



WESTERN AUSTRALIAN DEFENCE RESEARCH UNIVERSITIES CAPABILITY STATEMENT



FOREWORD



Western Australia is home to cutting edge defence innovation research and development capability. Our four “Team WA” universities – Curtin University, The University of Western Australia, Edith Cowan University and Murdoch University – undertake world class defence related research and have a long history of collaboration with industry.

These universities are enthusiastic supporters of defence capability and continue to work together to address the Department of Defence’s Priority Innovation Needs while contributing to programs and initiatives of the Next Generation Technologies Fund. Our Team WA universities have world-leading capability in underwater and offshore systems, data processing and analytics, cyber security and remote and autonomous technologies, to name a few.



Much of this cutting edge research and development has been driven by the collaborative partnerships forged during the State’s recent resources sector expansion. These partnerships between universities and industry have resulted in the development of innovative technologies which are now widely deployed across a range of market sectors in Australia and overseas. This collaborative approach is key to Western Australia’s success and will be required at a national level to ensure the Australian Defence Force remains regionally superior and has access to the latest technology.

Our universities have also developed partnerships with overseas Defence Forces and universities and are open to building further relationships to strengthen defence capability and assist in maintaining a secure Indo-Pacific Region.

As Minister for Defence Issues, I am proud to endorse this Capability Statement and encourage you to engage with our world-leading universities as Australia grows its sovereign defence capability.

Hon Paul Papalia CSC MLA
MINISTER FOR DEFENCE ISSUES



WESTERN AUSTRALIAN UNIVERSITY DEFENCE RESEARCH

Western Australia's universities have built a reputation for their collaborative nature, world-class research expertise and facilities, domain knowledge and contributions to Australia's defence and national security, with some capabilities attracting interest from allied export markets.

We have four world class public universities with over 100,000 students, contributing several hundred million dollars of value for fundamental and industry R&D each year. Our state's higher education and research sector is a major economic driver and contributes to integrating critical skills for industry development.

Each university's areas of expertise are highly specialised and spread across disciplines and technologies. The research community in WA embraces working across industry sectors and supports the progressively innovative nature of our state's economy.

Our state is also a fundamental provider of training and situated in an optimal location for providing ongoing knowledge transfer to Australia's Naval personnel at nearby Fleet Base West, home to the Navy's submarines and half of their frigates. The same applies to the troops stationed at Campbell Barracks, also close to all four universities, making WA a strategic location for defence research and training.

Our universities work collaboratively together in defence under a whole-of state approach, along with industry and state government (Defence West) to provide fundamental inputs to support Australia's Defence Force and associated defence industry to deliver innovative solutions to complex challenges to ensure a safer, brighter future for generations to come.



WESTERN AUSTRALIAN UNIVERSITY DEFENCE RESEARCH & DEVELOPMENT CAPABILITIES

Western Australia's universities have a proven research record in a wide range of discipline areas applicable to Australia's national defence strategy and priorities. Their capabilities and credentials are identified in this Directory against the broad capability areas of priority outlined below.



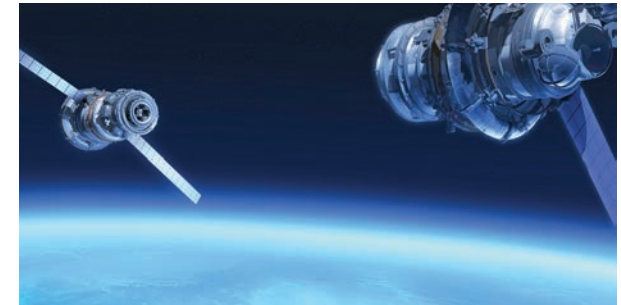
Integrated Intelligence, Surveillance and Reconnaissance

Research and development of technologies and solutions for effective enterprise intelligence, surveillance, reconnaissance integration and interoperability with Australia's allies to provide a capability edge through superior battlespace awareness.



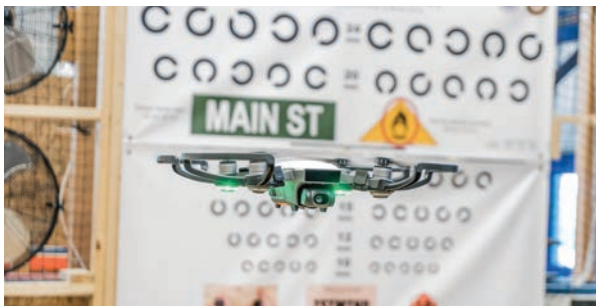
Quantum Technologies

Research and development of technologies to increase the security of military and government communications and computing through strengthened encryption and exploring new types of sensors based on quantum systems.



Space Capabilities

Research and development of technologies to de-risk Defence's dependence on space-based systems through technical expertise and enhanced capability agility.



Trusted Autonomous Systems

Research and development in trusted autonomous systems that may have the potential to support ADF capability in the future, such as the use of autonomous vehicles for resupply.



Enhanced Human Performance

Research and development of technologies that enhance soldiers' resilience and ability to interpret and use data in the battlefield.



Cyber

Research and development of technologies to address the threats presented by information and communications technology dependencies and vulnerabilities within military systems.



Medical Countermeasure Products

Research and development of technologies to provide effective protection of Defence personnel from a range of chemical, biological and radiological threats, pandemics and emerging infectious diseases.



Hypersonics

Research and development of hypersonic flight, including propulsion, flight dynamics, control surfaces and materials that support flight systems.



Multi-Disciplinary Material Sciences

Research and development of technologies to reduce detection of ADF platforms and improve ballistic and shock protection. Exploring materials and processes that support advanced manufacturing.



Directed Energy Capabilities

Research and development to explore novel technologies and the basic sciences of devices to better understand and develop building blocks for future directed energy capabilities.



