate team, SQC has pioneered unique technologies to create atom scale processors using scanning tunnelling microscopes (STMs) for precision atom placement and molecular beam epitaxy (MBE) to create ultra-pure single crystal integrated chips. With a one-week turnaround from design, manufacture and test, the SQC team have developed a rapid, high yield manufacturing process all in house with dedicated clean-rooms. This allowed them in 2022 to deliver the world's first quantum integrated circuit manufactured at the atomic scale.

In February, SQC achieved another significant milestone in their commercialisation journey. Leveraging their atomic-scale manufacturing capabilities, SQC scientists successfully demonstrated Grover's algorithm in a multi-qubit quantum processor with the highest fidelity of any quantum computing platform to date. This achievement demonstrates their leadership in maintaining performance quality as they scale their quantum processors bringing them closer to the development of a fully functional quantum computer. They are also releasing their first product in the machine learning space to customers in 2024, 4 years ahead of their milestones on the roadmap.



**Key capabilities**

- > The only company in the world that can manufacture at the atomic scale
- > Full stack, vertically integrated quantum computing company manufacturing in Australia.
- > Global leaders in silicon quantum computing technology



**Differentiators**

- > Pioneers and creators of atom qubits in silicon for scalable quantum processors
- > Significant capital funding from Corporate, Government and University funding exceeding A\$135 million
- > Specialist on-site facilities all in one location with a highly skilled team of over 70 scientists, engineers and dedicated corporate team



**Key shareholders**

- > Australian Commonwealth and NSW Governments
- > UNSW Sydney
- > Commonwealth Bank of Australia
- > Telstra Corporation



**Key application areas**

- > Machine-Learning
- > Chemical/Materials simulation
- > Defence, cryptography and cybersecurity
- > Healthcare and pharmaceuticals

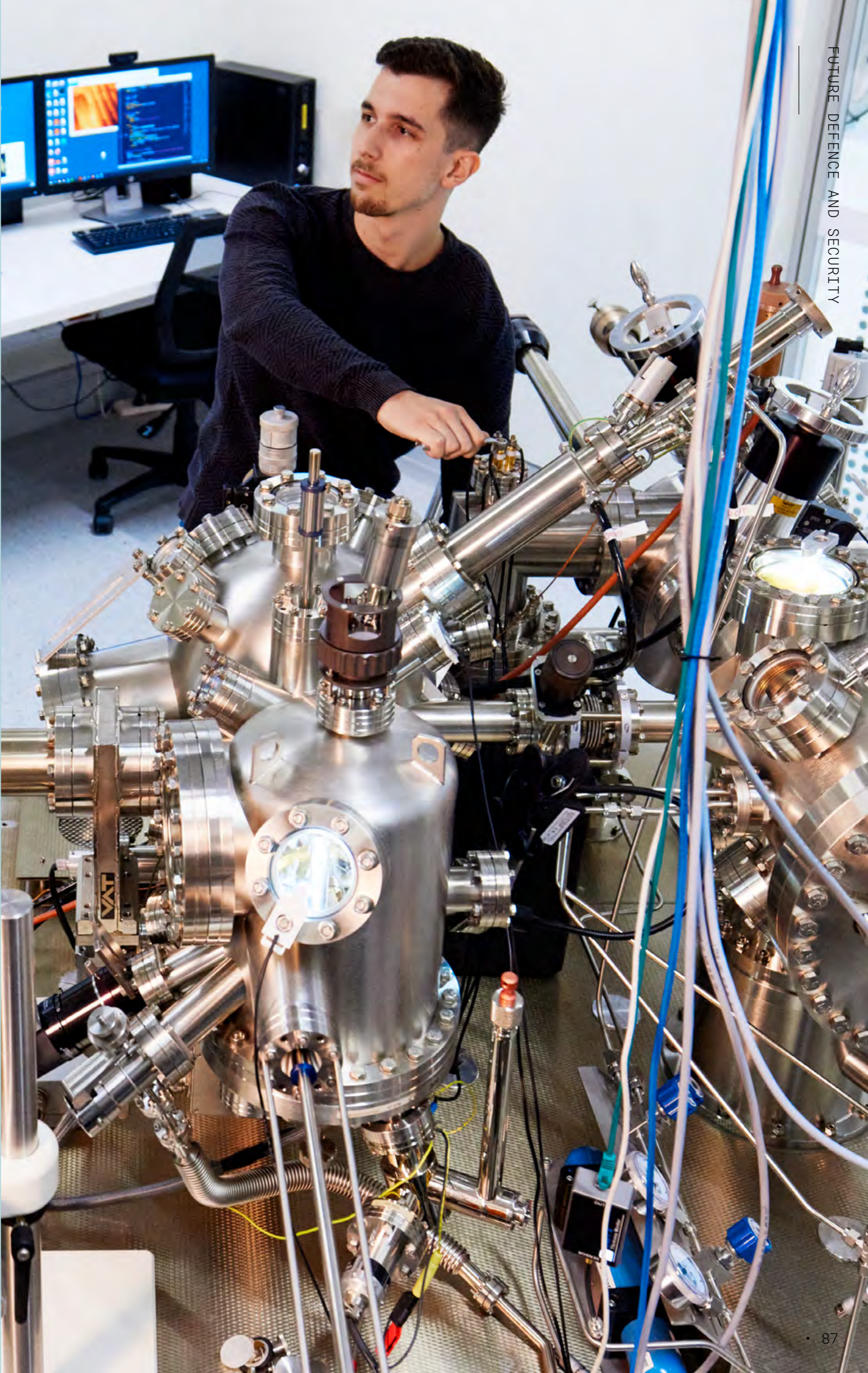


**Quality accreditations and awards**

- > SQC Founder and CEO Michelle Simmons has received numerous awards for her work including Australian of the Year 2018 and Prime Minister's Prize for Science 2023
- > Recognition for delivering numerous world firsts including the first single atom transistor, the first atomic-scale wire, the first integrated circuit manufactured with atomic precision, the fastest 2-qubit gate, the highest fidelity demonstration of Grover's algorithm along with many others.
- > Funding from the US military through the Army Research Office for 25 consecutive years.



[sqc.com.au](https://sqc.com.au)



# > Skykraft: Constellation as a Service (CaaS)

- **Developing and deploying space-enabled services for commercial and defence applications by harnessing LEO constellations**

Spin-out / Co-locator

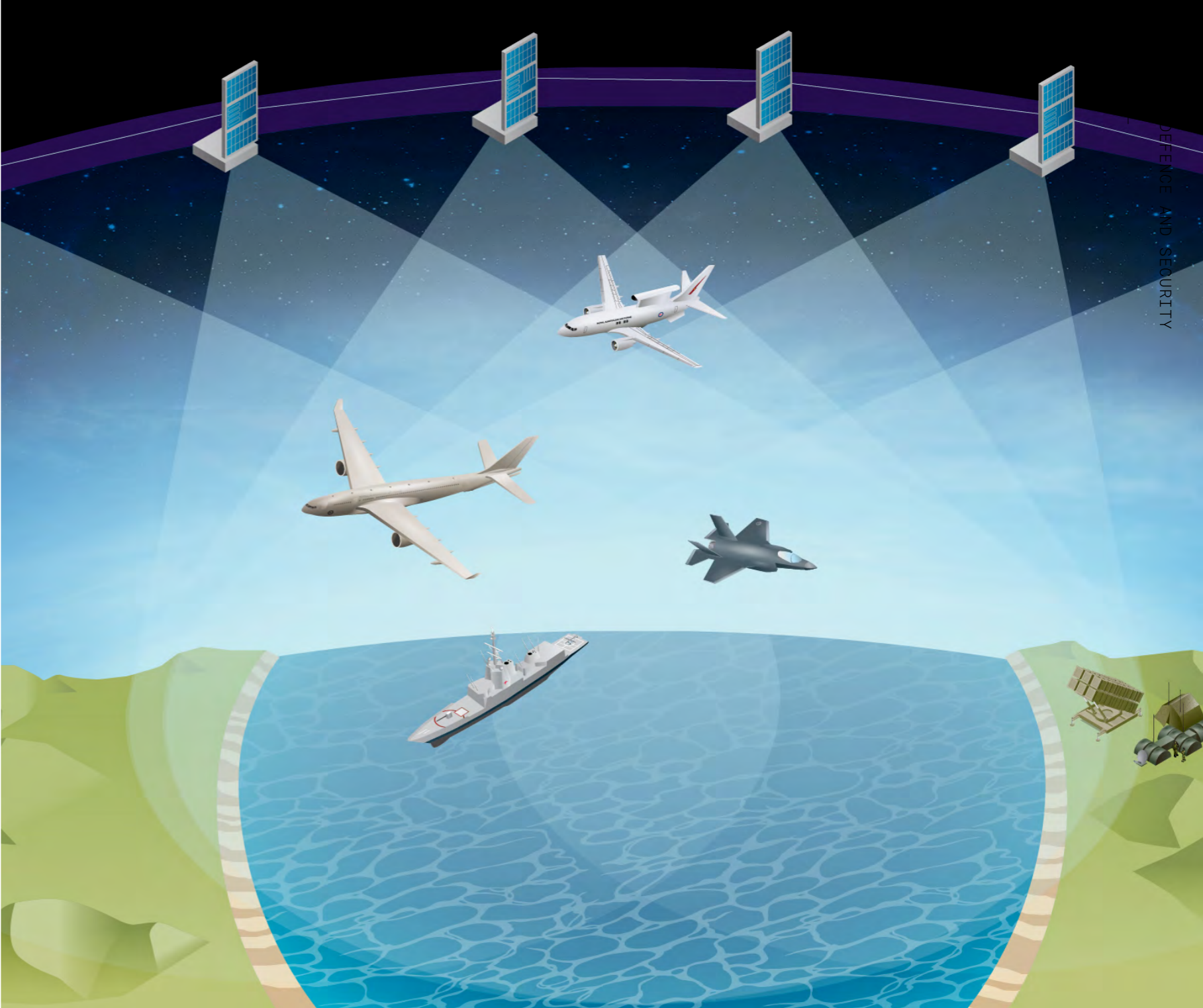
CaaS aims to provide Defence with a constellation of small, low-cost satellites in low-earth orbit to provide a disposable, high volume, and autonomous capability within 18 months. CaaS also provides:

- Global, persistent, redundant coverage
- Robustness against attack
- Constellation redundancy (spares in orbit), a space mesh network of narrow-beam intersatellite links, space-ground links, and redundant ground segments
- Operation in low-earth orbit, taking advantage of the lower horizon than those of satellites in geostationary orbit
- Continuous replenishment to maintain and grow capability
- Continuity of operations in the event of GNSS degradation or denial via independent in-orbit timing references

CaaS is payload-agnostic and supports a range of capabilities for Defence, including: \$200M+ investment to accelerate and grow Australian defence capability

- Electronic warfare
- Precision navigation and timing
- Communications services
- Space situational awareness

Cost-effective, resilient, and flexible, with an operational capability in service within 18 months, CaaS can provide Defence with an asymmetrical advantage over its adversaries.



Key capabilities

- > Space services
- > Space payloads
- > LEO Constellation



Differentiators

- > Constellation as a Service,
- > Rapid capability deployment
- > Operation in a GNSS denied environment



Key customers

- > Air navigation service providers, including Airservices Australia
- > Defence Forces, including Australian Defence Force

“ As a leading Australian university in Defence and Space, UNSW has a thriving spinout ecosystem supported by key teams like Industry & Innovation, the Defence Research Institute, Defence Trailblazer, UNSW Canberra Launch and Founders. This support, along with a streamlined spinout framework and dedicated programs, ensures UNSW’s research and innovations are transforming these sectors in Australia. ”

David Heffer  
Business Development Manager, UNSW Industry & Innovation



[skykraft.com.au](https://skykraft.com.au)



## > Stratoship High-Altitude Airship

Developing the capability to hold payloads in position in the stratosphere

### Start-up

Satellites are costly and have long lead times. Once in service, they pass rapidly overhead at heights of hundreds of kilometres, making them of limited use for many signals and observation missions, especially when there is a specific geographic area of interest.

A high-altitude platform station (HAPS) offers persistent satellite-like coverage to a dedicated geography from a height of 15 to 30 kilometres, opening up new performance capabilities for trusted ISR, EW, and assured PNT payloads.

Stratoship is developing a HAPS airship that can hold equipment and move in the stratosphere. Flight testing of the current, fully functional prototype at stratospheric altitude is scheduled throughout the second half of 2024. This prototype is designed to hold 10 kilograms at a height of 20 km for up to 7 days.

This is merely the starting point: Stratoship's capability roadmap looks to increase and extend all aspects of performance with each model.

### ⚙️ Key capabilities

- > High-Altitude Airship
- > Prototype HAPS
- > Flight operation of HAPS under civil aviation regulations

### 💡 Differentiators

- > 100% Australian
- > Dual-use across civil and Defence

### 👤 Key customers

- > Primary market interest is in Earth Observation
- > Also receiving interest in Communications, Scientific Research, and Payload Testing

### 🤝 Key partnerships

- > Trusted Autonomous Systems - HAPS Challenge 2022 and follow-on funding 2024
- > UNSW Defence 10x Accelerator 2023

### 🌐 [stratoship.au](https://stratoship.au)

### ⚙️ Key capabilities

- > Corrosion-resistant materials at high temperature by forming protective surface oxide scales
- > Control alloy and oxidant diffusion at high temperature by proper alloying
- > Advanced facilities in the field of corrosion by mixed gases

### 💡 Differentiators

- > High-temperature materials development based on mechanism understanding
- > 30 years' research and development experience on corrosion mechanism, failure analysis, and corrosion protection

### 👤 Key customers

- > Alloy companies
- > Haynes International
- > Exxon Mobil

### 🤝 Key partnerships

- > Metal dusting prevention for Haynes International (USA) and Exxon Mobil (USA)
- > CO2 corrosion in gas-cooled, unclar reactors (AGR) for EDF (UK)
- > Alloys to resist hot carburising-sulfidising gases in processing Queensland shale oil

### 🌐 [unsw.to/jianqiang-zhang](https://unsw.to/jianqiang-zhang)

## > The High Temperature Group

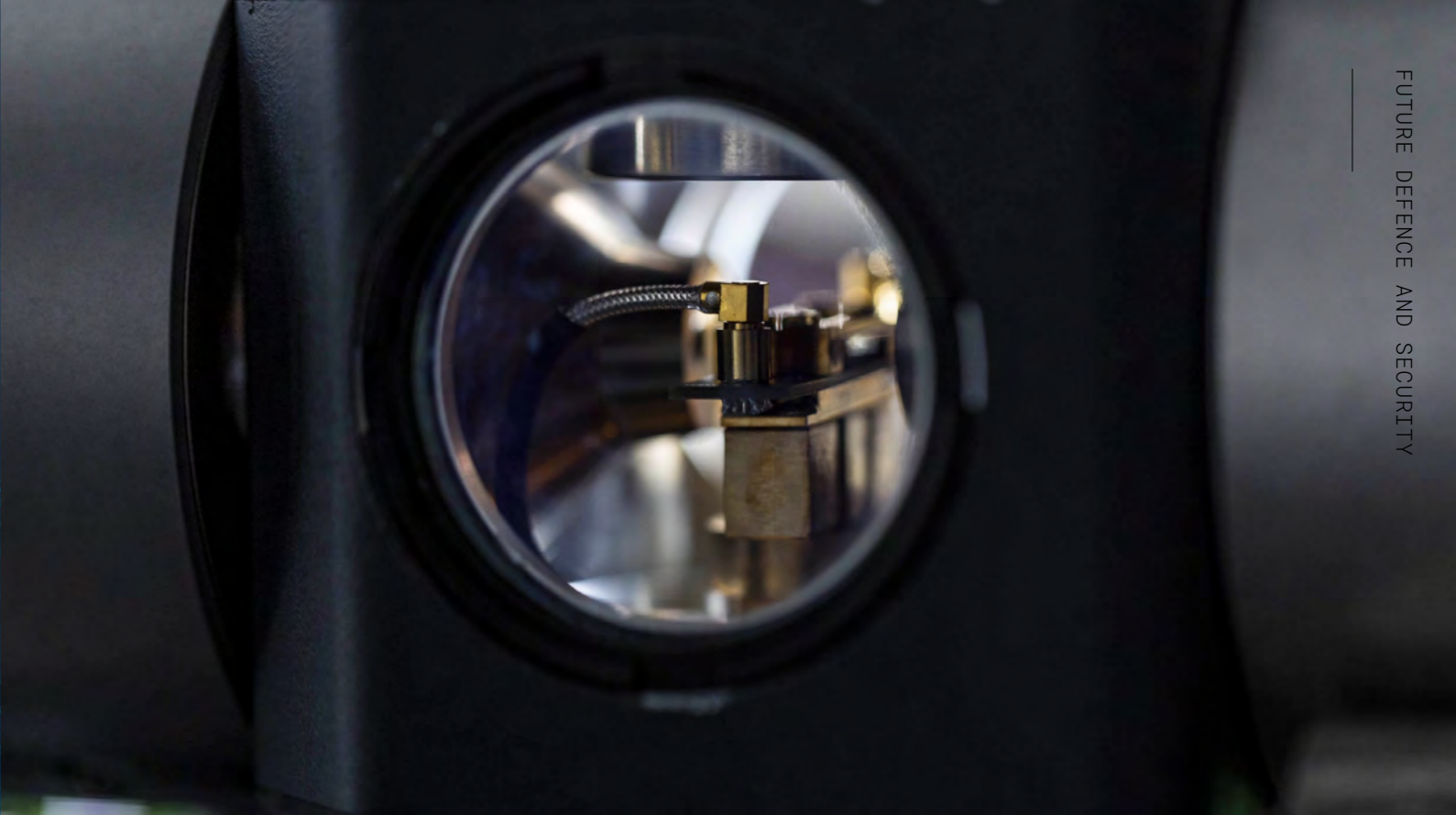
Corrosion-resistant alloys for high-temperature applications in clean-energy production

### Research Group

High-temperature materials are important for clean-energy production, for example solid oxide fuel cells, solid oxide electrolyser, and nuclear reactors where materials are exposed to harsh environments at high temperatures.

The High Temperature Group at the School of Materials Science and Engineering, UNSW, is one of the world's leading research groups in the field, working on high-temperature corrosion and high-temperature materials development.

Based on their mechanism of understanding of alloy corrosion, they have developed high-temperature chromia-forming and alumina-forming alloys to resist corrosion in atmospheres containing carbon, water vapour, chlorine or sulphur, and solid deposits, e.g., salts and ashes, etc.



## > The Quantum Internet via Space

### Empowering the next-generation Internet via the use of satellites and quantum mechanics

#### Research Project

The next-generation Internet is currently being designed worldwide. This will be a Quantum Internet, with quantum mechanics at its core. It will enable unconditionally secure communications that will be future proofed against any conceivable attack.

