

QUEENSLAND
JOBS FUND

QUEENSLAND AEROSPACE

10-Year Roadmap and Action Plan

2018-2028

Edition 2 | Updated April 2022



Queensland
Government

Acknowledgement of Country

The Department of State Development, Infrastructure, Local Government and Planning (DSDILGP) acknowledges the Country and people of Queensland's First Nations. We pay our respect to Elders past, present and emerging.

We acknowledge the continuous living culture of First Nations Queenslanders – their diverse languages, customs and traditions, knowledges and systems. We acknowledge the deep relationship, connection and responsibility to land, sea, sky and Country as an integral element of First Nations identity and culture.

This Country is sacred. Everything on the land has meaning and all people are one with it. We acknowledge First Nations peoples' sacred connection as central to culture and being.

We acknowledge the stories, traditions and living cultures of First Nations peoples and commit to shaping our state's future together. DSDILGP recognises the contribution of First Nations peoples and communities to the State of Queensland and how this continues to enrich our society more broadly.

Department of State Development, Infrastructure, Local Government and Planning

Copyright

This publication is protected by the *Copyright Act 1968*.



Licence

This work is licensed by the Queensland Government under a Creative Commons Attribution-Non-Commercial-No Derivative Works (CC BY-NC-ND) 4.0 Australia licence. To view a copy of this licence, visit: <http://creativecommons.org.au/by/3.0/au/>

You are free to copy, communicate and adapt this publication, as long as you attribute it as follows:

© Department of State Development, Infrastructure, Local Government and Planning, April 2022.



The Queensland Government is committed to providing accessible services to Queenslanders of all cultural and linguistic backgrounds. If you have difficulty understanding this publication and need a translator, please call the Translating and Interpreting Service (TIS National) on telephone 131 450 and ask them to contact the Queensland Department of State Development, Infrastructure, Local Government and Planning on (07) 3452 7100.

Disclaimer

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained within. To the best of our knowledge, the content was correct at the time of publishing.

Photography courtesy of the Commonwealth of Australia, Department of Defence.

Copies of this publication are available on our website at www.dsdilgp.qld.gov.au and further copies are available upon request to:

Department of State Development, Infrastructure, Local Government and Planning
PO Box 15009, City East, Queensland 4002

Phone: 13QGOV (13 74 68)
Email: info@dsdilgp.qld.gov.au
Web: www.dsdilgp.qld.gov.au

Foreword

The Queensland Government has recognised aerospace as one of the priority industries that will play an important role in diversifying Queensland’s economy and ensuring Queenslanders have access to the jobs of the future.

As our economy recovers from the impacts of COVID-19, we will continue to stimulate the aerospace industry through further investment in infrastructure, technology and international promotion. Growing our economy and creating jobs has never been more important.

In the next decade, it is predicted global aircraft engine maintenance, repair and overhaul (MRO) will become a US \$474.8 billion growth area, with 33% of MRO demand focused on the Indo Pacific Region.ⁱ Queensland is in prime position to take advantage of this opportunity, and to capitalise on the strong post-pandemic demand for international travel. Training for the aviation sector continues to be a focus, building on the work of Aviation Australia and the Qantas Group Pilot Academy (Toowoomba Wellcamp Airport) and the Qantas Group Flight Training Centre.

There’s no doubt Queensland is well-positioned as a hub for aerospace in the Indo-Pacific region. The state is home to Virgin Australia’s headquarters and half of the world’s top 10 aerospace companies have a presence here, including Boeing Defence Australia, Airbus Australia Pacific, Northrop Grumman, GE Aviation and Raytheon Australia.

Going forward, the government has created the right environment to attract even more big name players to Queensland. Our \$3.4 billion Queensland Jobs Fund is a one-stop-shop for investors who can easily access our suite of flagship industry development programs specifically designed to help them grow and prosper. This suite includes the \$350 million Industry Partnership Program, which is focused on creating jobs across a number of priority industry sectors including aerospace.