DEFENCE PRIORITY AREAS (NEXT GENERATION TECHNOLOGIES FUND)

	Directed Energy Capabilities	Hypersonics	Cyber	Trusted Autonomous Systems	Quantum Technologies	Multi-Disciplinary Material Sciences	Medical Countermeasure Products	Enhanced Human Performance	Space Capabilities	Integrated Intelligence, Surveillance and Reconnaissance
Curtin University	C	C	C	A	B	B	C	A	A	A
Edith Cowan University	C	C	A	B	C	B	C	A	C	B
Murdoch University	N/A	B	C	B	C	B	A	A	C	B
The University of Western Australia	C	C	B	B	A	B	A	A	A	A

A	Direct and significant defence research capabilities and/or defence industry reputation and engagement over an extended period
B	Some/limited defence research capabilities and/or defence industry engagement
C	Broader industry engagement (not defence) and demonstrable defence transferrable expertise for immediate deployment
N/A	Not applicable

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Integrated Intelligence, Surveillance and Reconnaissance

Space Capabilities

Enhanced Human Performance

Medical Countermeasure Products

Multi-Disciplinary Material Sciences

Quantum Technologies

Trusted Autonomous Systems

Cyber

Hypersonics

Directed Energy Capabilities



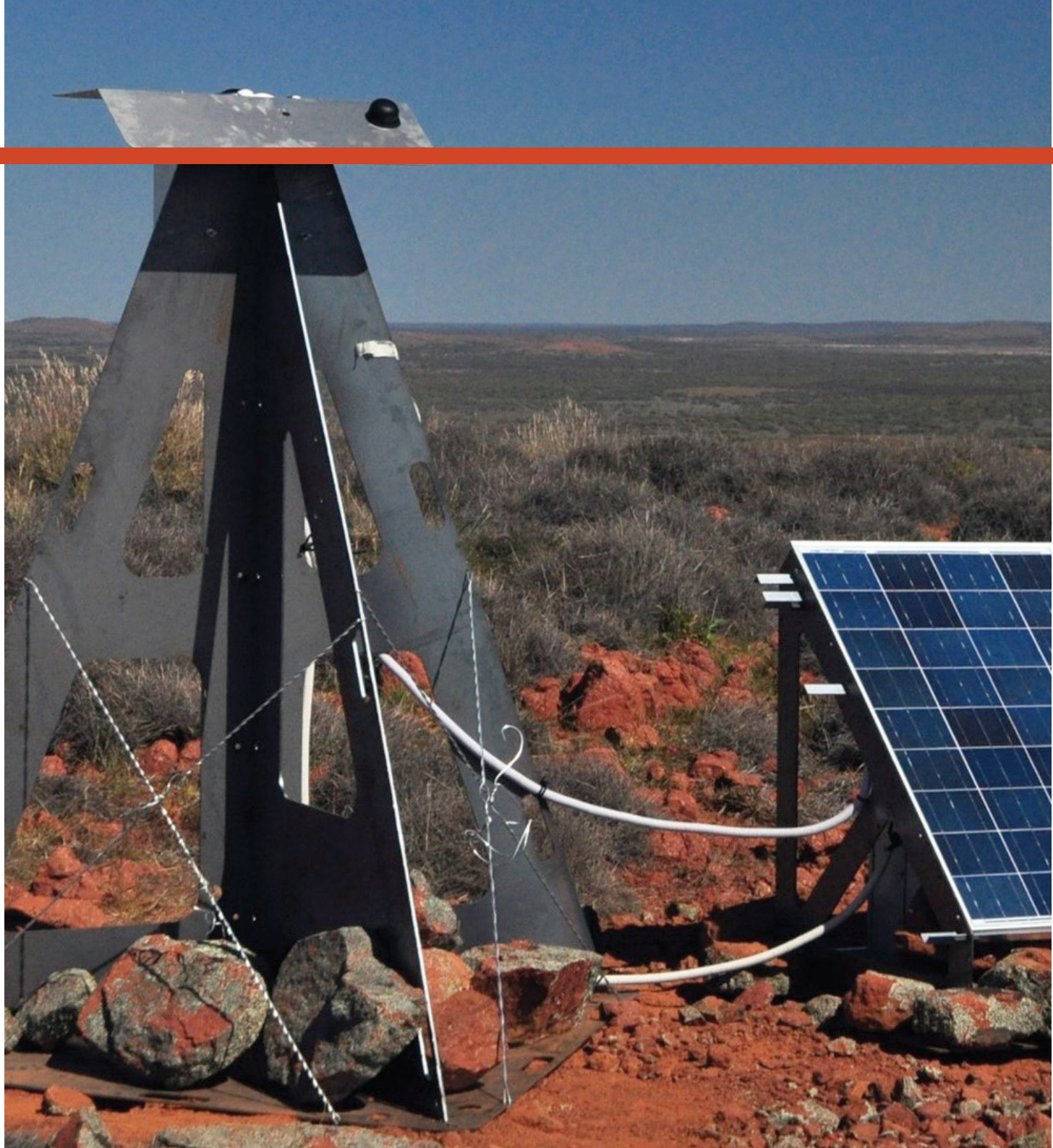
PRIMARY CONTACT

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CURTIN UNIVERSITY

research.curtin.edu.au/projects/defence/

Andrew Bell / Strategic Project Officer

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CAPABILITIES

- Laser scanning and photogrammetry – geometric-accurate derived 3D measurements, reconstruction, and classification/identification of attributes from images/laser scan data
- Remote sensing via radar, magnetic and infrared sensors, satellite technology etc. for marine optics, bio-optics, radiative transfer in ocean/atmosphere
- Signal processing, radar/sonar, target tracking and interference through multiple sensor networks and object tracking systems through real time online algorithms
- Trusted autonomous systems – performance testing for robot capabilities, explainable artificial intelligence, cyber security and anomaly detection for cyberphysical systems
- Computational fluid dynamics – research into challenges in increasingly complex systems: simulation, optimisation, data science, visualisation and industrial modelling
- Human performance – research into mental, social and physical health based optimisation. Resilience, recovery and performance based testing and analysis
- Defence and security studies – research and analysis into strategic defence and national security based policy and strategy analysis

TECHNOLOGY TRANSFERS

- Laser scanning is a highly demanded research topic in energy, resources and engineering/construction sectors
- Standard test methods for robot sensing, manipulation and mobility used by civilian and military government agencies internationally (US and Japan)
- Remote sensing research has direct transferability to marine science, climate analysis flowing through to agriculture etc
- Innovation Central Perth exists to apply direct deployable outcomes to alternative solutions through a rapid prototype process
- iCetana- Curtin commercialised research supplying intelligent video surveillance, highlighting anomalies through image processing algorithms, enabling concentration on 1% of events
- Research countering denial of service and intrusion cyberattacks using proven statistical laws to filter out malicious packets in real time

