



Curtin University

NATIONAL RESILIENCE AND SECURITY
(NRAS) PROGRAM OFFICE



SECURING OUR FUTURE

DEFENCE AND SPACE CAPABILITY STATEMENT

Partner with Curtin University
and explore the possibilities.

Make tomorrow better.

research.curtin.edu.au

About Curtin University

Ranked in the top percentile of world universities and among the top 100 universities in earth and marine sciences, Curtin University has built a national and global reputation for research excellence.

With a diverse range of experience and unique capabilities, Curtin is a trusted partner in the defence sector committed to addressing defence challenges and building further partnerships in emerging areas.

Curtin has DISP membership and offers a broad range of expertise spanning multiple disciplines, emphasising innovation and practical solutions. Its research centres serve as invaluable resources for partners addressing complex challenges in defence, security, and national resilience to fulfill defence capability requirements.

Much has been made of the growing concerns in regional and global stability through the emergence of state-on-state conflicts not seen since the Korean war. Moreover the rise of greater military capability amongst nations particularly in our Indo-Pacific region focused the need for the 2021 Defence Strategic Review from which the acquisition of nuclear powered conventionally armed submarines through the AUKUS program, the refresh of the navy's surface fleet through the surface combatant review, the refocus of the lens on our sovereign defence industrial base through the Defence Industry Development Strategy, and the 2024 announcement of the Henderson Industrial Consolidation program, all bode for greater opportunities for the active participation by academia. Through the involvement of higher education and learning institutes can the needs of a future Australian Defence Force be met by pushing boundaries of knowledge, improve operational capabilities through advanced sciences and technologies and the development of advanced sovereign capabilities.

The establishment of the National Resilience and Security (NRAS) Program Office at Curtin University is a significant investment to defence and the broader sovereign defence, national security and space industry.

NRAS aims to consolidate Curtin's defence collaborations, creating a centralised hub responsive to Australia's defence challenges, including technological innovation and workforce development. This initiative emphasises secure, collaborative programs of national and international importance, including fostering international partnerships, especially around AUKUS.

Through NRAS, Curtin is set to leverage its interdisciplinary expertise and strategic partnerships to actively help shape the narratives of defence, national security and space in both Australia and WA, while also contributing to the nation's economic prosperity.



GARY HALE

DIRECTOR

National Resilience and Security Program Office
Curtin University



BUILD & SUSTAINMENT

- Nuclear forensics and safeguards
- Platform engineering, optimisation, & asset management
- Condition monitoring, corrosion and biofouling
- Advanced/additive manufacturing, non-destructive testing (NDT) & material characterisation



CRITICAL MINERALS & SUPPLY CHAIN

- Defence critical minerals & energy transitions
- WA School of Mines: Minerals, Energy and Engineering (WASM)
- Critical Minerals Trailblazer
- Emerging technologies
- Curtin Frontier Institute for GeoScience Solutions (C-FIGS)



ENHANCED SITUATIONAL AWARENESS | SPACE TO SEABED

- Advanced space, land and undersea sensing
- Integrated detection models & algorithms (AI/ML)
- Maritime mapping & MetOcean
- Quantum sensing and technologies
- Underwater communications



ROBOTICS, AUTOMATION & NEXT GENERATION DEFENCE TECHNOLOGIES

- Autonomous and remote systems & swarming
- AI-driven decision making & adaptive control
- Human-robot interaction & trust
- Electronic warfare and signals intelligence
- Advanced combat system software architectures
- Secure collaboration platforms (Nebula)



PROJECT NEBULA

- Australian Secure Collaboration Hyperscale Platform
- Curtin University, Cyber CX and Microsoft partnership
- Bridging the gaps between academia, small-to-medium enterprises (SMEs), and industry.



WORKFORCE DEVELOPMENT & RESILIENCE

- Targeted skills & training
- Talent pipeline, recruitment & retention, including new pathways



Build & Sustainment

Curtin University's capabilities in Build and Sustainment play a pivotal role in supporting the construction, maintenance, and longevity of naval and defence assets, particularly as part of the AUKUS framework for shipbuilding and submarine development in Western Australia.