It will also interconnect current, noisy quantum devices and emerging quantum computers. UNSW researchers are currently constructing prototype quantum-enabled satellites that will allow for quantum communication links between earth and space. This will be pivotal to the development of the Quantum Internet.

## > Ubiquitous Quantum Sensing

### Using mass-producible organic electronic devices for quantum sensing

#### Research Group

Quantum sensors have the potential to enhance sensing capabilities relevant to defence. Sensitive detection of magnetic fields, for example, has the potential to improve identification of objects in undersea and space environments.

Standard approaches to quantum sensing tend to use advanced materials with significant hardware overheads. This research group takes a different approach, employing mass-producible technologies based on organic, light-emitting diodes to develop more cost-effective quantum sensors. The ability to widely deploy cheap, disposable quantum sensing elements may allow new use cases and improve situational awareness.



#### Key capabilities

- > Satellite communications
- > Quantum communications
- > Unconditional security



#### Differentiators

- > 15 years of UNSW research into quantum communications via satellites
- > Prototype under construction



#### Key customers

- > Large companies



#### Key partnerships

- > Northrop Grumman Australia



[unsw.to/robert-malaney](https://unsw.to/robert-malaney)



#### Key capabilities

- > New use mode for existing technology
- > Allows new use case for quantum sensing



#### Differentiators

- > Proprietary technology
- > Industry compatible fabrications



#### Key customers

- > Enhanced sensing capabilities for defence



[unsw.to/dane-mccamey](https://unsw.to/dane-mccamey)



## > UNSW 3DXLab



### Key capabilities

- > Simulation and training in XR
- > Immersion storytelling and data visualisation
- > 3D reality and volumetric video capture



### Differentiators

- > Creative approaches to XR 3D simulation and immersive training
- > XR immersive 3D data visualisation and interaction
- > Australia's highest resolution research, focused 3D Volumetric Video Capture Arena



### Key customers

- > Toll Group - Aeromedical Crewing Excellence (ACE) Training Centre, Australia
- > Syngenta Global
- > Commonwealth of Australia Department of Defence - DSTG Scheme



[unsw.to/3dxlab](https://unsw.to/3dxlab)

### 3DXLab - Visualising immersive futures

#### Research Centre

The UNSW 3DXLab is a multi-disciplinary research lab that leverages cutting-edge immersive technologies to conduct 3D visualisation research from a design-centred perspective.

The team tackles real-time 3D computer graphics challenges and innovates ways to navigate complex data visualisation and interaction challenges.

Its focus includes 3D reality capture, visualisation, training, simulation, and the education application of XR technologies.

## > UNSW Canberra Robotics and Autonomous Systems Laboratory

### Specialising in the application of AI-infused robotics for Defence applications

#### Research Group

The Robotics and Autonomous System (RAS) group at UNSW has expertise in applications of AI to robotics, intelligent control, multi-robot control, biologically inspired robotics, learning from scratch, and operations in contested environments.

It has excellent facilities and a critical mass of researchers for developing, training, and testing autonomous systems.



### Key capabilities

- > Large indoor UGV/UAV Test Area and VICON motion capture system
- > CASA UAV remote pilot operator certificate and CASA-qualified remote pilots
- > Numerous unmanned ground, aerial, and humanoid robots



### Differentiators

- > Unique combination of skills covering robotics, AI, control theory, and machine vision
- > Long-standing and deep ties with Defence
- > Focus on robot learning and learning from scratch



### Key customers

- > DST Group
- > Australian Army (RICO)



### Key partnerships

- > Defence Trailblazer
- > UNSW.ai Institute
- > DST Group



[unsw.to/trusted-autonomy](https://unsw.to/trusted-autonomy)

# > UNSW Canberra Space

Advancing space safety, security, and sustainability through innovative nano-satellite missions and transdisciplinary space domain awareness research

Research Centre

The number of satellites in orbit is expected to exceed 50,000 by 2030, creating a pressing global challenge to ensure a safe, secure, and sustainable space environment into the future. UNSW Canberra Space focuses on developing innovative satellite technology, developed through a world-class mission design facility (Australian National Concurrent Design Facility (ANCDF)). This will provide real-world platforms to develop and improve global space domain awareness, space traffic management, and cyber-resilient space systems.

UNSW Canberra Space has attracted more than \$30 million in funding, developing and launching five satellites across four missions. The M2 satellite formation represents Australia's most advanced nano-satellite launched to date. It is supported by a space domain awareness research theme that has established a global network of optical and radio frequency sensors covering Low Earth Orbit to near-Earth orbit (asteroid).



Key capabilities

- > Nation-leading small satellite mission design, build, test and operations heritage
- > Access to a global network of space domain awareness sensors and capabilities
- > Leading provider of research informed space operations and space engineering education



Differentiators

- > Nation leading Master of Space Operations and Master of Space Engineering programs
- > On-orbit satellite test platforms
- > Three successful space spin-out companies
- > Real-world and end-to-end satellite design and operation experience
- > Space Domain Awareness capabilities ranging from Low Earth Orbit to the Moon and beyond



Key partnerships

- > Royal Australian Air Force (RAAF), US Air Force Academy (USAF) and Air Force Office of Scientific Research (AFOSR)
- > Space Command, Australian Space Agency, Infinity Avionics and Aerospace Corporation
- > CSIRO, Geoscience Australia, Bureau of Meteorology and the Defence, Science, and Technology Group (DSTG)
- > Skykraft and Nominal Systems



Quality accreditations and awards

- > 2023 Academic Team of the year, Australian Space Awards



[space.unsw.adfa.edu.au](https://space.unsw.adfa.edu.au)

# Societal Resilience, Security and Stability



## Key capabilities

- > Specialised training in nuclear engineering and technology for defence purposes
- > Engaging faculties across UNSW to integrate diverse expertise in nuclear disciplines



## Differentiators

- > Preferred partner for nuclear engineering education for Defence
- > UNSW has the only Nuclear Engineering Research Group
- > High-level collaboration with international organisations, including the IAEA and the OECD-NEA



## Key customers

- > Department of Defence – education and bespoke courses in nuclear engineering
- > Westinghouse – industry partner and collaborator
- > Tokamak Energy – industry partner and sponsor of Atomcraft VIP



## Key partnerships

- > Imperial College London – a key ally in establishing the UNSW Nuclear Engineering program
- > MIT – research and delivery of short courses in Nuclear Engineering
- > The Stimson Centre collaborative research, short courses, and community engagement



## Quality accreditations and awards

- > Representing Australia on Council of Advisors of the OECD-NEA Global Forum
- > Invited expert in IAEA member state-support program task
- > ARC mid-career industry fellowship



[unsw.to/nuclear-innovation](https://unsw.to/nuclear-innovation)

## UNSW Nuclear Innovation Centre

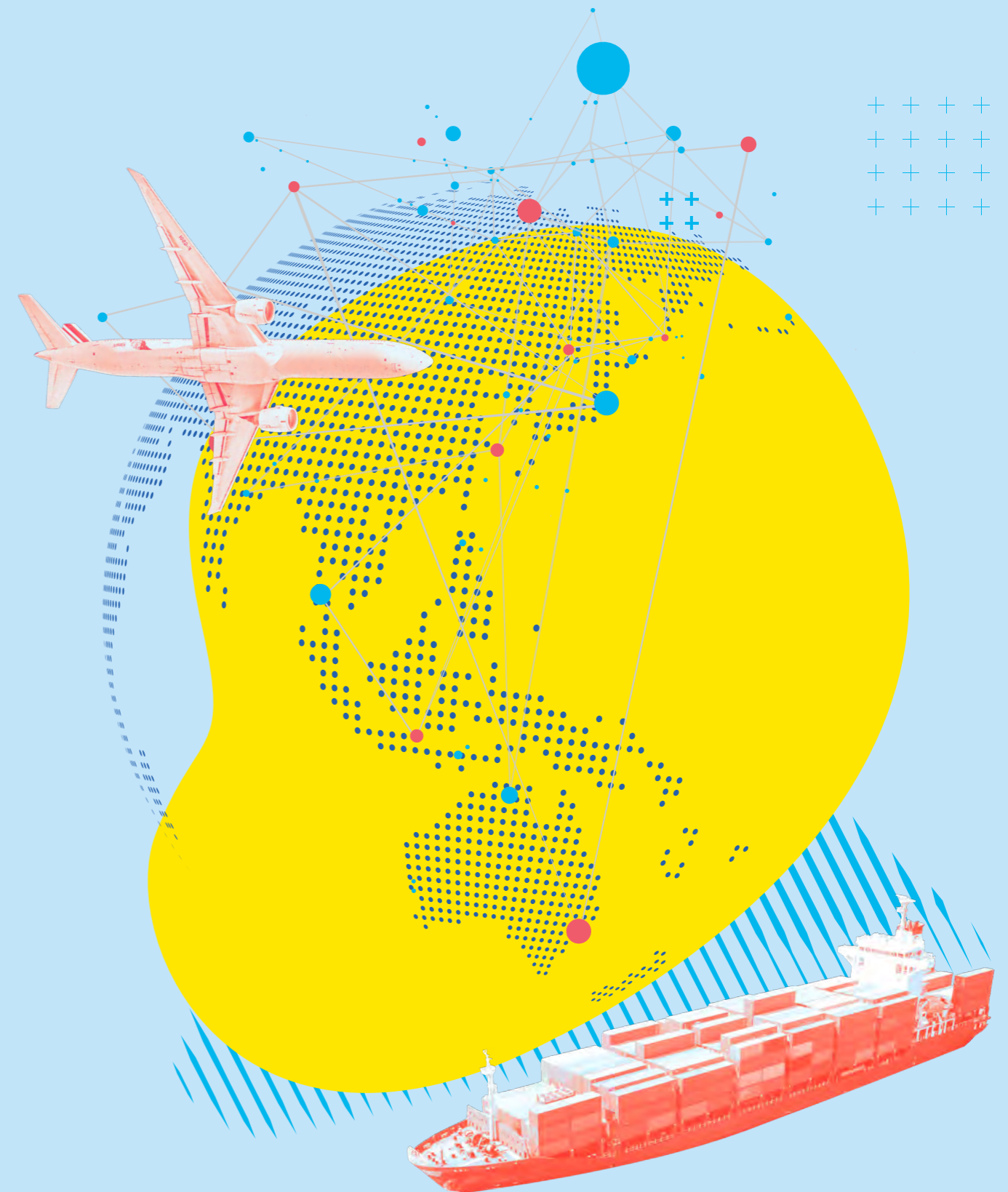
### Advancing Australia's nuclear technology for global impact