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance ✓
Space Capabilities ✓
Enhanced Human Performance ✓
Medical Countermeasure Products ✓
Multi-Disciplinary Material Sciences ✓
Quantum Technologies ✓
Trusted Autonomous Systems ✓
Cyber ✓
Directed Energy Capabilities ✓

INFRASTRUCTURE

- Curtin's Hub for Immersive Visualisation and eResearch (HIVE) is used widely by industry for virtual/augmented reality research
- The Pawsey Supercomputing Centre is a purpose-built data centre at Technology Park. Curtin has direct access to all facilities
- "Innovation Central Perth" – Curtin-headquartered collaborative community developing ingenious solutions for cloud, analytics and Internet of Things (IoT) network
- Curtin Institute for Computation – computation modelling, data analytics and visualisation across all disciplines of research for complex problems
- Curtin's Remote Sensing and Satellite Research Group has highly specialised instruments as well as access to Australia Copernicus Data Hub
- Curtin Institute of Radio Astronomy – Curtin's link with the International Centre for Radio Astronomy
- Desert Fireball Network – continual monitoring of the night sky
- Curtin Health Innovation Research Institute has a wide range of vital equipment capable of complex analysis

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance ✓
Space Capabilities ✓
Trusted Autonomous Systems ✓

CURTIN UNIVERSITY – DESERT FIREBALL NETWORK (DFN)

fireballsintthesky.com.au

Professor Phil Bland / DFN Director

Tel: 08 9266 9763 / Email: p.bland@curtin.edu.au

CAPABILITIES

- Continual monitoring of three million square metres of the night sky (third of Australian skies, all night, every night)
- Distributed network of fully autonomous observatories are disruption tolerant. Hardened systems only require maintenance once every two years
- Instrumentation and component design and manufacture
- Space situational awareness

INFRASTRUCTURE

- Desert Fireball Network, distributed nationally (52 observatories) and internationally (40 observatories)
- Intelligent imaging systems
- Automated data reduction pipeline
- Real time server-side triangulation
- Supercomputer data management system

TECHNOLOGY TRANSFERS

- In partnership with Lockheed Martin Space Systems, DFN hardware modified for high resolution satellite tracking
- New systems parallel to existing DFN, but allows wide area surveillance for multiple objects with real-time triangulation and orbit determination
- Engineering heritage from DFN, satellite tracking, and mission science team involvement, now being translated into CubeSat development

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance
Space Capabilities



CURTIN UNIVERSITY – CURTIN INSTITUTE OF RADIO ASTRONOMY

astronomy.curtin.edu.au

Professor Steven Tingay / Curtin Institute of Radio Astronomy Executive Director
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CAPABILITIES

- High time and spatial resolution characterisation and monitoring of the ionosphere
- Passive radar detection of space debris (collaborative projects with industry funded via Defence Innovation Hub)
- Antenna design and radio-frequency engineering
- Electromagnetic compatibility
- High-performance computing, digital systems and software engineering

INFRASTRUCTURE

- Square Kilometre Array (SKA). A multi-billion dollar international project to build the world's largest radio telescope
- Murchison Widefield Array. Low-frequency radio telescope operating between 80 and 300 MHz. 1/3 of telescopes for the precursor of SKA
- Murchison Radioastronomy Observatory
- Advanced Engineering Laboratory. Radio-frequency test and measurement equipment, antenna design systems, electromagnetic compatibility and low noise microwave engineering

TECHNOLOGY TRANSFERS

- Rapid surveillance and construction of "digital twins", for situational awareness, infrastructure maintenance and advanced modeling/analysis
- Space weather (solar, heliospheric and ionospheric) monitoring to protect space-based and terrestrial assets and infrastructure

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance
Trusted Autonomous Systems



CURTIN UNIVERSITY – CENTRE FOR MARINE SCIENCE AND TECHNOLOGY

cmst.curtin.edu.au

Professor Christine Erbe / Centre for Marine Science and Technology Director
Tel: 08 9266 7543 / Email: c.erbe@curtin.edu.au

CAPABILITIES

- Underwater soundscapes and ambient noise – measurement, monitoring, modelling and prediction
- Underwater acoustics; computational acoustics; measurement and modelling of sound generation, propagation, scattering and absorption; signal detection; acoustic tracking
- Noise and vibration from naval operations and ships
- Marine environmental acoustics; effects of naval operations on marine fauna
- Underwater acoustic communication for naval platforms
- Active and passive sonar performance measurement, modelling and prediction
- Seafloor acoustic mapping and classification; hydrographic surveying
- Subsea 3D optical imaging and visualisation

INFRASTRUCTURE

- 20-year database of underwater soundscape and ambient noise recording around Australia
- Autonomous underwater acoustic recorders, designed and manufactured in-house
- Software suite for acoustic data analysis; modelling of sound generation and propagation; signal detection, classification and tracking – all developed in-house
- Software suite for hydrographic surveying, seafloor mapping and water-column biomass assessments
- Catalogue of underwater sounds of Australian marine fauna (whales, dolphins, fishes)
- Catalogue of man-made underwater sounds
- Hydrographic equipment and metocean sensors including multibeam echo-sounder, multi-frequency echo-sounder, imaging sonar, sidescan sonar, CTD, particle velocity sensors and dGPS

TECHNOLOGY TRANSFERS

- Environmental impact assessments of offshore industrial operations (e.g. oil and gas exploration and production, port construction)
- Monitoring and mitigation of noise on behalf of industry and government
- Marine spatial planning
- Seafloor mapping, marine habitat classification, biomass surveys for offshore industry, fisheries and government
- Hydrographic, underwater optical and acoustic R&D for offshore energy, including renewables
- Acoustic hardware and software for marine stakeholders
- Investigation of Australian marine biodiversity, distribution and migration of marine animals of special interest, such as whales, dolphins and seals
- Short-courses for industry and government

PRIORITY AREAS

Multi-Disciplinary Material Sciences

Directed Energy Capabilities



CURTIN UNIVERSITY - CURTIN CORROSION CENTRE (CCC)

corrosion.curtin.edu.au

Dr Kateřina Lepková / Defence Team Leader at Curtin Corrosion Centre

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CAPABILITIES

- Corrosion assessment and failure analysis. Evaluation and prediction of various types of corrosion
- Material selection and qualification under simulated operation conditions
- Fit-to-purpose testing. Long-term exposure and accelerated electrochemical corrosion testing
- In-situ corrosion monitoring and evaluation of advanced corrosion preventative measures
- Specialisation in research and investigation on coatings, micro-biologically influenced corrosion, corrosion under insulation, under-deposit corrosion, stress-corrosion cracking and corrosion inhibitors

