

 STEM Research

Security and Resilience

RMIT's research in Security and Resilience delivers integrated, evidence-based solutions to Australia's complex challenges, including digital disruption, critical infrastructure integrity, and climate-driven disasters, providing leadership across digital and national security through expertise in technology, governance, policy, and risk management.

Aligned with one of Australia's core strategic objectives, "National Science Priority 5: *Building a secure and resilient nation*," RMIT strengthens Australia's sovereign capability through advanced research in the defence and aerospace sectors, including trusted autonomy, advanced manufacturing, structural integrity, and sensor technologies. This expertise is translated regionally through global programs that enhance digital readiness and resilience across the Indo-Pacific.

RMIT has significantly contributed to sustainable and resilient civil infrastructure and whole-of-society disaster management. Its research delivers solutions ranging from advanced materials and innovative structural monitoring to resilient, whole-of-life design for critical assets such as transport

networks and utility systems, while spearheading the transition to low-carbon infrastructure through new carbon-neutrality standards and high-value construction materials derived from recycled industrial and household waste.

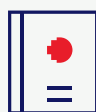
In Security and Resilience, RMIT applies systems thinking and community co-creation to manage complex, cascading "poly-crisis" events, translating world-leading natural hazards research into practice for emergency management, recovery, and long-term societal resilience. By mobilising expertise across engineering, computer science, business, and social sciences, the University adopts a whole-of-society approach that strengthens prevention, preparedness, response, and adaptation in an increasingly volatile global environment.

Key facts about Security and Resilience at RMIT



\$13.5m

average annual
research funding



208

average publications
per year



101

major project partnerships
across 12 countries



35.4%

research outputs are in
the top 10% most cited in
Security and Resilience



63.5%

research outputs are in
collaboration with international
partners across 110 countries



175%

above the global benchmark
in average field-weighted
citation impact

Metric	Value	Notes
Number of current researchers	74	
Number of projects	236	
Average citations per publication	30	
Top 25 citation percentile	59.5%	Almost 60% of research outputs are in the top 25% most cited in Security and Resilience
Number of industry partnerships	44	For profit organisations only. A further 25 not-for-profit partner organisations and 30 government organisations



Security and Resilience facilities, partnerships, and infrastructure

RMIT has access to world-class facilities that support advanced manufacturing, virtual experimentation, automation, and cloud supercomputing, enabling rapid prototyping, scalable innovation, and strong industry collaboration to drive real-world research impact.

Advanced Manufacturing Precinct (AMP)

A hub for advanced manufacturing: designing, prototyping, and scaling innovative products with industry, researchers, and real-world application in mind.

The AMP brings together RMIT's strengths in technology and design innovation to enable rapid prototyping and scalable production. By integrating digital design, additive manufacturing, and biofabrication under one roof, AMP supports researchers, startups, and industry to develop lightweight, customised, and highly complex products that cannot be achieved through traditional manufacturing, playing a key role in RMIT's Security and Resilience research.

Key capabilities include:

- Metal and polymer additive manufacturing (SLS, SLA, FDM, and DMLS)
- Biofabrication using cell-laden and biomaterial inks
- Reverse engineering and digital twin design
- Product performance testing and validation

AMP's specialised equipment and experts can assist companies to develop new conceptual products, perform multiple design iterations, or further develop existing products or enhance existing manufacturing processes.

The Virtual Experiences Laboratory (VXLab)

A collaborative virtual environment for visualising, testing, and operating complex cyber-physical systems.

The VXLab is a multidisciplinary facility that connects advanced visualisation and automation capabilities across RMIT and industry. It supports collaborative experimental design, operation, and testing of global cyber-physical systems, enabling researchers and partners to prototype, monitor, and troubleshoot complex systems, including those operating in remote or hazardous environments.

Key capabilities:

- Global Operations Visualisation Laboratory with high-resolution tiled displays and videoconference streaming
- VXPortals offering ultra-high-resolution, stereoscopic 3D mobile visualisation
- Advanced Manufacturing Robot Interoperation Test Laboratory with sensor- and camera-integrated industrial robotic arms
- System design, prototyping, and testing for complex automation and cyber-physical infrastructure
- Applications across engineering, manufacturing, analytics, games, medical imaging, and environmental management

RMIT AWS Cloud Supercomputing Facility (RACE)

Scalable cloud supercomputing, enabling data-driven discovery and digital innovation.

RACE is a University-led commercial cloud supercomputing resource delivered in partnership with Amazon Web Services (AWS) and AARNet. As Australia's first facility of its kind, RACE provides scalable, elastic high-performance computing (HPC) to support research, education, and industry by combining industry-leading cloud technologies with high-speed national research networks.