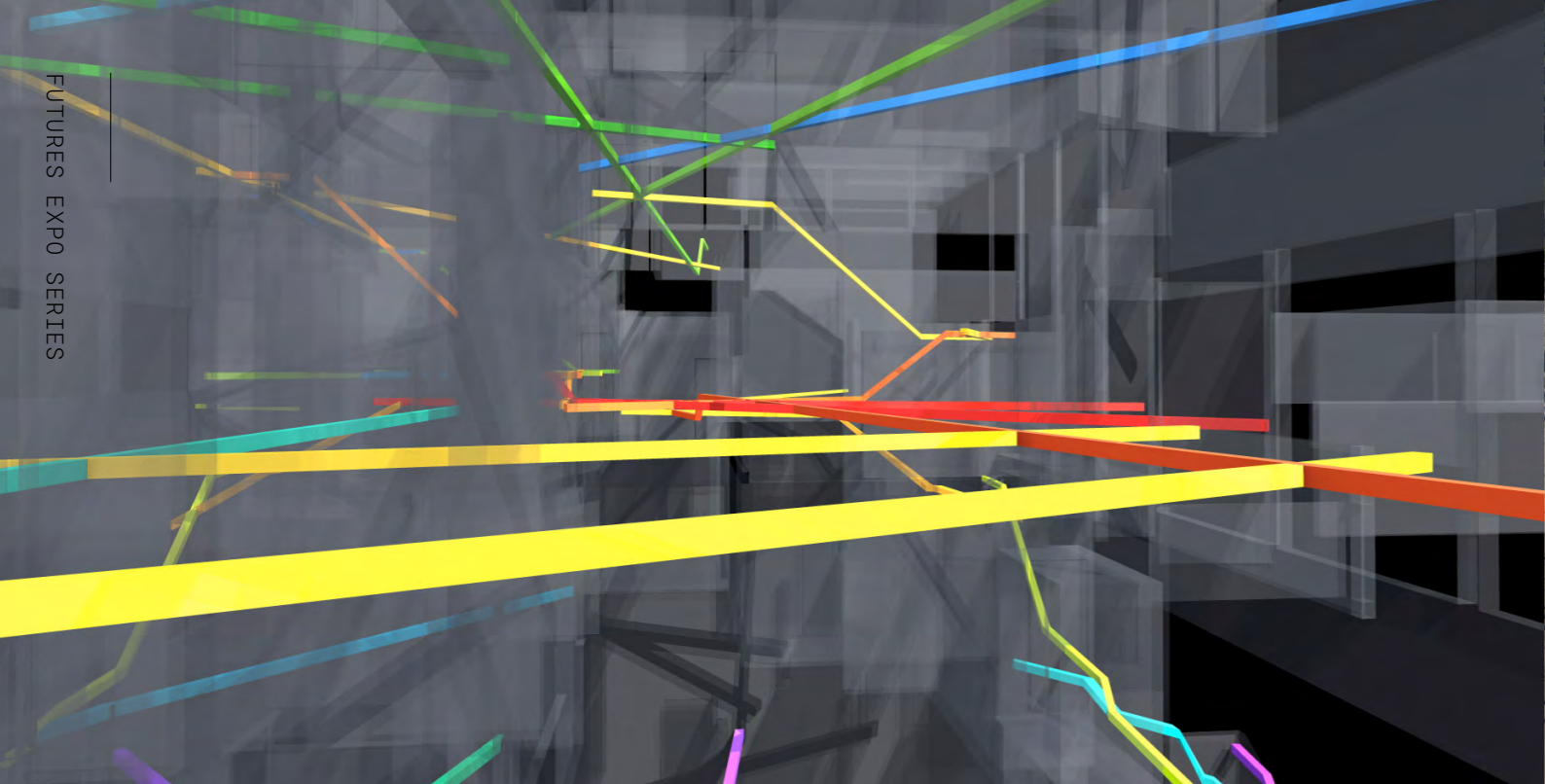
#### Research Centre

The UNSW Nuclear Innovation Centre addresses Australia's urgent need for nuclear expertise amid the AUKUS partnership. Backed by a A\$7.5m donation from the Sir William Tyree Foundation, the Centre focuses on interdisciplinary research in nuclear engineering, social engagement, and community awareness. It aims to elevate Australia's nuclear capabilities and forge strong international collaborations through innovative contributions to nuclear science, diplomacy, and engineering.

The Centre brings together more than 40 UNSW academics from faculties including Engineering, Science, Law, Arts, Design & Architecture, and UNSW Canberra at the Australian Defence Force Academy.

Key partners include the Department of Defence and ANSTO, alongside universities, industry leaders, and global organisations. This powerhouse of expertise is dedicated to driving policy changes, system development, and cutting-edge solutions in nuclear technology, ensuring Australia's leadership in nuclear research and capability on the global stage.





## > AI-Enhanced Spatial Cognition and Modelling

Advanced architectural analytics that improve spatial understanding, preparedness, responsiveness and awareness

### Research Group

Spatial cognition is the way people understand spaces, cities and buildings, including how they navigate, perceive, and respond to rapid or unpredictable events in them.

Methods developed by the Advanced Architectural Analytics Lab at UNSW (and in collaboration with national and international partners) support enhanced spatial understanding, optimal solutions to spatial challenges, and improved responses to emergency situations.



#### Key capabilities

- > Leaders in the application of advanced computational and mathematical spatial analysis to buildings and urban spaces
- > Use of unique AI/machine-learning methods to measure, optimise, and predict spatial properties, e.g., intelligibility, efficiency, surveillance
- > The ability to incorporate neurophysiological data into computational models of spatial understanding and response



#### Differentiators

- > Capacity to draw on expertise in architecture and urban design to develop software models and solutions
- > Only national laboratory of its type (AI-enhanced, syntactical and fractal modelling) and scope (architectural, spatial and urban)



#### Key customers

- > Local government partners
- > State government partners
- > The construction and design industry



[unsw.to/aaal](https://unsw.to/aaal)



## > Applied History - War Studies Research Group

Bringing together scholars to address modern defence and security challenges through applied historical research

### Research Group

The War Studies Research Group produces world-class military history for academic and popular audiences. It also offers applied history insights into contemporary challenges for the Australian Defence Force, the Department of Defence, and the Australian Government.

The research group supplies professional education and research services across a range of areas, including Australian military history, strategy and policy, and veterans affairs.

It has previously completed work for several entities within Defence, including JOC and the Army Research Centre.



#### Key capabilities

- > Applied history



#### Differentiators

- > Unique cluster of military historians in Australia



#### Key customers

- > Department of Defence
- > Service Research Centres (Sea Power Centre, Air & Space Power Centre Army Research Centre)
- > DFAT



[unsw.to/war-studies](https://unsw.to/war-studies)