TECHNOLOGY TRANSFERS

- Contribution to asset integrity and life cycle extension. Short term R&D projects involving material selection, product qualifications and failure analysis
- Fit-to-purpose testing. Corrosion monitoring and mitigation strategies through field corrosion assessment and laboratory testing under simulated operation conditions
- Standardised test methods and test methodologies developed at Curtin Corrosion Centre applied to solve industry problems
- Masters in Corrosion Engineering and other corrosion engineering courses. Workshops and seminars held for industry, academia and public
- Established strong national and international collaborations with industry (oil and gas, mining) and academic institutions

INFRASTRUCTURE

- Coatings analysis and research equipment. Thickness gauges, hardness meters, indentation devices, holiday detectors (HV and LV)
- Specialised microbiologically-influenced corrosion laboratories (PC1). Molecular microbiology suite, flow biofilm reactors, DNA/RNA analysis, bank of microorganisms and ASTM/DSM strains
- Corrosion under insulation test rig with environmental chamber to simulate fluctuation of temperature and relative humidity. In-situ electrochemical monitoring
- Corrosion inhibitor evaluation facilities at different pressure and shear stress. Inhibitor-film strength evaluation. Efficiency evaluation under-deposits (minerals and biofilms)
- Stress corrosion cracking and metallurgical analysis equipment. 3D surface profilometer, mechanical testing equipment (tensile and 3/4 point bending)
- Weathering (salt spray) chamber for cyclic corrosion testing (Silverfog 960) with UV exposure. Variable temperature, humidity and salt conditions
- Computer controlled potentiostats for corrosion testing and analysis using electrochemical methods, including long-term corrosion monitoring and accelerated corrosion testing
- High pressure/high temperature autoclaves (SS316, Hastelloy C276), Roto-clave oven and jet impingement cells (SS316, Hastelloy C276) for shear stress simulation



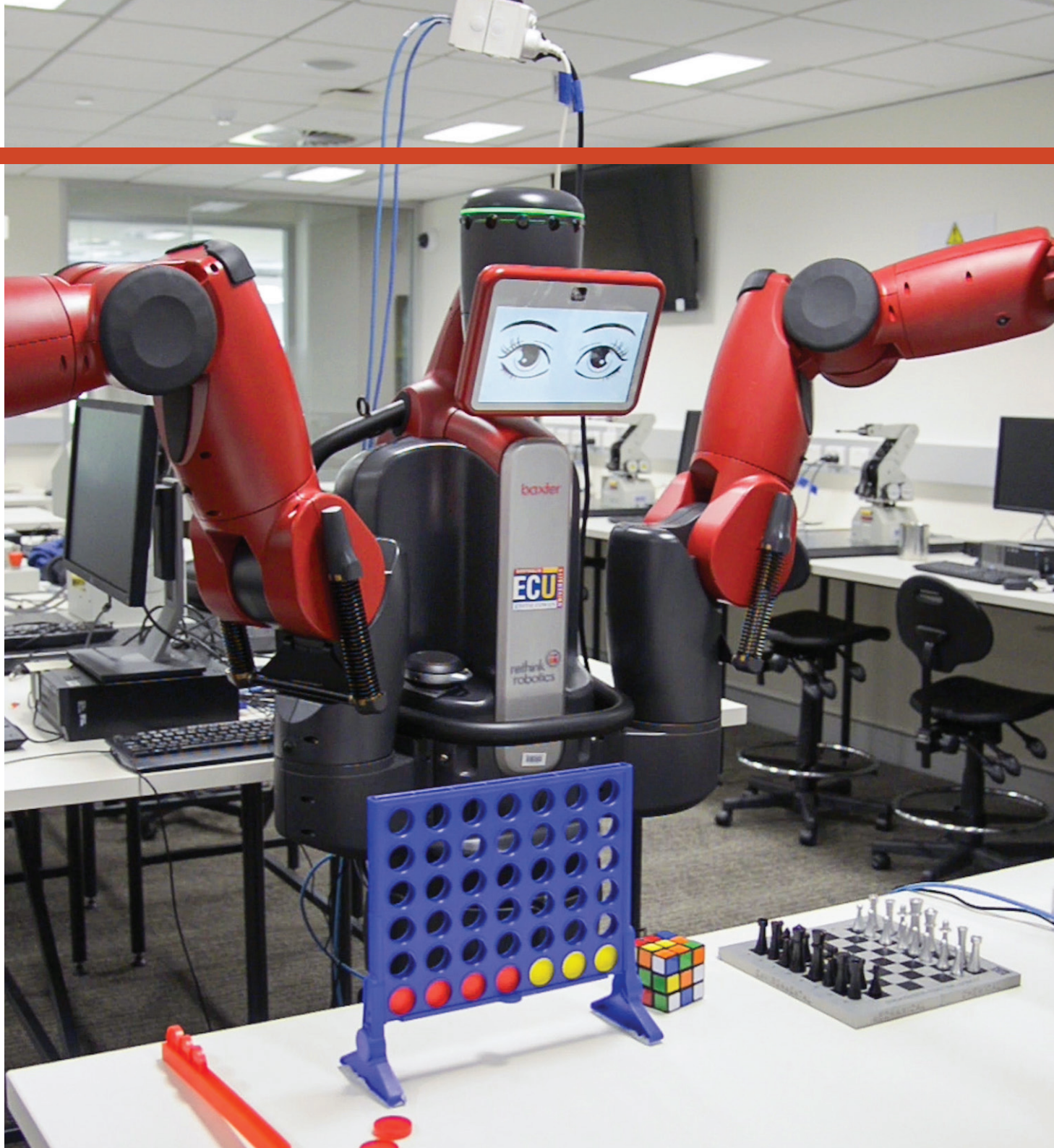
PRIMARY CONTACT

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PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance

Cyber

Trusted Autonomous Systems



EDITH COWAN UNIVERSITY - CYBER SECURITY

ecu.edu.au/schools/science/

Professor Craig Valli / ECU Security Research Institute Director

Tel: 08 6304 5109 / Email: c.valli@ecu.edu.au

CAPABILITIES

- Advanced digital forensics data extraction from multiple platforms and form factor devices i.e phones, disks, including chip-off technology
- Advanced network analytics and forensics capabilities with an emphasis on standard TCP/IP and ICS, BMS & SCADA protocols
- Advanced system of systems monitoring and forensic analysis
- Wireless device geolocation forensics and methods
- Advanced and automated steganographic detection
- Cyber range and CTF management and platform production
- Educational platform delivery
- Biometric systems analysis and design

INFRASTRUCTURE

- Purpose-built facility rated by Defence Information Security Program (DISP) at 'Secret' level
- Capacity to rapidly convert DISP rated facility to a Sensitive Compartmented Information Facility (SCIF)
- Cyber ranges - multiple including TCP/IP, Bacnet, Zigbee
- Dedicated phone forensics laboratory with chip off capability
- 10GHz 100DBI Faraday cage
- Advanced memory and disk forensics acquisition facility

TECHNOLOGY TRANSFERS

- Forensic triage tool for cybercrime investigation for WA Police
- Several RFID tracking patents
- Commercialisation: Industrial Control Systems (SCADA, BacNET) Cyber Security Solution - SC8



PRIORITY AREAS

Enhanced Human Performance



EDITH COWAN UNIVERSITY - HUMAN PERFORMANCE

ecu.edu.au/schools/medical-and-health-sciences/
ecu.edu.au/schools/arts-and-humanities/

Anthony Blazeovich / Director CESSR; Professor in Biomechanics
Tel: 08 6304 5472 / Email: a.blazeovich@ecu.edu.au

CAPABILITIES

- Individualised physical conditioning programs for muscular and physical performance, mission readiness and injury prevention
- Assessment of neuromuscular factors underpinning, and the development of countermeasures against, acute and chronic fatigue
- Development of physical tests and tissue biomarkers for prediction of soldier readiness, injury risk and physical performance capacity
- Comprehensive biomechanical analysis capability allowing the optimisation of movement speed, accuracy and efficiency in various contexts
- Link between physical capability and decision-making capacity in terrestrial and aquatic environments
- Development of training regimes for the acquisition of perceptual, cognitive and decision-making skills
- Assessment of cognitive abilities, and the development of resilience to factors limiting cognitive performance
- Redesign of exercise systems and technologies according to space, weight and cost limitations

TECHNOLOGY TRANSFERS

- Transfer of novel exercise testing and training modalities into general practice
- Close working relationships with leading Australian sporting organisations, institutes and industry providing exercise science and performance support
- Expertise in identifying, formalising and optimising in international partnerships and collaborations

INFRASTRUCTURE

- Multiple strength testing and training facilities to conduct large-scale exercise-based studies
- Unique capability to perform eccentric exercise, including cycle ergometers, strength training machines and robotic devices
- Multiple neurophysiology/neuroscience research laboratories allowing comprehensive assessments of neurologic and muscular function
- Exercise physiology laboratories for exercise and metabolic testing, thermoregulation assessment, muscle/blood sampling, biochemistry analyses, and blood flow
- Medical imaging capability including ultrasound, peripheral computed tomography and dual-energy x-ray imaging technologies
- Large, dedicated biomechanics laboratory for synchronous assessment of movement performance, muscle function and force application during physical tasks
- Assessment and training facilities for perceptual and cognitive abilities and skills, and physiological correlates
- Large indoor and outdoor spaces for use in research studies



PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance
Enhanced Human Performance
Medical Countermeasure Products
Multi-Disciplinary Material Sciences
Trusted Autonomous Systems
Directed Energy Capabilities



EDITH COWAN UNIVERSITY - SYSTEMS AND ENGINEERING

ecu.edu.au/schools/engineering

Dr Andrew Dowse / Director Defence Research and Engagement
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CAPABILITIES

- Robots in unstructured environments
- Sensing and control for autonomous systems and remote body stress monitoring
- Deep learning for object detection and grasp planning
- Applications of advanced additive manufacturing, composite manufacturing, design optimisation
- Design, synthesis and advanced characterisation of materials
- Intelligent techniques and tools in War Gaming/Red Teaming
- Innovative machine learning techniques and tools for the development of automated situation assessment tools
- Visualisation and automated fusion involving a number of different intelligence data sources

TECHNOLOGY TRANSFERS

- Evolutionary algorithms for strategy exploration using autonomous agents in air combat operations
- Feasibility of game technology to maritime operations simulation
- Advanced glazing systems for solar energy harvesting and radiation control
- Nano-engineered thin-film pH sensors for biomedical and chemical applications
- Applying a fibre-optic based surface plasmon resonance sensor prototype in desalination

INFRASTRUCTURE

- Immersive technologies
- Baxter research robot, deep neural network training workstation
- Software defined radio, 5G radio, advanced network and spectrum analysis systems
- Advanced manufacturing capabilities including CNC machining, 3D printing, welding etc
- PANalytical X-ray diffractometer, JEOL scanning electron microscope, Instron mechanical testing machines (5569 static & 8801 dynamic), nanoindentation system, UV-Vis spectrometer
- Visualisation and simulation
- Micro/Nano-Photonic fabrication and characterisation facility includes photonic and electronic laboratories
- 256m2 clean-room equipped for material growth, characterisation, metallisation, thermal and e-beam evaporation, electron microscopy, atomic force microscopy, spectrophotometry and fluorometry





PRIMARY CONTACT

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PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance
Multi-Disciplinary Material Sciences
Quantum Technologies
Hypersonics



MURDOCH UNIVERSITY – SCHOOL OF ENGINEERING AND INFORMATION TECHNOLOGY – TECHNOLOGY DEVELOPMENT

murdoch.edu.au/School-of-Engineering-and-Information-Technology/

Bogdan Dlugogorski / Dean of Engineering and Information Technology
Tel: 08 9360 6770 / Email: b.dlugogorski@murdoch.edu.au