The aerospace sector is closely linked to other industries including defence and space, with

national investment in defence projects and the emerging space sector, providing exciting opportunities for Queensland aerospace businesses. Through our strategies to grow the aerospace, defence and space sectors, the Queensland Government continues to support the collective success of our Defence Sovereign Industrial Capability Priorities.

Queensland is home to the Trusted Autonomous Systems Defence Cooperative Research Centre and the Queensland Flight Test Range, Australia’s first commercial drone testing facility in Cloncurry. These successes support Queensland industry and drive development in new Robotics, Autonomous Systems and Artificial Intelligence (RAS-AI) technology, one of Defence’s key Sovereign Industrial Capability Priority areas, signalling a bright future for Queensland’s aerospace industry.

The strategies and actions in this roadmap will help take Queensland’s aerospace sector to new heights.



The Honourable Steven Miles MP

Deputy Premier

Minister for State Development, Infrastructure, Local Government and Planning and Minister Assisting the Premier on Olympics Infrastructure





Contents

Executive summary	7	Queensland aerospace industry snapshot	24
Unleashing Queensland's natural advantages	8	Opportunities for growth	28
Industry capability	8	Hypersonic flight	27
Government and industry working together	9	Female Aircraft Maintenance Engineering program	29
Queensland's First Nations businesses	9	What is graphene?	32
		TAE Aerospace supports Joint Strike Fighter	33
Competitive advantages	10	Key industry challenges	34
What is aerospace?	12	Actions to date	36
Aerospace equipment manufacturers and suppliers	12	Addressing the challenges and opportunities	41
Maintenance, repair and overhaul services	12	Queensland Aerospace 10-Year Roadmap and Action Plan	42
Space technologies	12	Notes	44
Emerging technologies	13	Glossary	45
Queensland drones	14		
Growth drivers	20		
Global fleet demand	20		
Demand for MRO	20		
Regional demand for training	21		
Growing defence budgets	21		
Global sustainability trends	22		
Emerging technologies	22		





Executive summary

Vision

By 2028, the Queensland aerospace industry will be recognised as a leading centre in Australia and South East Asia for aerospace innovation in training; niche manufacturing; maintenance, repair and overhaul (MRO); and uncrewed aerial systems (UAS) applications for military and civil markets.

Key strategies and priority actions

The *Queensland Aerospace 10-Year Roadmap and Action Plan* builds on the state's current strengths and addresses a number of challenges identified through consultation with aerospace industry stakeholders.

The Roadmap includes three key strategies supported by priority actions summarised on pages 42 and 43.

Key Strategy 1

Grow Queensland's aerospace industry and create high-value, knowledge-based jobs

- 1.1** We will work with Queensland industry and research organisations to grow Queensland as an international hub for uncrewed aerial systems (UAS).
- 1.2** We will work with industry to assist Queensland businesses to target emerging capability areas such as UAS, niche manufacturing, training, MRO, space, hypersonic technologies and other Defence sovereign industrial capability priorities.
- 1.3** We will assist Queensland small-to-medium enterprises (SMEs) access defence contracts directly and through supply chain opportunities.

Key Strategy 2

Enhance Queensland's level of industry capability to access new national and global supply chain opportunities and international markets

- 2.1** We will work to secure a greater portion of national aerospace work, including in regional Queensland.
- 2.2** We will work with the aerospace industry to assist Queensland businesses to enter global supply chains.

Key Strategy 3

Promote Queensland as a preferred destination for aerospace capability, servicing both national and global markets

- 3.1** We will promote Queensland industry capability to national and international civil and military aerospace markets.