# > Asia Pacific Development & Security Project: Disinformation in the Indo-Pacific Region

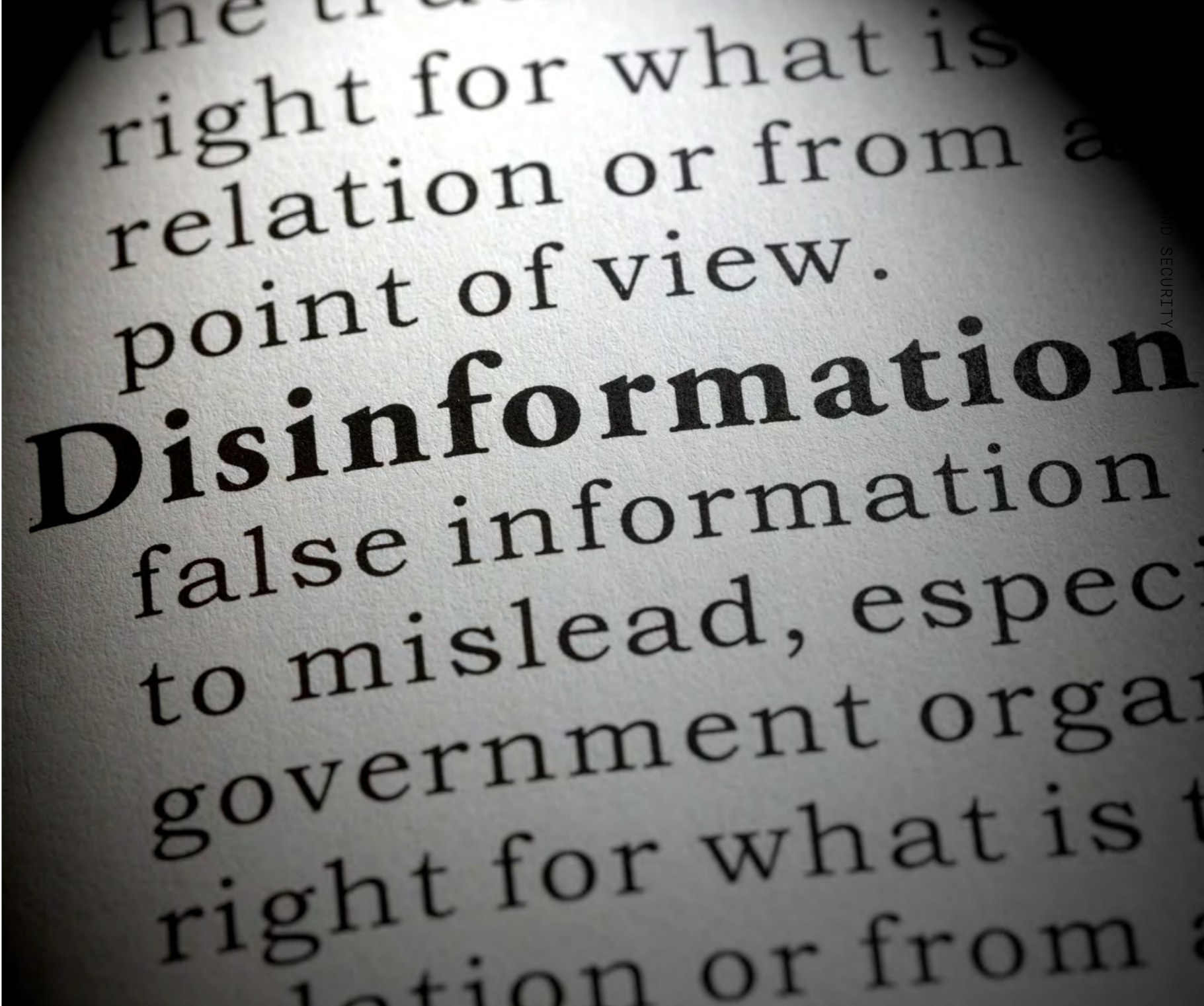
Examining the electoral impact of disinformation in the Indo-Pacific region

Research Group

This project examines the impact of disinformation on elections across the Indo-Pacific region. In the largest electoral year in human history, disinformation has been identified by the World Economic Forum as the most pressing geopolitical challenge of our time.

Across the Indo-Pacific region is the threat of what Chief of Defence, Angus Campbell, has described as 'truth decay', perforating democracies and undermining trust in electoral institutions.

The task of identifying, defining and tracking disinformation is a complex and nuanced challenge. Specifically, the team is looking to evaluate how the disinformation campaigns not only disseminate, amplify and corrupt information, but also how they polarise debate, thereby reducing the public's ability to process and comprehend their electoral choices.



Key capabilities

- > Information warfare
- > Indo-Pacific studies
- > Disinformation



Differentiators

- > Indo-Pacific studies
- > Sharp power analysis



Key customers

- > Defence
- > Government
- > Regional partners



Key partnerships

- > RMIT Crosscheck



[unsw.to/asia-pacific-development](https://unsw.to/asia-pacific-development)



## > Asia Pacific Development & Security Research Group

Examining regional security challenges, including human rights, climate change, and social cohesion

### Research Group

The Asia Pacific Development & Security Research Group examines regional security issues such as China's rise, human rights, climate change, and social cohesion. It brings together academics and stakeholders to share knowledge and ideas that will help strengthen Australia's security and defence interests in the Indo-Pacific region.

The group engages in research on key security issues, such as regional security, the Chinese military, climate change, disaster relief, human rights, gender, and religion. It looks into conducting extensive research, providing professional training courses, and performing project evaluations on a large scale.



#### Key capabilities

- > Multidisciplinary social-science research approach
- > Regional expertise and networks in the Indo-Pacific regio



#### Differentiators

- > Multilingual capabilities
- > Established reputation as leading experts, as shown by awards



#### Key customers

- > Government agencies (DFAT, Defence)
- > International non-government organisations



#### Key partnerships

- > Lowy Institute
- > Gadjah Mada University, Indonesia
- > State Islamic University, Jakarta



#### Quality accreditations and awards

- > The Indonesian Government Order of Culture Award (AKI) 2023
- > Winner of the Boyer Prize for the best original article in The Australian Journal of International Affairs
- > UNSW VC's Award for Excellence in Higher Degree Research Supervision (2023)



[unsw.to/asia-pacific-development](https://unsw.to/asia-pacific-development)



## > Climate Change Research Centre

Experts in global climate change, climate extremes and tipping points

### Research Centre

The Climate Change Research Centre (CCRC) at UNSW is a multi-disciplinary research group with extensive climate expertise in the key areas of atmosphere, ocean, land, cryosphere, and the carbon cycle.

Researchers at the CCRC apply fundamental scientific principles to pressing questions on climate dynamics, climate variability, global climate change, extremes of weather and climate, and tipping points. The CCRC also provides the scientific foundations to groups working on climate impacts and climate risk-related problems.

CCRC's innovative research focus is, arguably, unique among university groups worldwide. It is also the largest hub of such research in the Australian region.



#### Key capabilities

- > Climate modelling
- > Downscaling
- > Machine learning



#### Differentiators

- > Leading Australian, university-based research centre on climate sciences



#### Key customers

- > State governments
- > Insurance companies
- > Financial institutions
- > Federal government



[unsw.to/ccrc](https://unsw.to/ccrc)

## > EPIWATCH®

### An AI early-warning system for epidemics and pandemics

#### Research Project

EPIWATCH® is an AI-driven epidemic surveillance observatory developed at UNSW that curates and processes vast, multilingual, open-source intelligence (OSINT) to generate valid early-warning signals for potential serious outbreaks. OSINT taps into local communities and news agencies and provides warnings about potential epidemics before health authorities are aware of them. There may be financial disincentives to reporting in some countries or regions and OSINT can overcome censorship or delays.

In addition, outbreaks due to new pathogens for which there is no test, can be detected by OSINT. The two AI systems of EPIWATCH® create highly valid signals. EPIWATCH® software comprises a web-search function, database, and application layer. It searches for diseases and syndromes in 46 languages, and 70% of data captured by EPIWATCH® is not in English.

The team currently collaborating on a wargame with the US Department of Defence.



#### Key capabilities

- > AI
- > Advanced geospatial information systems



#### Differentiators

- > Chosen partner of US Indo-Pacific Command for Able Resolve 2024 bio surveillance wargame
- > Data analytics on demand
- > Climate and environmental maps that allow epidemic data to be analysed by these factors



#### Key customers

- > US Department of Defence
- > Australian health departments
- > Biodefence pharma companies



#### Key partnerships

- > Microsoft (including Microsoft AI accelerator grant)
- > The Kirby Institute (made space available for the Decision Theatre)
- > Philanthropic donor



#### Quality accreditations and awards

- > InnovationAus Award 2022 - People's Choice Award
- > Finalist 2023 and 2024 Australia India Business Award



[epiwatch.org](https://epiwatch.org)



#### Key capabilities

- > Cognitive psychology



#### Differentiators

- > World experts in facial recognition



#### Key partnerships

- > Australian Passport Office



[unsw.to/david-white](https://unsw.to/david-white)

## > Human-AI teaming in person-identification tasks

### Interdisciplinary research to understand person-identity decisions made by humans and AI

#### Research Project

Modern identity management systems involve multiple sources of identity information and incorporate human and AI judgments. This project aims to develop a new knowledge framework around how these sources of information can be combined into reliable identity decisions.

Expected benefits include improved accuracy, human oversight, and explanation of identity decisions. This will support equitable and secure identity management in defence scenarios.



## > Maritime Security Research Group (MSRG)

Drawing on legal, historical, strategic, and regional perspectives to address challenges in traditional security, human security, and the blue economy

### Research Group

The MSRG has recently completed an Australian Research Council project with colleagues in UNSW Law on the use and regulation of Maritime Autonomous Vehicles (MAVs) and challenges and opportunities under international law.

The project addresses pressing international law questions arising from the increased deployment of MAVs for maritime security and other purposes. While the project examines the influence of national frameworks and policies, its focus is on the international legal landscape.

Depending on the MAV task or mission, adaptations to existing legal frameworks may be required if the MAV is to be used legally. The forthcoming adoption of the MASS Code by the International Maritime Organization (IMO) is set to significantly redefine the law on MAVs in commercial shipping.

Beyond the commercial sector, the team's findings will inform policy development in fields, including maritime security, law enforcement, maritime cybersecurity, and the challenges posed by criminal or hostile uses of MAVs.

### Key capabilities

- > Expertise in international law, including maritime law and the law of naval operations
- > Interdisciplinary insights from law, history, and strategic studies

### Differentiators


- > Integration into a world-leading network of maritime-affairs scholars

### Key customers

- > Government security and law enforcement agencies
- > The Australian Defence Organisation

### Key partnerships

- > Strategic relationships with maritime affairs experts in universities across Australia, the UK and the US

 [unsw.to/maritime-security](https://unsw.to/maritime-security)

### Key capabilities

- > The portal will provide authoritative (evidence-based and expert-compiled) responses to diverse user-enquiries, through an intuitive and easily navigable interface

### Differentiators

- > Global experts

### Key customers


- > Defence Space Command
- > Australian Space Agency
- > Department of Foreign Affairs and Trade

### Key partnerships

- > Australian Centre for Space Governance
- > King's College London
- > Arizona State University

### Quality accreditations and awards

- > Winner of Security and Defence PLuS Alliance Seed Grant

 [unsw.to/duncan-blake](https://unsw.to/duncan-blake)

## > Online Emerging Norms for Space Activities

Providing the space community with the means to track emerging norms – on a spectrum from standard practices to legal rules

### Research Project

The Five Eyes (FVEY) principles in the Combined Space Operations initiative emphasise the need for a clearer normative framework for space activities, particularly norms of responsible behaviour. Existing treaties and laws lack specificity. Creating new, legally binding instruments is unlikely, due to low consensus and time constraints. Developing norms based on practices, policies, and procedures can establish a normalised space domain and promote responsible behaviour. However, the many disparate initiatives in norm development dilute the benefits of broad collaborative efforts.