CAPABILITIES

- Multi-scale molecular modelling of materials design and properties: quantum chemistry through to molecular dynamics, including pollutant removal
- Quantum mechanical modelling of molecular adsorption on substrates, including adhesion of cells and biofilms
- Nano-structured composite and thin-film alloy coatings for superhard surfaces and high-performance absorption, emission and reflection in the microwave region
- Mechanical strength and thermal stability, heat transfer and surface chemical reactions (corrosion and oxidation) at high temperatures
- Formulation and testing of firefighting foams and development of foam and water-mist fire-suppression systems
- Dielectric characterisation of electrolyte solutions
- Measurement and calculation of material flammability and fire suppression
- Synthesis and spectroscopic characterisation of thin film coatings for opto-electric applications including sensors, photovoltaic devices and photodetectors

INFRASTRUCTURE

- Fire Safety and Combustion Kinetics Laboratory – advanced analytical instrumentation for investigations of fire mitigation and pollutant formation
- Surface Analysis Research Laboratory – x-ray photoelectron spectrometer; atomic force microscope; scanning tunneling electron microscope
- Bayer Pilot Plant – advanced control systems using a modern industrial data acquisition and control platform
- UAV systems with various capabilities, endurance and range
- Solution Chemistry Laboratories: calorimetry, densimetry, viscometry; dielectric, FT Raman, NMR spectrometers, to high temperatures and pressures

TECHNOLOGY TRANSFERS

- Executable computer code for prediction of the physicochemical properties of Bayer process solutions, has become the Australian alumina industry 'standard'
- Comprehensive thermodynamic and physicochemical property database for chemical speciation modelling under industrial conditions

PRIORITY AREAS

Medical Countermeasure Products
Enhanced Human Performance
Space Capabilities
Trusted Autonomous Systems
Multi-Disciplinary Material Sciences



MURDOCH UNIVERSITY – SCHOOL OF ENGINEERING AND INFORMATION TECHNOLOGY – IT SYSTEMS, MEDICAL COUNTERMEASURES AND HUMAN PERFORMANCE

murdoch.edu.au/School-of-Engineering-and-Information-Technology/

Bruce Gardiner / Deputy Dean of Engineering and Information Technology; Head of Discipline Electrical Engineering, Energy and Physics
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CAPABILITIES

- Managing musculoskeletal tissue – to avoid overuse injury, adaption to change work, biomechanics and human performance
- Medical diagnostic devices for tissue injury
- Development of 3D simulation interfaces based on virtual reality for injury rehabilitation and human movement training
- Design, construction and testing gas canisters for individual and collective protection against chemical warfare agents
- Development of chemical- and bio-sensors for detection of explosives, hazardous gases, diseases, for health and performance monitoring
- Management of waste water and water management systems in closed systems

INFRASTRUCTURE

- IT Innovation Hub
- Mixed and Augmented Reality Studio
- Multiple non-contact and marker-less full human body tracking systems
- Brain-Computer Interfaces
- Custom built, highly configurable and networked driving simulator with physiological monitoring of driver performance
- VR/AR teaching laboratory under construction

TECHNOLOGY TRANSFERS

- Integrated computational measures to enhance human physical performance and avoidance of overuse injuries
- Systems for enhancing human neuroplasticity
- National and international award-winning system for enhancing human cognitive performance following brain trauma
- Systems for enhancing human perception-action performance
- High resolution upper body movement data set of patients with stroke

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance
Trusted Autonomous Systems
Cyber Security
Enhanced Human Performance



MURDOCH UNIVERSITY – SCHOOL OF ENGINEERING AND INFORMATION TECHNOLOGY – IT SYSTEMS AND APPLICATIONS: SECURITY BIG DATA, ARTIFICIAL INTELLIGENCE, VISUALISATION TECHNOLOGIES AND AUGMENTED REALITY

murdoch.edu.au/School-of-Engineering-and-Information-Technology/

Hamid Laga / Head of Discipline Information Technology, School of Engineering and Information Technology
Tel: 08 9360 2325 / Email: h.laga@murdoch.edu.au

CAPABILITIES

- Surveillance: integrated vision systems for detection, localisation, recognition and tracking of objects using aerial, satellite, high underwater and ground imagery
- Development of UAV systems for high altitude flight and remote sensing applications
- Computer vision and artificial intelligence algorithms that perform practical tasks: scene understanding; object and action recognition; event analysis
- Scalable security and trust models for the Internet of Things
- Covert channels / network steganography detection and mitigation
- Password security and usability
- Industrial control system vulnerability and computer forensics
- Development of process control instrumentation for remote or autonomous control

INFRASTRUCTURE

- UAV systems with various capabilities, endurance and range
- Mixed and Augmented Reality Studio
- Cyber-Security and Networking Labs
- Data and Networking Operation Centre

TECHNOLOGY TRANSFERS

- Artificial Intelligence algorithms and programs for knowledge extraction, inference and prediction from heterogeneous Big Data
- Computer vision and artificial intelligence algorithms and programs for image and video analysis and understanding
- Advanced computer graphics, virtual, augmented and mixed realities
- Game technologies for combat simulation and training, and military infrastructure and equipment simulation and training

PRIORITY AREAS

Enhanced Human Performance
Medical Countermeasures Products
Space Capabilities
Trusted Autonomous Systems



MURDOCH UNIVERSITY – SCHOOL OF PSYCHOLOGY AND EXERCISE SCIENCES

murdoch.edu.au/School-of-Psychology-and-Exercise-Science/

Timothy Fairchild / Associate Professor in Sports Science
Tel: 08 9360 2959 / Email: t.fairchild@murdoch.edu.au

CAPABILITIES

- Advanced human performance evaluation and enhancement of physiological, biomechanical and psychological capacity
- Integration of pharmacology, diet and physical capacity to maximise physiological and psychological capacity
- Perceptual-cognitive (decision making) expertise and skill learning
- Integration of virtual reality/visual search behaviour and decision making skills in the field; training and testing capabilities
- Research and expertise in the mechanisms associated with pain perception
- Expertise in application of field-based tracking technology of physical capacity

INFRASTRUCTURE

- Exercise Physiology Laboratory – integrated climate and altitude chamber capable of simulating extreme environmental conditions, metabolic testing systems
- Rehabilitation, Strength and Conditioning Laboratory – HumacNorm Isokinetic Dynamometer, Swift timing gate technology, fully equipped gym
- MindBody Lab. Unique perceptual and exercise facility to test how stress and performance can be adapted to optimise critical decision-making
- Neuroplasticity laboratory using noninvasive measurement of neuroplasticity
- Australian Metabolic Phenotyping Centre, providing expertise in analytical chemistry, computational biology, data modelling and visualisation