During the next three to five years, particular focus will be given to securing a greater portion of the aerospace spend arising from the following strategic opportunities:

- › continuing to position Queensland as a UAS centre of excellence in the Indo-Pacific through pursuing opportunities with the Trusted Autonomous Systems Defence Cooperative Research Centre (TAS DCRC), in collaboration with universities and industry, supporting the development of new and complementary aerospace sector technologies and increasing testing opportunities at the Queensland Flight Test Range (QFTR).
- › capitalising on major international defence and civil aerospace programs such as the F-35 JSF and Boeing Airpower Teaming System.
- › supporting export opportunities of aerospace-related education and training services, UAS, niche manufacturing, MRO, and space and hypersonic technologies.
- › promoting and showcasing Queensland aerospace industries nationally and internationally, through marketing industry capabilities, attracting significant events, and stimulating export opportunities.



Unleashing Queensland's natural advantages

Queensland has competitive advantages that place it in a favourable position to capitalise on growing demand for aerospace services.

Some advantages of Queensland's aerospace sector include:

- › the highest product quality levels within the Indo-Pacific region at competitive prices
- › innovative, high-quality, cost-effective aerospace design with excellent communications and IT infrastructure
- › world-leading research into hypersonics at The University of Queensland's (UQ) Australian Program Office for Advanced Hypersonics (APOAH) and at the University of Southern Queensland (USQ) and Defence's Australian Hypersonics Research Precinct
- › UAS development with Australia's pre-eminent aerospace autonomy group at QUT
- › the only large commercial common user (UAS) drone flight test facility in the Southern Hemisphere located at Cloncurry
- › one of only a few locations in the world with the full range of capabilities needed to assemble, test and maintain advanced military and civil helicopters
- › the only aircraft heavy engineering maintenance facility in Australia, servicing Boeing 737s and Airbus 330s

- › the presence of prime aerospace contractors based or headquartered in Brisbane
- › extensive capabilities in systems integration and support services including operational testing and evaluation, and airworthiness planning
- › Brisbane airport's second runway - doubling capacity and capability into 2040

Queensland is home to half of the world's top 10 aerospace companies

- › Sunshine Coast's international airport new runway – capable of handling long-haul wide-body jets, enhancing the region's national and global connections
- › proximity to key markets.

Queensland is home to:

- › half of the world's top 10 aerospace companies
- › one-quarter of Australia's aerospace companies
- › five international passenger airports (Cairns, Townsville, Sunshine Coast, Brisbane, Gold Coast)
- › a further two international airports with customs clearance (Rockhampton) and freight clearance (Toowoomba).

In addition, the state has a modern and effective road network and access to reliable rail and port services. Queensland is becoming increasingly prominent in Indo-Pacific's aviation sector with Brisbane having hosted and sponsored the MRO Australasia event in 2020, with further events being planned.ⁱⁱ

Industry capability

The span of capabilities in Queensland includes major aircraft modification; helicopter design and assembly; life cycle support; avionics; MRO; logistics analysis and management; electronic systems integration, modelling and simulation; space technologies; and UAS design; and manufacture.

Complementary to the civil aerospace sector, Queensland also offers a diverse range of well-established defence industry capabilities and provides support to significant defence facilities across the state. In particular, the RAAF base at Amberley plays a significant role in bolstering Defence's mobility, strike force and heavy lift capacity as well as key elements of the RAAF Intelligence, Surveillance and Reconnaissance (ISR) capability, Airborne Early Warning and Control (AEWC).

Queensland is helping Defence to maintain a technological edge, as well as the supporting infrastructure to maintain and develop new

systems and sub-systems that will support the Australian Defence Force (ADF) and its mission.

Government and industry working together

Drawing together industry, researchers and businesses, Queensland is actively developing capabilities such as hypersonic flight, space technologies, robotics, uncrewed aircraft and trusted autonomous systems, positioning the state as a global leader in innovative technologies.