Key capabilities include:

- Scalable and elastic HPC via AWS cloud infrastructure
- High-speed, secure connectivity enabled by AARNet fibre networks
- Comprehensive AWS- and Azure-oriented cloud services
- Training and expert technical support for researchers and industry partners
- Data-intensive computing to maximise the value of existing data and digital infrastructure





Our Researchers

Professor John Thangarajah

Professor Thangarajah is a global leader in artificial intelligence (AI), specialising in autonomous multi-agent systems and human-machine teaming, and leads RMIT's Security and Resilience Hub as its Director.

Professor Pier Marzocca

Professor Marzocca is a recognised leader in aerospace and defence research, advancing digital engineering, multi-physics modelling, and complex aerospace and energy systems. Professor Marzocca is the Director of RMIT's Sir Lawrence Wackett Aerospace and Defence Centre.

Professor Matt Duckham

Professor Duckham, Director, RMIT's Information in Society Enabling Impact Platform, is an international leader in spatial reasoning, AI, and geospatial computing, driving innovation in defence, emergency management, and disaster resilience.

Dr. Erica Kuligowski

Dr. Kuligowski is an internationally recognised expert in behavioural disaster research, integrating engineering and sociology, to improve emergency management and resilience.

Professor Sujeeva Setunge

Professor Setunge is a research leader focused on translating fundamental and applied research into impact and leads RMIT's TREMS hub through global academic and industry partnerships.

Professor Andrew Greentree

Professor Greentree is an international leader in quantum science, advancing quantum sensing, information, and secure systems through industry collaboration.

Professor Kate Nguyen

Professor Nguyen leads RMIT's Innovative Fire and Facade Engineering Group, developing advanced materials and construction solutions for sustainability and fire safety.

Professor Zahir Tari

Professor Tari is a specialist in cybersecurity and system resilience, known for pioneering solutions in anomaly detection and large-scale systems.

Dr. Damiano Spina

Dr. Spina is an award-winning researcher advancing responsible, human-centred information access, retrieval-augmented generation, and conversational AI.

Professor Kandeepan Sithamparanathan

Professor Sithamparanathan is an expert in satellite, wireless, airborne, and cognitive radio communications for next-generation networks.

Professor Guomin 'Kevin' Zhang

Professor Zhang is a specialist in sustainable construction and asset management, supported by digital engineering and life-cycle assessment.

Associate Professor Dilan Robert

Associate Professor Robert is a recognised leader in experimental and modelling research on construction materials and infrastructure performance.

Professor Iqbal Gondal

Professor Gondal is an Associate Dean of Cloud, Systems and Security at RMIT University. He has received significant funding to support research in intelligent malware analysis, threat intelligence, fraud detection, cyber-attack triage, malware web-inject detection, phishing attack identification, remote condition monitoring, and blockchain.

Associate Professor Toh Yen Pang

Associate Professor Pang specialises in systems design, biomechanical modelling, and developing digital twins for advanced biomedical research. His research focuses on integrating advanced technology and simulation applications into the development of bioengineered models and devices.

Professor Cees Bil

Professor Bil is a Professor in aerospace engineering with expertise in complex systems design, optimisation, and autonomous systems. He is an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA) and AIAA Region VII Director.

Professor Sumeet Walia

Professor Walia is the Director of RMIT's Centre for Opto-Electronic Materials and Sensors (COMAS) leading research in opto-electronic materials and sensors.

Professor Suelynn Choy

Professor Choy is an expert in GNSS and precise satellite positioning, applying space-based technologies to atmospheric and environmental monitoring.

Professor Asha Rao

Professor Rao is a leader in cyber resilience and digital trust, spanning cryptography, cybersecurity, and policy responses to emerging threats.

Dr. Sebastian Rodriguez

Dr. Rodriguez specialises in AI software engineering, leading applied research in simulation, emergency management, energy, and logistics.

Professor Priya Rajagopalan

Professor Rajagopalan is a building scientist researching energy-efficient buildings, indoor environmental quality, and climate adaptation.

Professor Jennifer Palmer

Professor Palmer is a pioneer in aerospace engineering, specialising in autonomous aerial systems, swarming, and novel air vehicle design.

Associate Professor Tariq Maqsood

Associate Professor Maqsood is an expert in natural hazard risk assessment, focusing on reducing vulnerability and enhancing community resilience.

Dr. Mittul Vahanvati

Dr. Vahanvati is recognised for improving housing resilience through governance and capacity building in post-disaster recovery.

Dr. Chamila Gunasekara

Dr. Gunasekara is a Chartered Member of Engineers Australia (CPEng), bringing with him experience in the construction engineering and structural design sectors. He has been leading research in low-carbon concrete, construction materials, and structural engineering.