TECHNOLOGY TRANSFERS

- The influence of environmental stress (i.e. heat) on performance in both athletes and the industrial sector
- Identifying metabolic predictors of fatigue, working with air traffic control, elite sport, forensics and the police
- Oral delivery strategies for peptides and proteins

PRIORITY AREAS

Medical Countermeasures Products ✓
Trusted Autonomous Systems ✓
Space Capabilities ✓
Enhanced Human Performance ✓
Integrated Intelligence, Surveillance and Reconnaissance ✓



MURDOCH UNIVERSITY - SCHOOL OF VETERINARY AND LIFE SCIENCES

murdoch.edu.au/School-of-Veterinary-and-Life-Sciences/

Richard Harper / Acting Dean of Veterinary and Life Sciences
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CAPABILITIES

- Enhanced biosecurity/bio-disinfestation to maintain the operational readiness of soldiers in the field
- Enhanced biosecurity/bio-disinfestation to maintain the operational readiness of military equipment being transported across international borders
- UAVs for large to local-scale surveys of marine environments: appropriate technologies, protocols and survey design for adequate detection
- Automating the detection of marine fauna within images, at or under the surface and within a range of environmental conditions
- Epidemiology for disease surveillance and management, including the ability to monitor the spread of disease/ pathogens in various environments
- Research and development of technologies to provide effective protection of personnel against tick-borne and waterborne enteric diseases
- Development and manufacture of synthetic drugs and small-scale precision medicine synthesis

INFRASTRUCTURE

- Sequencing and advanced cellular immunology technologies, supported by an in-house, customisable Laboratory Information and Management System and robotic workstations
- Anti-Microbial Resistance Reference Laboratories for Human and Animal Infectious Diseases
- Australian Metabolic Phenotyping Centre, providing expertise in analytical chemistry, computational biology, data modelling and visualisation
- Access to field sites for testing and evaluation (including the proposed Whitby Falls Drone Hub)
- Algorithms and access to software capable of detecting and mapping marine fauna within UAV images
- A number of UAV systems with various capabilities, endurance and range

TECHNOLOGY TRANSFERS

- Gene editing drugs to treat a wide spectrum of genetic disorders
- Gene editing technologies to enhance desirable traits in organisms
- Development of UAV techniques and methodologies that can be used in remote areas and developing countries
- Testing and developing techniques to use affordable and user-friendly UAVs
- Development of automated detection and mapping software that can be adapted for various species and locations



THE UNIVERSITY OF WESTERN AUSTRALIA



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PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance ✓
Space Capabilities ✓
Enhanced Human Performance ✓
Medical Countermeasure Products ✓
Multi-Disciplinary Material Sciences ✓
Quantum Technologies ✓
Trusted Autonomous Systems ✓
Cyber ✓

THE UNIVERSITY OF WESTERN AUSTRALIA

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CAPABILITIES

- UWA engages in a broad spectrum of research including radio astronomy and supercomputing, offshore engineering, marine science and comprehensive health research. Research areas include;
- Maximising capabilities in intensive environments (submarines) by understanding work design and human interface with technology to optimise performance
- Sensing technologies for manufacturing, medicine, agriculture, defence, remote sensing and environmental monitoring
- Computer vision for ground, underwater or ground platforms with focus on target detection, recognition, classification, tracking and subtle change detection
- Precision measurement involving frequency, time and quantum systems
- Data science, machine learning and artificial intelligence including new algorithms, artificial neural networks and computational intelligence for optimisation, modelling and control
- Development of new antibiotics, with different modes of action, that are capable of treating a broad range of bio-warfare agents
- Host to the Perth USAsia Centre, a leading think tank focusing in geo-political issues, policy development and building strategic affairs

INFRASTRUCTURE

- Australian National Fabrication Facility (ANFF) node at UWA is a state-of-the-art facility in infrared technology and micro electro mechanical systems fabrication processes for industry and broader research communities
- The UWA Oceans Institute including facilities focused on oceanography, ocean dynamics, ecology, offshore and geotechnical engineering. It also includes an Ocean Glider Facility operates a fleet of autonomous, underwater ocean gliders
- Watermans Bay, which is the Indian Ocean's first sea water facility for marine research with state-of-the-art laboratories
- Pawsey Supercomputing Centre (UWA Visualisation), which operates multiple supercomputers, data-intensive machines and storage systems
- Centre for Microscopy, Characterisation and Analysis provides world-class microscopy and microanalysis facilities
- National Geotechnical Centrifuge Facility is a world leading geotechnical centrifuge facility working on a wide range of onshore and offshore geotechnical solutions
- Extensive Radio astronomy experience (ICRAR), the Gingin observatory which hosts tracking facilities and the Zadko telescope

TECHNOLOGY TRANSFERS

- UWA has a focus on adoption and commercialisation of research including dedicated teams to facilitate partnerships with industry around the world

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance ✓
Multi-Disciplinary Material Sciences ✓
Trusted Autonomous Systems ✓

THE UNIVERSITY OF WESTERN AUSTRALIA – OCEANS INSTITUTE

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CAPABILITIES

- Includes 100 experts from disciplines including marine science, ocean engineering, environmental management, commerce, law and policy, communications, history and archaeology
- Oceans expertise in in situ measurement, remote sensing, modelling of surface and internal waves, currents, sediment, morphology, and biogeochemical properties
- Research in turbulent flows, ocean circulation models, and laboratory work on transport and turbulent mixing within oceans
- Expertise relevant to defence includes the dynamics of large amplitude internal waves and the ocean response to tropical cyclone forcing.
- Expertise and a significant research portfolio in floating vessel dynamics, ocean-structure interaction, offshore anchoring dynamics and geotechnical engineering
- Expertise in metocean dynamics and ocean forecasting, offshore fixed and floating structural engineering, hydrodynamics and structure interaction, and asset management
- Trans-disciplinary expertise to develop innovative and transformative in ocean decommissioning solutions
- Research expertise in noise in the ocean environment and the impact on marine life and the role of bioluminescence by deep-sea organisms