A testament to the depth of the skills underpinning this capability, Queensland is the home of the headquarters of the first Trusted Autonomous Systems Defence Cooperative Research Centre (TAS DCRC). With \$50 million invested under the Next Generation Technology Fund over seven years — and substantial support by the Queensland Government —

the Defence Science and Technology Group, universities and industry are working together with the TAS DCRC to deliver trustworthy smart-machine technologies for the ADF across multiple domains including aerospace. This national facility, in conjunction with the development of the common-user Queensland Flight Test Range for testing, trials and evaluation of uncrewed aerial systems, will enhance Queensland's status as an innovation, science and technology hub.

Queensland's First Nations businesses

The Queensland Government is committed to supporting First Nations businesses, communities and peoples to participate in the Queensland economy by:

- › driving economic growth and enabling well-planned, inclusive and resilient local communities

- › reframing the relationship with First Nations peoples and the Queensland Government by enshrining the state's commitment towards the delivery of the Moving Ahead Strategy, Reconciliation Action Plan, Cultural Capability Framework, Cultural Capability Action Plan, Path to Treaty, Closing the Gap commitments and the Queensland Indigenous Procurement Policy.

This commitment is embedded in the government's support for the defence and aerospace industry sectors and includes working with First Nations businesses seeking to enter supply chains and connecting First Nations businesses to defence and aerospace primes.



Image courtesy of Department of Defence



Competitive advantages

Queensland's aerospace sector



Proximity to key markets



Innovative, high-quality and cost-effective design and product quality



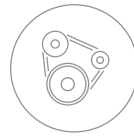
World-leading research being undertaken into hypersonics



Queensland has Australia's largest share of aircraft manufacture and repair service enterprises.



Queensland is home to the national Trusted Autonomous Systems Defence Cooperative Research Centre.



Queensland has the only aircraft heavy engineering maintenance facility in Australia.



Queensland has several supersonic-to-hypersonic wind tunnels.



Townsville is home to Flying Colours Aviation, Australia's largest aircraft repainting provider, servicing the civil and defence aircraft and operators.



Queensland is one of the few locations in the world with the full range of technical capabilities needed to assemble, test and maintain advanced military and civilian helicopters.



The Queensland Flight Test Range at Cloncurry Airport is a state-of-the-art commercial test facility for uncrewed aerial systems, the first of its kind in Australia and largest in the southern hemisphere.

Queensland has a strong network of businesses that are involved in, or supply to, the defence and aerospace industries. Major companies with offices in Queensland include:

AIRBUS

BAE SYSTEMS
INSPIRED WORK

BOEING

NORTHROP GRUMMAN

TAE
AEROSPACE

QANTAS

Virgin australia

Raytheon
Australia

Nova Systems
Experience Knowledge Independence

CAE



StandardAero

Together ahead. **RUAG**

QINETIQ

Alliance
AIRLINES

COBHAM

JET AVIATION
A GENERAL DYNAMICS COMPANY

Requirements – Cockpit Layout

- 124.1 The Mission Configuration shall place and control the Mission Display in front of the Pilot.
 - 124.2 The Cockpit Display Mission Display shall be controlled by the Mission Configuration.
 - 124.3 The Cockpit Display Mission Display shall be controlled by the Mission Configuration.
- The intent is to attach display's to the cockpit.
 - MS Right section.
 - MS Right section.



What is aerospace?

The aerospace industry comprises the wide range of entities involved with the research, design and development of flight vehicles and equipment, as well as the support of these activities. Flight vehicles include aeroplanes and rotorcraft, UAS, rockets, missiles and spacecraft such as satellites.

Aerospace businesses provide goods and services across all aspects of the design, development, manufacture, modification, testing, operation and maintenance of all flight vehicles and their on-board and ground systems.

Aerospace industry activity is diverse, with a multitude of commercial, industrial and military applications. Key activities within the aerospace sector include:

Aerospace equipment manufacturers and suppliers




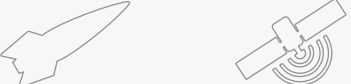
In addition to aircraft, propulsion systems and parts, this subsector includes manufacturers and suppliers of component and platform designs, on-board and ground-based electronic systems, communication networks and decision support systems.