A proposed online portal would track emerging norms across these disparate initiatives, providing authoritative responses and visual representations of their status. This portal would benefit military space operators, decision-makers, policymakers, and researchers by identifying normative gaps, influencing norm emergence, bolstering existing norms, supporting compliance, guiding commercial and research efforts, and aiding in alliance management, threat analysis, Space Domain Awareness, attribution, training, and doctrine development.



## > RAND Australia

**Collaborating with UNSW for defence analysis, focusing on autonomy, planning, and evidence-based research for national security**

### Research Partner

RAND Australia, in collaboration with UNSW, undertakes objective research and analysis to address critical challenges in defence and national security. This partnership focuses on studies related to autonomy, leveraging RAND's expertise in planning and analytic methodologies. The collaboration agreement includes the potential for RAND to be part of the Launch community at UNSW's new Canberra City Campus, enhancing its presence and impact in the region. Additionally, RAND is a key partner in the Global Policy Hub, further solidifying its role in global defence policy analysis.

Key capabilities of RAND Australia include robust planning and analytic methodologies, with a commitment to objective, evidence-based analysis which is supported by rigorous quality assurance. Its primary clients are federal government entities.

#### Key capabilities

- > Planning and analytic methodologies

#### Differentiators

- > Objective, evidence-based analysis supported by rigorous quality assurance

#### Key customers

- > Federal government

#### Key partnerships

- > UNSW Canberra

#### [rand.org/australia](https://rand.org/australia)

#### Key capabilities

- > Policy analysis
- > International law
- > Comparative methods

#### Differentiators

- > The team comprises academics from a range of disciplinary backgrounds, including from world-leading UNSW Faculty of Law & Justice (ranked 12th in the world for law)
- > Extensive experience in government-funded projects and providing advice to government
- > Strong Asian experience across China, Korea, Vietnam, and beyond

#### Key customers

- > Government agencies
- > International organisations
- > Industry partners seeking strategic insights

#### [economiccoercion.com/unsw](https://economiccoercion.com/unsw)

## > Statecraft, Economic Security and International Law

**Harnessing international law for geopolitical challenges**

### Research Cluster

Economic security is an increasingly important part of the Australian security landscape. Recent instances of economic coercion and the broader geopolitical context have highlighted the need for Australian economic statecraft.

This project supports a range of key Australian economic interests, such as export, critical supply chains, and the policy tools needed for green energy transition. It does so by critically analysing economic statecraft, trade law and policy of Australia and its regional neighbours. The objective is to provide research-led insights for policy makers across the whole of government

# > Strategic Visual Communication

## Designing visual messages to counter misinformation and build societal resilience and stability

### Research Project

Graphic design has a surprising influence across defence and security domains. Trust in strategic messages is critical in an era where we see thousands of visual messages every day, misinformation is rife, and AI constructs alternate visions of reality.

Audiences make judgements of trust based on visual elements they see, regardless of actual messages. These are visual elements that can signify authority, like logo, colour, images, and design style.

Countering misinformation with informed design and analysis means tailored messages for different audiences, which is key for societal resilience on climate change, health, renewable energy, and has added implications for Defence focus on UN Women, Peace and Security perspectives.

From trust in human, humorous visuals like military cartooning, analysis and design of visual communication of vaccination and climate, VR immersion and production of a series of speculative future video media campaigns, this research provides key capabilities in an important emergent field.



### Key capabilities

- > Making Good Media: fostering positive climate action through speculative design in short social media clips
- > Design and analysis of complex visual messages on climate change and COVID vaccination campaigns
- > VR immersive design and analysis for air ambulance aeromedical evacuation



### Differentiators

- > Dedicated team of UNSW designers, directors, visual effects creators, actors/ presenters and writers (Making Good Media)
- > Australian military experience (Air Force, Joint and Combined environments)
- > Research affiliate of VR immersion design 3DXLab



### Key customers

- > Government and military communications agencies
- > Industry and media communications agencies
- > Aeromedical evacuation agencies

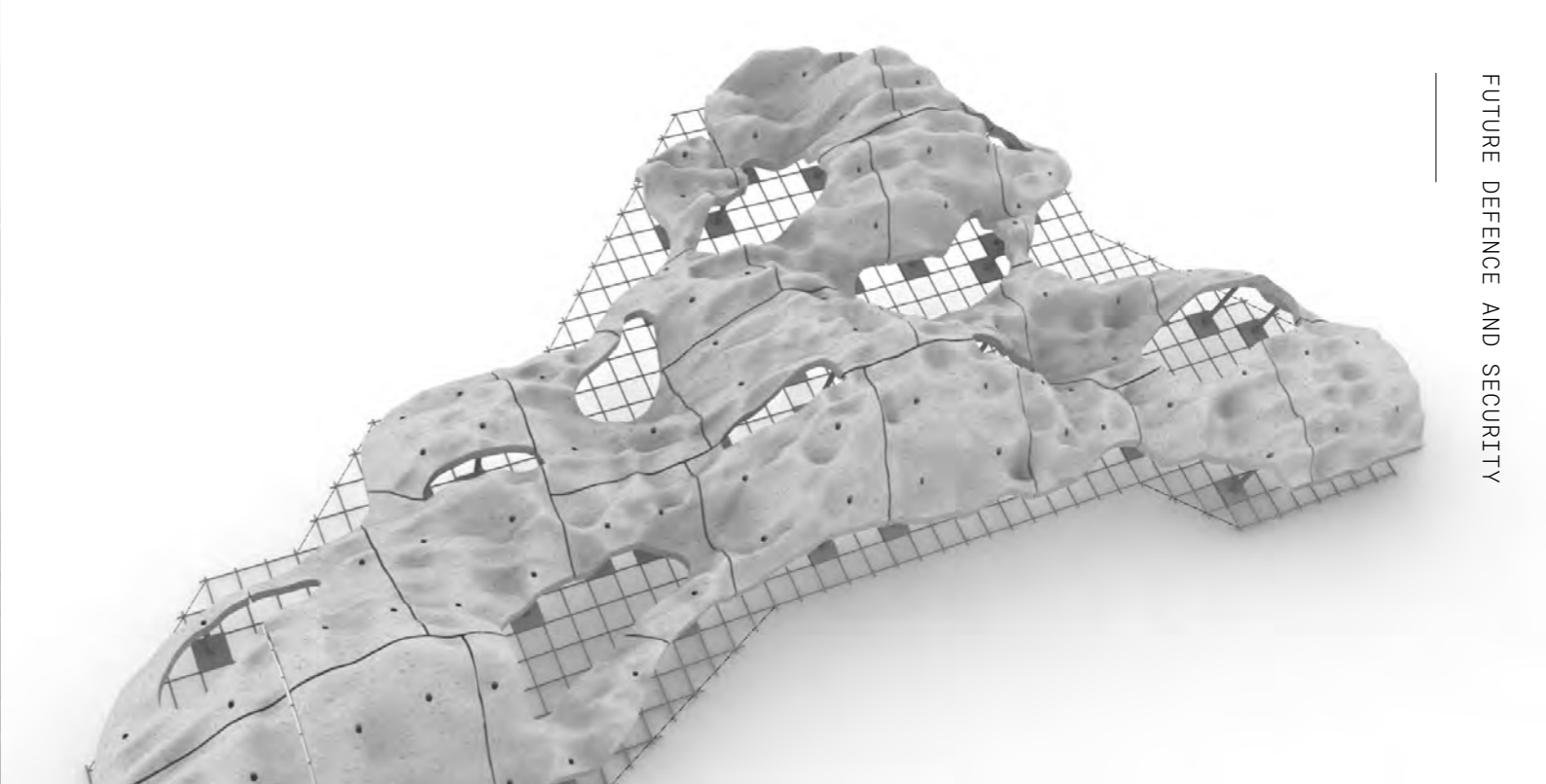


### Key partnerships

- > UNSW Digital Grid Futures Institute
- > UNSW 3DXLab
- > Massive Change Network



[unsw.to/rebecca-green](https://unsw.to/rebecca-green)



## > Trustworthy Systems

### Providing secure computer systems for the real world

#### Research Group

Software is at the core of virtually everything that is safety or security-critical in defence, infrastructure, medical devices, or transport. Yet almost all software contains faults that allow attackers to subvert it, leading to data theft and risk to human life.

Software can only be guaranteed free from such exploitable defects by mathematical proof that it operates as expected. Long considered an academic curiosity, Trustworthy Systems pioneered using such proofs for real-world software, starting with the seL4 microkernel.

seL4 has been designed for various defence and civilian systems and has triggered major projects funded by DARPA. Trustworthy Systems continues to lead the way in extending the guarantees of mathematical proofs into further parts of the software and developing complete operating systems that are readily deployable, highly performant and provably secure.