Centres, Networks, and Hubs

Security and Resilience Hub (S&R Hub)

The University's integrated capability in Security and Resilience is strategically coordinated through the S&R Hub. The Hub focuses on advancements across national and digital security, sustainable infrastructure, and natural disaster management.

Serving as the front door to industry, government, and communities on security and resilience issues, the Hub fosters a collaborative environment where cutting-edge technology and strategic partnerships converge to create sustainable solutions that safeguard society and infrastructure and build disaster-resilient communities.

The Hub enriches academic programs by offering minors and work-integrated learning opportunities, and strives to transform the workforce by developing micro-credentials and offering tailor-made training through masterclasses and short programs.

This mechanism facilitates industry access to world-class researchers and facilities, conducting collaborative projects to translate research directly into practice.

Sir Lawrence Wackett Defence and Aerospace Centre (SLWDAC)

SLWDAC is a recognised leader and trusted partner to Australia's Defence and Aerospace sectors, strengthening their security and resilience through innovation and interdisciplinary research.

The Centre's expertise covers the entire lifecycle of sovereign capability development, from initial concept, design, and testing, to policy and implementation. SLWDAC focuses on critical research areas including Advanced Manufacturing and Sustainment, Trusted Autonomy and Digital Engineering (e.g., Autonomous Systems and Digital Twins), and Sensor Technologies such as photonics and quantum positioning, navigation, and timing.

By translating research into new intellectual property and industry best practice, the Centre directly supports the growth of Australia's technology economy and builds essential sovereign capabilities.

Centre for Cyber Security Research and Innovation (CCSRI)

CCSRI is a leading, award-winning hub for multidisciplinary research, uniting experts, government, and industry to address the human, organisational, and technological aspects of cyber security.

The Centre focuses on critical domains including risk management, secure data sharing, governance, and policy formulation for the protection of civil society. CCSRI actively contributes to sovereign security by research in critical areas such as information warfare and hybrid threats and securing critical infrastructure such as urban systems and the maritime supply chain.

Demonstrating its regional leadership, the CCSRI delivers international programs, such as DFAT-funded initiatives, to enhance digital readiness and resilience across the Indo-Pacific.

ARC Hub for Transformation of Reclaimed Waste Resources to Engineered Materials and Solutions for a Circular Economy (TREMS)

TREMS is an ARC Industrial Transformation Research Hub leading Australia's response to the national waste crisis. The Hub's core mission is to progress scientific research and innovation toward a circular economy by engineering sustainable, high-value construction, and other materials from recycled household, commercial, and industrial waste.

TREMS drives change by developing novel materials, creating metrics and tools to evaluate the social, environmental, and economic benefits of these solutions, and promoting behavioural change around waste generation and reuse.

The Hub serves as a crucial focal point for collaboration, linking academics and practitioners to translate research into practical applications and field trials for sustainable infrastructure.





Other Research Networks, Centres, and Hubs involving or including Security and Resilience in their research outputs

Australian Research Council (ARC) Centres of Excellence

- ARC Centre of Excellence for Quantum Computation and Communication Technology
- ARC Centre of Excellence for Automated Decision-Making and Society (ADM+S)

Leading Research Centres (LRCs)

- Centre for Atomaterials Nanomanufacturing (CAN)
- Centre for Human AI Information Environments (CHAI)
- Centre for Future Construction (CFC)
- Centre for Opto-Electronic Materials and Sensors (COMAS)
- RMIT Applied Quantum Technologies Centre (RAQT)
- Research Centre for Additive Manufacturing (RCAM)

Other Research Networks, Centres, and Hubs

- SmartSat Cooperative Research Centre (CRC)
- Post-Carbon Research Centre
- Disaster Research Network
- Infrastructure and Sustainable Systems Research Cluster
- Satellite Positioning for Atmosphere, Climate and Environment (SPACE) Research Centre



Select Industry Partners in Security and Resilience

Industry and Private Sector

ACCIONA	LEAP Australia
Advanced Composite Structures Australia	Leonardo Australia
Airbus	Lunar Outpost
Arkeus	Macdonald Lucas
Arup	MEMKO
Azraq	Microsoft Research
Babcock	Natirar
BAE Systems	Navantia Australia
Boeing Australia	NBN
BOSCH	Nova Systems
Brightspace	OneWeb
Carer Manager Plus	Optus
CONSUNET	SAAB Australia
Cyclotek	Samsung
ERBAS	Strahan Research
FLEET Space	Suncorp Insurance
GHD	Surround Australia
Here Technologies	Sypaq
IBM Research	Tax Leopard
InnovateGPT	Thales Australia
Insurance Australia Group (IAG)	Veris
Kai-2	