Curtin Corrosion Centre

Research at the Curtin Corrosion Centre focuses on new methods to enhance asset performance and longevity. Within its unique laboratories, the Corrosion Centre investigates various types of corrosion, including mechanically assisted, microbiologically influenced, acid gas, and atmospheric corrosion. Expertise in structural dynamics, material characterisation, and corrosion protection helps mitigate the costly and potentially dangerous breakdown of metals. As a leader in corrosion prevention and structural health research, the Corrosion Centre focuses on extending the lifespan of naval ships, submarines, and other critical defence infrastructure in marine environments. By protecting these assets from corrosion and mechanical degradation, the centre enhances durability and reduces operational risks and maintenance costs, which is essential for maintaining high-readiness fleets, including Collins-class submarines and future AUKUS-led nuclear submarines at key sites like HMAS Stirling.

Process Optimisation and Control Group

This group specialises in optimising logistics and supply chain efficiency, applying advanced algorithms to improve resource allocation and maintain operational continuity. By enhancing the resilience of supply chains, ensuring that defence assets remain mission-ready with minimal downtime. Curtin's expertise in this area supports sustainable asset management and high-tempo operations, particularly important for the rapid-response needs of defence bases in the Indo-Pacific.

Centre for Optimisation and Decision Science (CODS)

This Centre applies data science and high-performance computing across big data analytics, machine learning, optimisation and visualisations, supporting defence with scalable, data-driven solutions. This Centre is made-up of expertise in project management, code optimisation and simulation, which has the potential to support

mission-critical defence applications from project scoping to lifecycle management, enhancing autonomous decision support across complex scenarios.

The John de Laeter Centre (JdLC)

In support of defence, JdLC needs to provide additive/advanced manufacturing, materials characterisation and non-destructive and destructive testing in support of the certification of new manufacturing methods and processes that support build and sustainment activities. This includes the new PFAM (Photon Forge Additive Manufacturing Lab) at Tech Park to support significant Additive and Advanced Manufacturing assets to develop these new methods and processes, as well as the JdLC's capability to test, characterise and certify these new methodologies and outcomes in line with Lloyd's seaworthiness certification. Furthermore, JdLC is already home to testing regimes with the Australian Safeguards and Non-Proliferation Office (ASNO), and in partnership with the International Atomic Energy Agency (IAEA), conducts nuclear safeguards and forensics activities. These can easily be expanded to provide forensics and investigation support for the sustainment of nuclear-powered submarines and environmental needs. In support of material characterisation, including support for critical minerals and rare earths, as well as moon and mars sample returns, the JdLC hosts state-of-the-art analytical and mass spectrometry infrastructure, essential for detailed mineral analysis. The Centre's expertise spans ore mineralisation, geophysical imaging, sedimentary environments, organic and isotope geochemistry, and metal ore bioleaching. For defence, this depth of research aids in identifying, characterising, and sustainably extracting critical minerals, such as rare earth elements, which are vital for producing advanced military technologies and weaponry. By securing local supply chains for these resources, the Centre minimises dependence on foreign sources, supporting defence resilience and self-sufficiency.



Critical Minerals & Supply Chain

Strategic Resource Management is crucial for defence by securing access to critical minerals and materials necessary for advanced defence manufacturing and supply chain resilience.

Curtin University supports this mission through advanced research in geosciences, mineral processing, and emerging technologies that strengthen resource sustainability and reduce reliance on foreign sources.

WA School of Mines: Minerals, Energy and Chemical Engineering (WASM)

Consolidating engineering, economics and science capabilities to form WA School of Mines: Minerals, Energy and Chemical Engineering (WASM: MECE), the School attracts strong industry partnerships and investment in high-tech facilities, operating from campuses in Perth and the historic mining town of Kalgoorlie located in the Goldfields region of Western Australia.

Critical Minerals Trailblazer

The Critical Minerals Trailblazer transforms collaboration between universities, industry, and researchers by embedding industry-led research and commercialisation practices in higher education. It focuses on reducing risks associated with adopting new technologies, enabling SMEs and startups to thrive through innovative pathways. By leading commercial innovation, it translates research outcomes into impactful products, services, and processes, fostering growth in Australia's critical minerals, defence and technology sectors.