#### Key capabilities

- > Creators of the world's first operating system kernel with proof of correctness and security
- > Secure-by-construction design of embedded software



#### Differentiators

- > World leaders in applying mathematical proofs to real-world software
- > World leaders in secure microkernel-based systems
- > Track record of successful real-world deployment



#### Key customers

- > Collins Aerospace
- > Penten
- > NIO



#### Key partnerships

- > seL4 Foundation, chaired by Group Leader Gernot Heiser
- > National Cyber Security Centre (UK)
- > US Defense Advanced Research Projects Agency (DARPA)



#### Quality accreditations and awards

- > ACM Software System Award
- > ACM SIGOPS Hall of Fame Award
- > Fellowships of learned societies: ATSE, RSN, Leopoldina



[rand.org/australia](http://rand.org/australia)



#### Key capabilities

- > Computational Design
- > Robotic and digital fabrication
- > Biodesign



#### Differentiators

- > Proprietary technology in design and fabrication
- > Tried and tested product



#### Key customers

- > Councils, commercial harbour operators, and owners



#### Key partnerships

- > Landcom
- > Infrastructure NSW
- > Sydney Institute of Marine Science



#### Quality accreditations and awards

- > Bruce Mau Award for Life-Centred Design
- > Tested and approved by marine biologists



[archmanu.com](http://archmanu.com)

## > UNSW Arch\_Manu Büro - BioShelter

### Protecting and restoring inner city harbours with an artificial seawall to enhance marine biodiversity and mitigate climate change consequences

#### Research Project

With the increasing need for space in coastal cities, shorelines are moving outwards to increase availability. A byproduct of these processes includes the destruction of natural habitats for marine life, diminished biodiversity, and polluted rivers and harbours.

BioShelter uses site-specific marine biology data to generate computationally designed models and produce robotic, 3D-fabricated artificial seawalls using custom-made sustainable materials. BioShelter restores natural habitats for native species by improving the water quality of a harbour. This was demonstrated by proof-of-concept research in 2019 in the Sydney Harbour and a first product implementation, commissioned for the new Sydney Fish Market development. The development is to be completed in September 2024.

BioShelter also has potential defence applications, particularly in maintaining and restoring naval bases. By enhancing marine biodiversity and water quality, BioShelter can contribute to the sustainability and operational readiness of naval facilities, ensuring these critical infrastructures are resilient to environmental challenges.



## > UNSW Bushfire

**Quantifying and mitigating the threat of pyro-terrorism to Australia's security, critical infrastructure and surveillance operations**

### Research Group

Climate change is recognised as having severe impacts on Australia's relationships with south-west Pacific nations and, more broadly, poses three threats to Australia's national security:

1. Direct risk to defence bases.
2. Terrorist use of arson to create extreme bushfires, or insurgent or military action.
3. Smoke impacts on airspace, surveillance activities, and the public health of Australasian/Pacific nations.

UNSW Bushfire is recognised as a global leader in extreme bushfire research. The group can characterise and mitigate against these risks by providing the most comprehensive risk assessment and mitigation strategies to bases, including risk from extreme dynamic fire events and ember attack not considered by traditional fire danger rating systems. Advanced computational simulations are used to investigate and quantify the potential impact of pyro-terrorism and smoke plumes.



#### Key capabilities

- > Interdisciplinary scientific knowledge and practical experience
- > Computational modelling of fire risk and smoke transport
- > Expertise in mitigation strategies



#### Differentiators

- > Rigorous mathematical, engineering, and computational simulation approach
- > Comprehensive understanding of extreme fire and pyrocumulonimbus formation
- > Deep understanding of how fire can be used maliciously



#### Key customers

- > Australian Defence Force, for management of fire risk on bases, planning operations in our neighbourhood
- > Australian Geospatial-Intelligence Organisation, to understand risks in our neighbourhood



[unsw.to/bushfire](https://unsw.to/bushfire)



#### Key capabilities

- > Explainable AI (XAI)
- > Systems modelling
- > Supply chain analytics



#### Differentiators

- > Critical mass of faculty focusing on Defence supply chains
- > Unique combination of computer science, engineering, and social science techniques
- > Broad experience across multiple supply chain contexts



#### Key customers

- > Capability Acquisition & Sustainment Group
- > Australian Army
- > Royal Australian Navy



[unsw.to/scsrg](https://unsw.to/scsrg)

## > UNSW Canberra Supply Chain Sustainment Research Group

**Promoting supply chain resilience through explainable AI**

### Research Group

Australia's Defence capability relies on robust global supply chains. Shortages in critical inputs such as fuels, medicines, manufactured goods, consumer goods, and high-technology goods have become more regular. This research group is working towards addressing these challenges through Explainable AI (XAI). XAI is an emerging technology that allows users to see how an AI algorithm works. It offers greater transparency of data sources and visibility of how they are used and generate outputs.

Members of the Supply Chain Sustainment Research Group have recently developed XAI approaches to address supply chain management risk management, transparency and accountability problems. The next research stage will explore cutting-edge XAI-enabled systems modelling and machine learning capability to map supply chain vulnerabilities in critical defence material supply chains. Such a capability could improve Defence supply chain resilience by enhancing decision-making efficiency in the presence of time-critical events while maintaining transparency and accountability.

# > UNSW Defence Research Institute (DRI)

Using UNSW’s premier research, education, and workforce-development network to enhance Australia’s defence and security

Research Institute

The Defence Research Institute (DRI) facilitates partnerships across academia, government, defence and the defence industry to address critical challenges in defence and security. To achieve collective growth and success, these strategic partnerships leverage UNSW's premier research, education, and workforce development through lifelong learning.

The DRI fosters a collaborative environment to progress cutting-edge technology, health, business, and humanities across the university for societal impact. Its aim is to translate world-class defence and national security research into enduring transformational solutions that support Australia's national interests.

A current focus is workforce uplift, ensuring that personnel are equipped with the latest knowledge, skills, and expertise to meet the demands of a rapidly evolving defence and security landscape. This commitment to technological advancements and human-focused development exemplifies UNSW's proactivity in mitigating complexities inherent in the sector.

The DRI champions UNSW’s unwavering pursuit to maintaining a safe and stable community in a challenging global environment.



Key capabilities

- > Connected with all seven faculties and 47 schools across Sydney and Canberra
- > Research, development, and education focused



Differentiators

- > A team of highly skilled business-development specialists
- > Dedicated focus on research translation
- > Strategic stakeholder engagement



Key customers

- > Australian Department of Defence
- > Australian Government
- > Australian Defence industry



Key partnerships

- > Defence Trailblazer Program – Concept to Sovereign Capability with the University of Adelaide
- > Security & Defence PLuS Initiative with Arizona State University and Kings College London



Quality accreditations and awards

- > Finalist - Defence Innovator of the Year (Company) – Australian Defence Industry Awards 2024



[dri.unsw.edu.au](http://dri.unsw.edu.au)



Key capabilities

- > Evidence-based, multidisciplinary research
- > Embedding research in real-world industry scenario



Differentiators

- > Embeds objective, evidence-based, multidisciplinary research within organisations
- > Secured several industry partnerships



Key customers

- > Collaboration with industry resulted in the appointment of a co-funded UNSW Industry Scientia Academic, who will work with partners in the insurance industry to model the impacts of extreme weather events.
- > Successfully integrating behavioural science principles to drive increased climate action in the financial sector.
- > Convening industry, government and academia at co-developed workshops and roundtables to improve dissemination and application of new knowledge on climate risk and response.



[unsw.to/icrr](http://unsw.to/icrr)

# > UNSW Institute for Climate Risk & Response (ICRR)

Research that empowers businesses, governments, and society to address the risks and opportunities of climate change

Research Institute

The ICRR research team addresses climate change mitigation and adaptation strategies – a critical issue due to its global impact on ecosystems and human livelihoods. It offers innovative responses to climate risk by drawing on research findings from climate, behavioural, economic sciences, business, and law.

The research group investigates climate risks across governments and industries. This includes identifying and measuring risks, such as extreme weather events, and how they will play out, as well as developing specific advice on approaching and managing these risks.

Practical steps include recommending evidence-based policies, creating prototype systems for climate action, and collaborating with industry partners to embed solutions in real-world scenarios. This approach ensures that the research not only advances theoretical knowledge but also delivers tangible benefits to society, setting it apart as a leader in climate action.

The research has progressed to the stage of implementing new methodologies and seeking investment for broader application.



## > UNSW International Ethics Research Group

### Providing ethical solutions to security challenges

#### Research Group

The International Ethics Research Group offers short courses and research consultancies that address the significant ethical and moral dilemmas confronting national security professionals at all levels. This includes military personnel, policy makers, technologists, and others.

Ethical challenges can include those posed by using military force, deterrence, armed humanitarian intervention, unmanned and autonomous weapons systems, the bioengineering and enhancement of soldiers, non-lethal weapons, and the use of ICT technologies in modern warfare campaigns.

The group develops practical, action-guiding tools for ethical decision-making, policy recommendations, and advanced methodologies for the responsible use of military technologies.

Its aim is to foster a more ethically aware application of force and technology in global security contexts.