Maintenance, repair and overhaul services

A large proportion of activity in the aerospace sector is classified as MRO services. MRO is the term to describe services relating to assuring aircraft safety and airworthiness.

Space technologies

Queensland has a burgeoning space industry with locational

Flight vehicles include:	
Aeroplanes and rotorcraft	
Uncrewed aerial systems (UAS)	
Rockets and missiles	
Spacecraft (such as satellites)	

advantages through to established strengths in launch activities, ground systems, Earth Observation, niche manufacturing, robotics and automation. Queensland is also home to large downstream industries, such as agriculture and mining, that are both driving and benefitting from the state's expertise in Earth observation and data analytics.

To capitalise on these strengths and opportunities, the Queensland Space Industry Strategy was launched in 2020, which details targeted actions to grow the Queensland space industry.ⁱⁱⁱ

Growth in space-enabled services is driving demand for rocket testing and launch, creating opportunities to launch, operate, manufacture, test and develop launch supply chains.



Queensland is perfect for space launches due to its east coast location, access to the equator and Australia's most advanced launch vehicle developers.

Australia's most advanced launch vehicle developers – Black Sky Aerospace, Gilmour Space Technologies and Hypersonix Launch Systems – are based in Queensland and are developing affordable access to space for small and medium-sized payloads.

Supporting capabilities include:

- › Rocket Technologies International (RTI) world-class static rocket engine testing facility
- › APOAH, the world's leading university-based hypersonics research group
- › University of Southern Queensland's long-duration hypersonic wind tunnel.

The Institute for Advanced Engineering and Space Sciences is nation leading in research and commercial work in rocket manufacturing and testing, hypersonics, ultra-high temperature composites, astrophysics, airborne Earth re-entry observations and robotic vision in uncontrolled environments.

Emerging technologies

The most well-known emerging aerospace technology is in the area of UAS, which includes the remotely piloted and automated flight vehicles (drones) and Advanced Air Mobility (AAM). Other emerging technologies include counter-UAS capabilities plus the support and ground systems used to control the vehicle and its functions and anti-drone systems.

Recognising these emerging opportunities, the Queensland Drones Strategy (QDS) was developed to position Queensland as a world leader in UAS

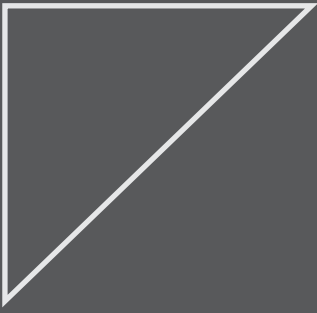
technology and application, and drive investment and jobs growth statewide.^{iv}

UAS offer exciting new applications across a range of industries and will have future benefits for Queensland's agriculture, biosecurity and environmental monitoring capability just to name a few.

Queensland can capitalise on its existing technical expertise, along with its highly regarded research agencies and specialist capability in UAS to develop the systems that will operate across these industries.

New technologies are being developed across a broad range of areas including equipment for military and commercial hypersonic flight, electrification of aircraft, surveillance technologies, robotics and automated systems, microelectronics, microwave and radio frequency communications, and geospatial, simulation and space technologies.





Queensland drones

The Queensland Drones Strategy (QDS), released in mid-2018, was the first of its kind in Australia. The QDS was designed to build on Queensland's strengths and leverage the state's innovation success achieved through championing new and emerging opportunities, complementing the Queensland Government's Advance Queensland initiatives and job creation objectives.

Achievements to date

The implementation of the QDS has progressed significantly with state drone-based issues identified within the QDS having largely been addressed and the majority of objectives and actions having been completed or on track for completion. At the time of publication, 32 of the 34 actions have been completed. The remaining two actions are on track for completion in 2022. Many of the actions have progressed to 'business as usual' activities for their respective agencies.