Emerging Technologies

Curtin's capabilities in digital connectivity and automation are crucial for defence applications. Through research in the Internet of Things

(IoT), artificial intelligence, data science, virtual reality, and robotics, Curtin builds innovative systems that support the evolution of defence and industry. This includes developing immersive visualisation tools for training, real-time data analysis platforms, and AI-driven decision support systems that improve resource management and operational efficiencies across defence sectors.

Curtin Frontier Institute for GeoScience Solution (C-FIGS)

This initiative is developed to unite world-class geoscience expertise from the schools of Earth and Planetary Sciences, WA School of Mines: Minerals, Energy and Chemical Engineering to deliver end-to-end solutions to geoscience challenges, which is unique to Australia. C-FIGS will support connection of the Future Battery Industry CRC, the Resources Technology and Critical Minerals Trailblazer, and build on the foundations of Curtin-funded research support units including the John de Laeter Centre (JdLC), The Hub for Immersive Visualisation and eResearch (The HIVE), and the Curtin Institute for Data Science (CIDA). C-FIGS aims to fill gaps attract large-scale government and industry contracts, accelerate critical mineral research, and enhance Curtin's capacity for innovation, commercialisation, and knowledge transfer.



Enhanced Situational Awareness | Space to Seabed

Curtin University's research groups enhance Australia's situational awareness by advancing technologies in maritime, terrestrial, and space monitoring critical to defence.

Leveraging Western Australia's geographic and strategic positioning, these groups contribute to comprehensive detection, intelligence gathering, and environmental monitoring across air, land, sea, and space. Their combined capabilities strengthen regional security from space to seabed through high-resolution data collection, advanced signal processing, and space domain awareness, supporting defence decision-making across complex accurate tracking and position data and contested environments.

Subsea 3D Optical Imaging and Visualisation

Curtin's Laser Scanning and Photogrammetry Group enhances situational awareness through advanced 3D data acquisition and analysis. This capability aids underwater detection, mapping, and object identification, supporting training and operational decision-making in underwater military contexts.

FireOPAL

The FireOPAL project uses a range of sensors to track satellites and space debris which will ultimately provide a persistent view of objects in orbit around the Earth. It will also provide an early warning system of potential problems affecting satellites and their interaction with the thousands of pieces of space debris.

Advanced Signal Processing Group (APSG)

This group's scalable technology, capable of tracking millions of objects simultaneously, is vital for enhancing situational awareness. By fusing sensor data from various sources, including ground-based sensors, APSG supports the dynamic needs of Defence networks, contributing to real-time information flow and intelligence gathering.

Centre for Marine Sciences and Technology (CMST)

Curtin's CMST is a leader in maritime research, collaborating extensively with industry and government. The Centre's research focuses on vessel hydrodynamics and the acoustic performance of ships, submarines, and underwater mammals. CMST has partnered with Defence Science and Technology Group and other agencies on critical projects, including sonar array performance and sound propagation modelling in dynamic marine environments. CMST's expertise in marine acoustics both enables theoretical and experimental research to optimise sound performance and enhance underwater detection. This research supports defence decision-making by advancing understanding of the background and operational sound, improving vessel stealth and sonar accuracy across dynamic environments.

Remote Sensing and Satellite Research Group (RSSG)

Specialising in Earth observation, the RSSG uses quantitative satellite data that provide environmental information to monitor coastal and offshore waters. The combination of radiometric, optical, and geophysical information is key for early detection and regional intelligence spanning underwater horizontal visibility, vertical transparency, bioluminescence, and current mapping.

Desert Fireball Network (DFN)

With autonomous observatories tracking meteor paths and satellites, the DFN contributes to space domain awareness through its nationally distributed network of over 50 disruption-tolerant, fully autonomous digital observatories. The DFN captures the paths of fireballs in the sky using intelligent imaging systems, automated data reduction pipeline, real-time server-side triangulation, and supercomputer data management systems. Covering vast Australian skies, it bolsters intelligence for defence space operations, ensuring uninterrupted situational awareness.

Global and Regional Satellite Navigation Positioning and Timing Program

Curtin's Satellite Navigation and Timing Program enhances defence positioning and navigation accuracy through cutting-edge GNSS research. By focusing on positioning, atmospheric sensing, and timing, the program ensures high integrity and precision for geospatial data critical in defence contexts. With state-of-the-art multi-GNSS equipment and tracking stations, Curtin's capabilities provide essential real-time navigation solutions that support defence operations in the Indo-Pacific.