Government and NGO

ABC

Australian Communications and Media Authority

Australasian Fire and Emergency Service Authorities Council

All India Disaster Mitigation Institute

Australian Research Data Commons

Asthma Australia

Australian Red Cross

Capability Acquisition and Sustainment Group

Country Fire Authority (Victoria)

Commonwealth Scientific and Industrial Research Organisation

Defence Aviation Safety Authority

DEECA (Victoria)

Emergency Management Victoria

Emergency Recovery Victoria

Australian Federal Government

Geoscience Australia

Habitat for Humanity (Australia and Fiji)

International Telecommunications Union

National Research Council Canada

Natural Hazards Research Australia

Northern Hospital

NSW Reconstruction Authority

NSW Rural Fire Service

Parks Victoria

Queensland Fire Department

South Australian Country Fire Service

SA Police

SECCA

SES (VIC, NSW, SA)

St. Vincent's Hospital Melbourne

Sustainability Victoria

Tasmania Fire Service

Tweed Shire Council

UN-Habitat

United Nations Environment Programme

U.S. National Fire Protection Association, U.S. National Institute of Standards and Technology, U.S. Society of Fire Protection Engineers

Victorian State Government

Western Australian State Government



Our excellence in Security and Resilience— impact cases



Bushfire evacuation simulation tool improves community readiness

The number of people who live in bushfire-prone areas around the world is growing. As the effects of climate change increase the size and severity of bushfires, it's important for communities to be prepared for emergency incidents.

RMIT researchers have joined a global project, funded by the U.S. National Institute of Standards and Technology, spanning Europe, Australia, and North America, to develop a digital tool that simulates evacuation scenarios. The tool, known as WUI-NITY, visualises pedestrian and traffic movement as well as bushfire spread to assess the time required for a community to evacuate under various conditions.

Utilising RMIT's interdisciplinary expertise, researchers have been involved in numerous

upgrades to the tool, receiving one of the U.S. National Fire Protection Association's highest honours—the Foundation Medal—for developing social media data mining techniques to understand evacuation behaviour.

The tool has been used by consulting firms that work with local governments, councils, and emergency services to run virtual scenarios, rather than large-scale physical exercises, to plan for future bushfire response.

This has helped decision makers to plan for incidents and optimise road networks, signage, and evacuation relief centre locations—key factors shaping how civilians respond to evacuation orders—which may minimise fatalities and injuries during real bushfire events.

Digital tool supports proactive aircraft maintenance, securing defence, and economic resilience

Aviation plays an important role in Australia's economy and national security, supporting connectivity of communities, tourism, emergency services, critical supply chains, and defence. Thus, keeping aircraft fleets in good condition is imperative. Around 80% of aircraft lifecycle costs occur in operations and sustainment, and recurring technical defects can cost over ~\$200,000 per aircraft per year, translating to millions of dollars across a fleet.

RMIT researchers are leading the way in aircraft predictive maintenance research, helping to identify and manage aircraft defects before they become too costly.

Working with defence and industry partners, the team has designed a practical software tool—FlightLogik—that employs AI and machine learning to analyse pilot and maintenance reports at scale. These reports contain valuable insights into emerging risks and maintenance needs, previously underutilised due to the time it takes to analyse them manually.

By automating analysis of maintenance report text, FlightLogik reduces engineering workload and helps identify costly recurring defects earlier and shift maintenance programs from reactive to proactive.

The tool is currently being developed for the Royal Australian Air Force in collaboration with Defence Science and Technology Group, Capability Acquisition and Sustainment Group, and other partners, with further applications in maritime, land, space, rail, and clean energy systems being explored.

New clay concrete blend cuts carbon emissions

The global production of cement—a key ingredient in concrete—is responsible for 8% of global CO₂ emissions, making it one of Australia's most carbon-intensive industrial processes.

In the past, research has shown that replacing some cement with clay reduces environmental impact. However, the high-grade kaolin clay, best suited for cement replacement, is in high demand for ceramics, paints, cosmetics, and paper.

In a novel application, RMIT researchers have demonstrated that illite clay, which is cheaper and more abundant than kaolin-based substitutes, can be mixed with low-grade kaolinite clay to make stronger concrete.

The new blend reduces the embodied carbon found in modern cement while improving the strength and durability of traditional cement substitutes, unlocking new possibilities for sustainable construction.

Through collaboration with industry partners Acciona and Heidelberg Materials Australia, the researchers are on track to achieve both economic and environmental impact.

The use of locally sourced clays means that the construction industry can minimise its dependence on imported additives, resulting in lower costs and enhanced supply chain resilience. Further work is underway to expand this innovative green concrete for field trials and monitoring, with the environmental advantages of this approach expected to contribute to Australia's net zero emissions objectives.