Significant outcomes to date include:

- › Establishment of the TAS DCRC national headquarters in Brisbane.
- › Established the foundation stage of the Queensland Flight Test Range at Cloncurry Airport in Oct 2020. QinetiQ was awarded the inaugural operational contract to manage the facility.
- › Committed funding of \$2 million to support the development of Australia's first tropical maritime autonomous system testing capability in Townsville in conjunction with the Australian Institute of Marine Science (AIMS), which forms part of the Townsville Regional Economic Recovery Plan.
- › The Queensland Government Drone Use Policy (QGDUP) to guide the safe, respectful, accountable and innovative use of drones within the Queensland Government was developed and released on 10 July 2020.
- › The Queensland Government sponsored the World of Drones Congress in Brisbane in 2018, 2019, 2020 and 2021. The Queensland Government has committed to continue support in 2022.
- › Completion of a review of Queensland's laws relating to civil surveillance and the protection of privacy in the context of current and emerging technologies by the Queensland Law Reform Commission (QLRC). The review report, including draft legislation was tabled by the Attorney-General to Parliament on 29 June 2020.

Since the release of the QDS, at least six Queensland Public Service agencies have added the use of drones as part of their service delivery. Agencies include the Department of Agriculture and Fisheries, Department of Environment and Science, Queensland Fire and Emergency Services (QFES), Queensland Police Service (QPS), Department of Transport and Main Roads and the Crime and Corruption Commission. Agencies have opted to either outsource their drone flying tasks to local providers and/or develop in-house capability through the establishment of roles with remote pilot flying qualifications – including Chief Remote Pilot roles – to meet air safety regulatory requirements.

Fisheries Queensland continues to expand drone usage for tasks including habitat monitoring, general surveillance, and compliance monitoring. The Department of Environment and Science is utilising drones to monitor populations of native wildlife such as crocodiles, marine turtles and sea birds to inform the management and conservation of these species.

Drones are now being used for emergent wildlife incident responses such as crocodile removals and site assessments. During 2019, a new technique was developed using drones to assist

in catching and removal of problem estuarine crocodiles.

QFES continue to integrate drones into 'business as usual' operations with significant benefits. The QFES drone program was expanded in 2020 with 20 new drones across the state to support frontline personnel, almost doubling the size of the QFES drone program. The program was expanded after successfully trialling the drones in vertical rescues, land searches and joint operations with the QPS.

“Around 24% of Australia's growing UAS industry is located in Queensland”

The state's investment in critical infrastructure and collaboration between industry, academia and regulators is ensuring that Queensland has an unmatched UAS ecosystem in Australia. The decision by Boeing Australia to establish a final assembly facility in Queensland (subject to production orders) for the Airpower Teaming System, also known as MQ-28A Ghost Bat, further cements the state's reputation as a leader in UAS and will introduce a new manufacturing capability to Australia.

The Boeing Defence Australia Advanced Manufacturing Facility will be established at Toowoomba's

Wellcamp Aerospace and Defence Precinct. The Wellcamp Precinct plans to be one of the world's most environmentally sustainable, supporting manufacturing industries to meet their sustainable manufacturing goals with renewable technologies.

Queensland has a robust UAS industry with capabilities in research and development, product commercialisation, systems integration, bespoke manufacturing, drone-based services, training providers and policy and specialist consultancy firms.