Curtin Institute of Radio Astronomy (CIRA)

The Curtin Institute of Radio Astronomy (CIRA) is instrumental in advancing next-generation radio telescopes and enhancing electromagnetic surveillance capabilities vital for securing the Indo-Pacific against space-based threats. This program develops, deploys, and remotely operates large, distributed radio-frequency sensor arrays and sophisticated signal processing techniques, enabling detailed air and space domain awareness. These capabilities offer essential insights into radio-frequency activity, strengthening strategic defence and situational awareness in complex and contested regions.

Space Science Technology Centre (SSTC)

The Space Science Technology Centre (SSTC) at Curtin advances satellite technology, orbital tracking, and aerospace engineering. The Centre contributes to defence through collaborations on planetary missions, FireOPAL—a space domain awareness partnership with Lockheed Martin—and precision tracking innovations. With expertise in space situational awareness, SSTC enhances defence readiness by supplying essential data to monitor and mitigate space-based threats effectively.

Binar Space Program

The Binar Space Program, hosted by the SSTC, develops small, Australian-designed spacecraft, expanding capabilities for defence and space exploration. Binar's satellites enable Western Australia to locally design, build, and deploy advanced space technology, advancing defence's ability to monitor and operate in space. This program not only furthers understanding of the solar system but also strengthens Australia's autonomous space operations and intelligence gathering.



Robotics, Automation & Next Generation Defence Technologies

Curtin University's capabilities in Operational Autonomy and Advanced Systems position it as a critical partner in developing autonomous, secure, and resilient platforms for defence.

Through an integrated approach that combines expertise in robotics, data science, AI, IoT, and high-performance computing, Curtin supports defence's growing need for advanced unmanned systems and secure, data-driven decision-making across complex and dynamic environments.

Robotics and Automation

With a strong history in robotic innovation, Curtin's Robotics and Automation capability leads the development of autonomous vehicle technologies and intelligent control systems. From the first Australian trial of a commercial driverless bus to advanced work in sensor fusion, scene understanding and autonomous navigation, Curtin's expertise supports defence needs for unmanned systems and robotic operations in complex, contested environments. Resources include mobile and social robots, robotic arms, and a robust computing infrastructure for AI model training, essential for high-stakes defence applications.

High Performance and Intelligence Systems Group (HPIS)

HPIS focuses on developing resilient combat systems architecture for submarines, secure communication networks, and software engineering standards tailored for adversarial environments. The group is advancing technologies such as Swarm Intelligence Platforms for Unmanned Autonomous Vehicles, blockchain-based identity management for critical infrastructure, and secured signal processing, ensuring operational security for defence systems. HPIS's expertise supports defence needs for resilience and secure, autonomous platforms in high-risk zones.

Machine Learning and Artificial Intelligence

Through hubs like the Curtin Institute for Data Science (CIDS), Curtin researchers develop machine learning applications that optimise defence operations and support autonomous decision-making. This research transforms data into actionable insights, crucial for optimising defence logistics and efficiency.

Advanced Control Systems

Specialising in the control and dynamics of complex systems, Curtin's Mechanical Engineering School develops technologies for land, air, and sea vehicles. These capabilities enhance autonomous navigation, stabilisation, and operational reliability, supporting a wide range of defence vehicles, including submarines and UAVs.

Internet of Things and Sensor Technology

Curtin's "living laboratory" uses IoT systems for real-time data collection and monitoring of structural integrity and operational environments. This capability is valuable for defence applications, enabling real-time facility monitoring and optimising resource management in connected, autonomous systems.



Project Nebula with CyberCX & Microsoft

Curtin University, Cyber CX and Microsoft have partnered to develop and launch Nebula, a unique Australian sovereign cloud platform which will secure, facilitate and accelerate sensitive research. Nebula is powered by Microsoft's sovereign PROTECTED accredited Azure, M365 and security platforms providing the innovation community with a fully connect secure defence innovation ecosystem across our TAFEs, Universities, State Government and Defence, including DSTG. The online platform allows users to develop and store research-related files including sensitive data sets, research papers and other key documents safely separated from their everyday workplace environment. This groundbreaking platform bridges the gaps between academia, defence science and innovation, small-to-medium enterprises (SMEs), and industry. It will reshape the landscape of defence and national security innovation, fostering synergies and advancements across various sectors. Nebula will facilitate collaboration between researchers

and industry and accelerate projects by fast-tracking researchers into the environments they need, with ready-to-use analysis and collaboration tools in a matter of days. This includes the development and implementation of cutting-edge defence and national security innovations and programs, spanning critical areas such as software architectures, complex sustainment modelling, autonomous systems, advanced sensors and human factors.