INFRASTRUCTURE

- Ocean Glider Facility operates a fleet of autonomous, underwater ocean gliders to make sustainable measurements from the continental shelf and associated boundary currents
- A large pool of state-of-the-art field oceanographic and bioacoustic equipment available, including ocean sensors and laboratories
- The O-tube is a unique in-situ test facility for pipeline stability
- Centre for Offshore Foundation Systems provides solutions to worldwide offshore foundation needs through sophisticated modelling and experimental facilities
- National Geotechnical Centrifuge Facility is a world leading geotechnical centrifuge facility working on a wide range of onshore and offshore geotechnical solutions
- Watermans Bay Facility is the Indian Ocean's first sea water facility for marine research with state-of-the-art laboratories
- Woodside OceanWorks is an innovative space focused in bringing together industry and academia

TECHNOLOGY TRANSFERS

- Object recognition software
- Prototype and design of anchoring systems
- Remote operated vehicles
- Biofouling technology development

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance
Space Capabilities
Quantum Technologies



THE UNIVERSITY OF WESTERN AUSTRALIA – ICRAR AND THE FACULTY OF ENGINEERING AND MATHEMATICAL SCIENCES

icrar.org/

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CAPABILITIES

- ICRAR's astronomers, engineers and data specialists are contributing to the end-to-end design, construction, data processing and science extraction for the SKA
- Specialisation in antenna design, radio-frequency engineering, electromagnetic compatibility, high-performance computing, digital systems and software engineering
- Current engineering research includes SKA Signal and Data Transport (SaDT) phase and frequency synchronisation studies
- ICRAR/UWA leads the Galaxy and Mass Assembly Survey, an investigation of the properties of over 300,000 galaxies in the local universe
- In support of next-generation computational technologies, the Frequency and Quantum Metrology Research Group are world leaders in precision measurement involving frequency, time and quantum systems
- Research includes miniaturised gravity gradiometer, interferometric EM gradiometer, microwave sensors and precision oscillators and clocks
- The group uses advanced mathematical methods and numerical techniques to model the dynamics of quantum systems and investigate quantum algorithms
- Space laser communications group working collaboratively with NICT and DSTG working on mitigating the effects of the atmosphere

INFRASTRUCTURE

- Pawsey Supercomputing Centre, which operates multiple supercomputers, data-intensive machines and storage systems
- ESA operates one of the world's largest radio dishes as a Deep Space Tracking station and routinely downlinks data from their space missions
- Western Australian Space Centre (WASC) hosts NASA's satellite laser ranging facility, one of only two stations in the Southern Hemisphere
- UWA has developed the necessary expertise and specialised equipment to operate a dedicated Astronomy and Space Instrumentation Lab
- UWA operates Gingin observatory which hosts rapid response, launch tracking and space debris tracking facilities and the Zadko telescope.

TECHNOLOGY TRANSFERS

- Ground-station support from CubeSat to Deep Space missions
- Space debris monitoring using either UWA facilities or facilities hosted by UWA
- Launch tracking capacity (in collaboration with ESA and Airbus)
- Detector and sensor development
- Advanced space data analysis tools

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance
Space Capabilities
Multi-Disciplinary Material Sciences
Trusted Autonomous Systems
Cyber



THE UNIVERSITY OF WESTERN AUSTRALIA – SENSORS AND AUTOMATION

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CAPABILITIES

- Next generation technologies in remote operations, new materials for sensor fabrication, novel sensor architectures to sensor readouts and data analysis
- Development of new class infrared detection, imaging and multi/hyperspectral sensors, terahertz band sensing, optical/fibre systems, high sensitive magnetometers single-chip gas, chemical, pressure and temperature sensors
- Designing and building hardware, electronics and software for almost 100 driving, walking, swimming/diving and flying robots
- Computer vision, particularly tools for machine learning in 3D biometric, RGB-D object segmentation and recognition, robot grasping and sub-sea ecology projects
- Signal and image processing, separation of acoustic signals using remote sensors, audio-visual data, and human speech recognition systems for human machine interface
- Autonomous and electric drive systems, spanning DC, AC, and brushless systems, including motors, controllers, battery banks and charging systems
- Intelligent systems, artificial neural networks, biomedical engineering, control, digital signal processing, parallel and distributed computing, image processing, pattern recognition and software engineering

INFRASTRUCTURE

- Australian National Fabrication Facility (ANFF) at UWA provides state-of-the-art facilities and expertise in IR technology and MEMS systems design and fabrication processes
- The Microelectronics Research Group runs a completely vertically-integrated sensor facility, from materials growth, through device design, fabrication and testing, to packaging and sub-system assembly

TECHNOLOGY TRANSFERS

- Licensing of multiple MEMS technologies
- Software analysis products embedded in international companies' products
- From basic computer vision and robotic research to product development and education

PRIORITY AREAS

Integrated Intelligence, Surveillance and Reconnaissance
Enhanced Human Performance
Medical Countermeasure Products



THE UNIVERSITY OF WESTERN AUSTRALIA – HUMAN PERFORMANCE OPTIMISATION

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CAPABILITIES

- Work design, resilience and performance related to the cognitive mechanisms that underlie human performance in safety-critical work contexts
- Prospective memory, situational awareness, human interaction with automated systems and error from interruptions, distraction and multitasking
- Research partner with RAN on submarine crews and the interface of new technology in future submarines to ensure optimal performance
- Development of new antibiotics with target components for virulence but not growth of bacteria, to reduce development of resistance
- Extensive experience in containment level 3 work (PC3) and experience in Biosafety Level 2 and 3 work in both experimental and animal laboratories.
- Capability to handle and manipulate security sensitive biological agents (SSBAs), in vitro testing of novel drugs, also including virulence screening at PC2
- Injury management, spinal cord repair, soft tissue regeneration, enhanced cooling from hyperthermia, mechanisms of and delay of muscle fatigue,
- Chemical measurement of stress, assessment tools for screening and early detection of mental health problems, remote health provision using wearables

INFRASTRUCTURE

- The Control Room Use Simulation Environment (Cruse) Lab
- Air Traffic Control Simulation
- Driving Simulator
- High level PC2 facilities
- PC3 animal facilities at the BRF

TECHNOLOGY TRANSFERS

- Teamwork paradigms and developing reliable measurements for optimising team performance
- Phase II Coxiella Burnetii
- PC3 animal work