#### Key capabilities

- > Bringing together international relations experts, political theorists, and moral philosophers to provide ethical solutions to national security challenges



#### Differentiators

- > Providing ethical solutions that are both academically rigorous and sensitive to the real-world constraints faced by Australian military and security professionals



#### Key customers

- > Department of Defence



[unsw.to/international-ethics](https://unsw.to/international-ethics)



#### Key capabilities

- > Advanced numerical modelling
- > Ocean observing
- > Innovative data assimilation



#### Differentiators

- > Collaboration with international experts
- > Unique combination of novel ocean data and advanced models
- > Superior performance to available ocean models



#### Key customers

- > Fisheries managers
- > Undersea defence
- > Shipping, Search and Rescue



#### Key partnerships

- > BOM for atmospheric and global ocean data
- > CSIRO for defence applications
- > Fisheries for vessel-mounted observations



#### Quality accreditations and awards

- > GODAE and OceanPredict: Recognised our research as a world-leader in the integration of novel observations and modelling in Western Boundary Currents



[oceanography.unsw.edu.au](https://oceanography.unsw.edu.au)



## > UNSW Regional Ocean Prediction

### Combining ocean models and observations for improved prediction of the subsurface ocean

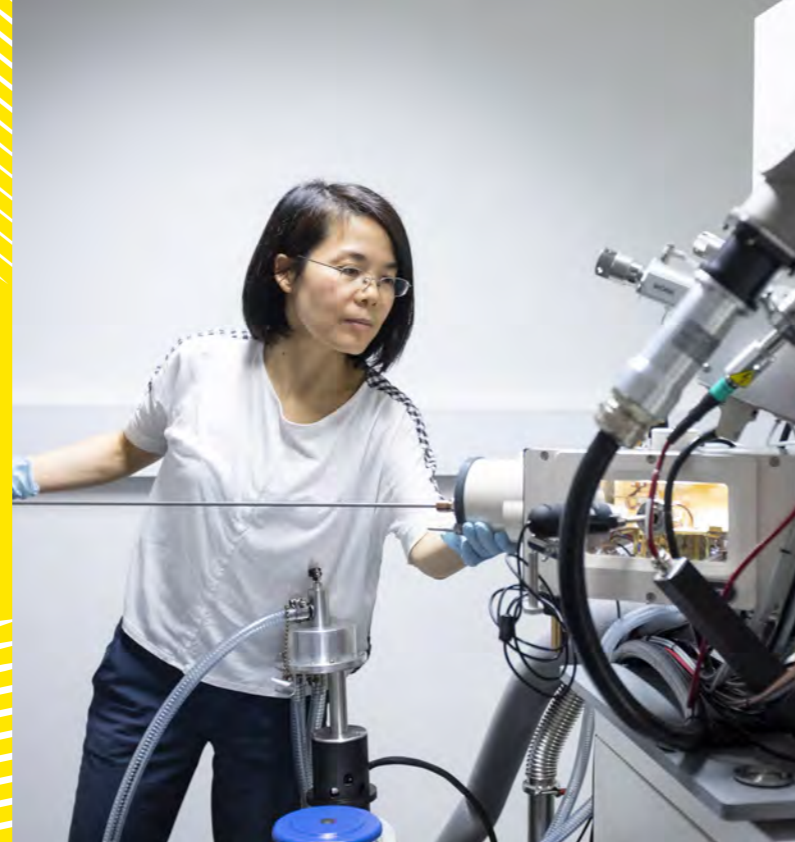
#### Research Group

With 85% of Australia's population living by the sea and the output of our blue economy valued at \$81.2 billion, managing our ocean environment is a crucial priority for our nation. Australia relies on accurate ocean predictions to support the safe operation and sustainable growth of marine industries, the sustainable management of our warming marine environment, and undersea warfare and surveillance.

While the surface structure of the ocean is well-observed by satellites, data on the structure of the ocean below the surface are particularly uncertain and accurate predictions of the ocean's subsurface are often lacking. UNSW's Regional Ocean Prediction team is combining ocean measurements and numerical models to advance subsurface ocean prediction.

The novel methods will directly impact Australia's regional ocean prediction capability. Strong collaboration with marine forecasting bodies guarantees translation into the national ocean modelling framework, providing superior ocean data to support decision-making across government, industry, and defence.

# Enablers



## Mark Wainwright Analytical Centre (MWAC)

### Powering UNSW research capabilities

The Mark Wainwright Analytical Centre is a large group of multiuser core facilities that provide scientific instrumentation and expert technical support, used to study the structure and composition of biological, chemical and physical materials.

Accessible to UNSW researchers, government and industry, MWAC services wide cross-section of industries. Facilities relevant to Future Defence & Security include 3D Imaging, Surface Analysis, Mineral Phase Identification & Element Analysis.

[analytical.unsw.edu.au](http://analytical.unsw.edu.au)



## Unisearch

### Expert opinion services

Unisearch has been a provider of expert opinion and consulting services since 1959. Drawing on expertise from leading universities and independent consultancies, Unisearch offers commercial and technical contracts in a range of disciplines from testing of products and materials to Australian Standards through to analysis of equipment failure.

[unisearch.com.au](http://unisearch.com.au)

## UNSW Canberra

Providing short course and degree education for leaders and professionals in Defence and associated industries, and all other interested parties

In all areas relating to military, strategic, and defence studies, UNSW Canberra offers high-quality undergraduate and postgraduate degrees, and short courses. Additionally, UNSW's Canberra city campus expands on the faculty's reputation for excellence in tertiary education and enables increased collaboration with local industry and the broader the Canberra community.

Building on 50 years of local collaboration with the Australian Defence Force, a wider range of students will now be able to access world-class university programs across multiple campuses. UNSW's deep connections to industry and government through its teaching and research make the university an ideal place to develop your defence & security career.

[unsw.to/canberra-study](http://unsw.to/canberra-study)





## UNSW Graduate Research School (GRS)

**Partner with a global research powerhouse to increase your competitive advantage and drive innovation**

Partnering with UNSW allows businesses to engage with talented PhD candidates and gain fresh insights and innovative approaches to complex R&D challenges. UNSW is a global research powerhouse, developing the next generation of research leaders with the skills and expertise to solve real-world problems and drive innovation. UNSW's Industry Engagement programs offer a range of options for accessing their highly skilled pool of talented PhD researchers to increase competitive advantage and drive innovation in various sectors.

Working with UNSW PhD candidates benefits you by:

- Gaining fresh ideas and diverse thinking from emerging research leaders
- Finding innovative approaches to complex R&D challenges
- Developing your future workforce as part of a globally connected research environment
- Building partnerships with UNSW's world-class academic researchers, and accessing the best minds in each field.

[unsw.to/industry-engagement](https://unsw.to/industry-engagement)

## UNSW Industry & Innovation

**Simplifying innovation and research commercialisation with tailored, end-to-end support for industry and government partners in defence and security**

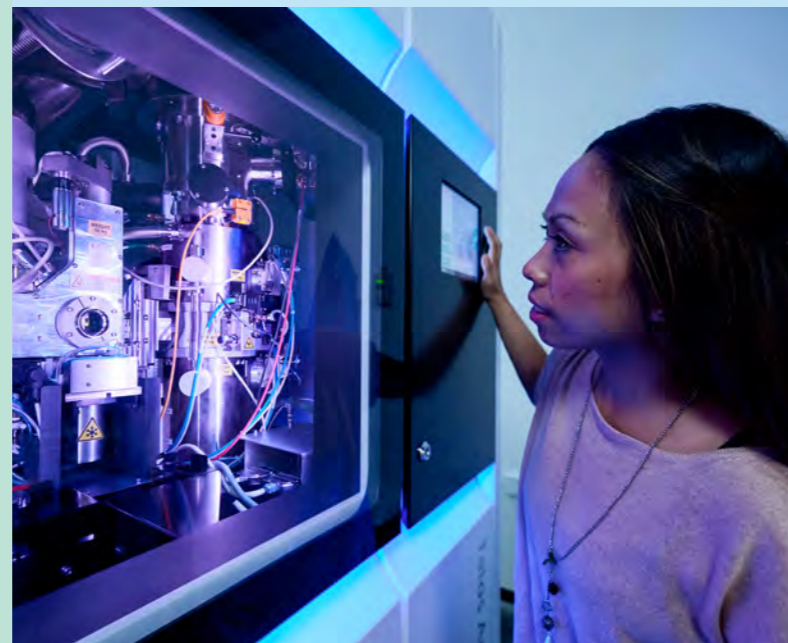
UNSW Industry & Innovation simplifies the engagement process for partners. The team of business development and commercialisation managers provide a clear entry point, guiding partners through the complexities of university collaboration with transparent processes and deliverables.

Their end-to-end service supports the journey from bright ideas to market-ready products, offering expertise, access to leading infrastructure and facilities, funding application support, and tailored IP advice. They enable collaborations that create competitive advantage, regardless of a project's size, budget, or timeline.

As outlined in this booklet, UNSW boasts broad and deep defence and security research capabilities. Industry & Innovation connects partners with this expertise through the Defence Research Institute and the Defence Trailblazer, and their successful track record in securing collaborative grants ensures appropriate funding opportunities are within reach.

Collaborate with UNSW to commercialise innovative research and advance Australian sovereign capability.

[innovationcommunity.unsw.edu.au](https://innovationcommunity.unsw.edu.au)



## UNSW Launch

**A secure collaborative hub that brings together industry, government and academia to grow innovation and sovereign capability in defence and security**

Launch is a secure, collaborative innovation hub specifically designed for Defence and Security SMEs and startups. Its mission is to bridge the gap between academia and industry, fostering innovation and collaboration within the Defence and Security sector.

Since its inception in 2020, Launch has grown to host 14 companies specialising in cybersecurity, space, AI, and defence-related technology. Additionally, Launch has cultivated an ecosystem of 24 companies that actively collaborate with UNSW on research, curriculum design, work-integrated learning, and more.

What sets Launch apart is its sector-specific focus, secure spaces, and access to university expertise and facilities. Together with its industry collaborators, Launch is committed to supporting the development of Australia's sovereign capability in the Defence and Security space.

[unsw.to/launch](https://unsw.to/launch)



**Discuss your project or idea  
with UNSW**