Workforce Development & Resilience

Strengthening defence capabilities requires skilled personnel equipped with the knowledge, adaptability, and technological expertise needed for complex operations.

Curtin University supports this objective by advancing research in human-systems integration, immersive training, and defence-focused educational programs.

Future of Work Institute (FoWI)

FoWI specialises in human-systems integration, developing evidence-based solutions to support workforce readiness, leadership, and wellbeing in defence. The Institute's Future Capability Lab (FCL), including the Future Control Room, offers immersive simulated environments for complex work settings, enabling research and training in areas like maritime autonomy and subsea operations. Collaborating with partners like the Royal Australian Navy and DSTG, FoWI enhances defence personnel's adaptation to technology-driven environments, aligning with AUKUS's goal of an advanced, capable workforce in Western Australia.

HIVE – Hub for Immersive Visualisation and eResearch

Curtin's HIVE provides immersive VR and AR simulation environments that support mission preparedness and interdisciplinary defence training. Equipped with advanced visualisation tools, HIVE offers a variety of systems—such as the Tiled Display, Dome, and Hologram Table—facilitating interactive, data-driven defence training experiences. This centre strengthens defence collaboration and training, enhancing skills and decision-making in simulated real-world defence challenges.

Mechanical and Electrical Engineering Disciplines

Curtin's engineering strengths in computational fluid dynamics, vibration modelling, and signal processing contribute directly to the mechanical resilience and operational performance of naval vessels. This expertise addresses the unique challenges of maritime and submarine operations, ensuring that defence assets can withstand the demanding conditions of prolonged deployments across the Indo-Pacific. Curtin is supporting the creation of a sustainable pipeline of appropriately skilled workers to deliver current and emerging defence projects in WA, guided by the key principles – right skills, right place at the right time.

Workforce Development – Empowering Lifelong Learning and Industry Readiness

Curtin's approach to workforce development is designed to ensure that the university remains responsive to the evolving workforce needs of tomorrow and create flexible, accessible career pathways that are directly aligned with industry demands. We integrate Higher Education (HE), Vocational Education and Training (VET), and industry partnerships to ensure that learners gain both practical skills and technical knowledge critical for success in the modern workforce.

The approach

- **Student Recruitment and School Engagement Programs**
These programs focus on expanding the future student recruitment pipeline in STEM and business fields, aiming to meet the growing workforce demands in clean energy and defence sectors across WA.
- **Student and Industry Engagement Initiatives**
Targeting K-12 students and current university students, these initiatives raise awareness and provide clear pathways into study and careers within the emerging defence sector.
- **Industry-Driven Learning Solutions**
By embedding new skills and knowledge into curriculum through industry-led Short Form Learning initiatives, we prepare future graduates for the emerging workforce needs while also supporting the upskilling of the existing workforce during the transition to defence industries.

Enablers

- **Commonwealth Supported Places (CSP)**
Curtin was awarded 320 additional CSPs in Mechanical and Electrical Engineering, enhancing engagement with the defence sector over a four-year study period, tracking graduate employment in the industry.
- **CCIWA Partnership**
Curtin has partnered with the Chamber of Commerce and Industry WA (CCIWA) to connect students with defence industry opportunities. This collaboration includes a dedicated full-time staff member to lead the initiative through 2024–2025.
- **Cross-Sector Engagement**
Curtin is actively engaging with government, industry, and education providers to align workforce development strategies and



Curtin University

NATIONAL RESILIENCE AND SECURITY
(NRAS) PROGRAM OFFICE

For more information please email
directorNRAS@curtin.edu.au

Curtin University

Kent St, Bentley
Western Australia 6102

Postal address

GPO Box U1987
Perth Western Australia 6845

Tel: 1300 222 888

research.curtin.edu.au