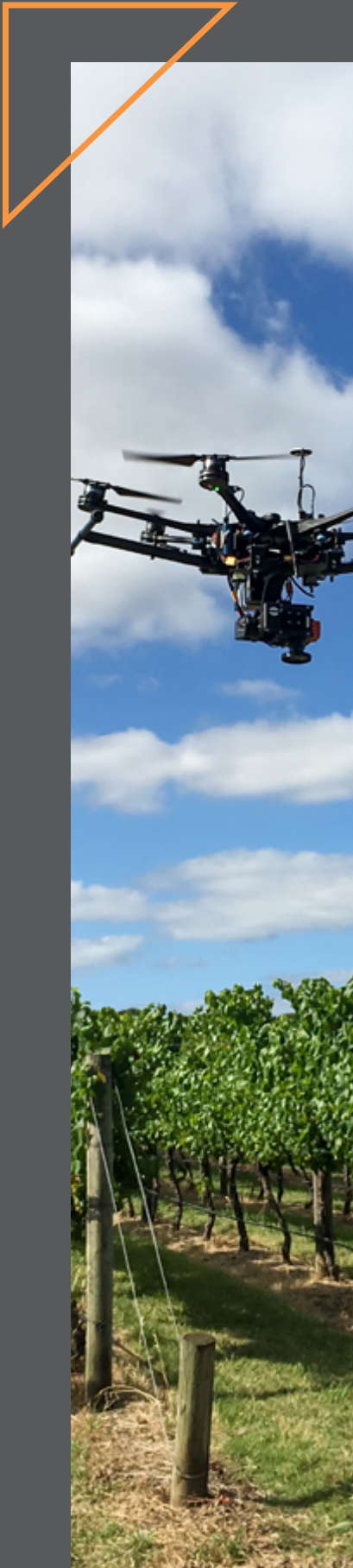
The Queensland Government's purchase of drone-based services is supporting the growth of the UAS industry in Queensland, including value-add capabilities and

products involving application of robotic vision, artificial intelligence and high-volume data and image processing.

Drone operation and licence data from the Civil Aviation Safety Authority (CASA) shows that Queensland is home to around a quarter of Australia's drone industry participants.

The significant outcomes achieved since the release of the QDS in 2018 demonstrate that Queensland is well on the way to achieving the QDS vision that 'Queensland is a world-leader in drone technology and application'.





Way forward

As the first of its kind in Australia, the QDS has been successful at putting Queensland on the world map in the drone/UAS sector. Mechanisms are in place to continue to build on the work undertaken to date and facilitate the continued development of this sector in Queensland including through Aerospace and Defence Roadmap initiatives.

Various initiatives have been formulated and are being implemented to develop Uncrewed Aerial Vehicle (UAV) flying capabilities in the industry, including through STEM courses in schools participating in aviation related programs and through TAFE Queensland accredited courses. There are also numerous Queensland-based providers offering CASA-accredited UAV training courses, including strong demand for the Certificate III in Aviation (Remote Pilot) which supports occupations in surveying, energy, mining, building, photography, lifesaving and other sectors.

The Queensland Government will continue to work with Queensland industry and research organisations to strengthen aerospace capability by establishing Queensland as an international hub for UAS. Specifically, these actions include:

- funding support to the TAS DCRC for development of a National Accreditation Support Facility Pathfinder Project for autonomous systems, and development of Detect and Avoid Design, Test and Evaluation guidelines for UAS applications, particularly for realising Beyond Visual Line of Sight (BVLOS) remotely piloted and autonomous flights
- collaboration with universities and industry pursuing opportunities for innovative application of UAS technologies, including autonomous systems emerging from TAS DCRC work

- supporting Queensland-based small businesses to access UAS research, development and testing services and trialling of UAS technologies including Advanced Air Mobility (AAM).

The business-as-usual adoption and use of drones in government service delivery is set to grow.

These actions and others will support the maturation and evolution of the drone sector in Queensland.

The Queensland Government continues to engage with the Australian Government through the Commonwealth-State Drones Working Group and contributed to the development of the National Emerging Aviation Technologies Policy Statement (NEAT). The NEAT was released by the Australian Government on 6 May 2021 as part of the Digital Economy Strategy 2021-22. The NEAT sets out how the Australian Government will support individuals and businesses to harness the opportunities offered by digital aviation technologies such as drones, BVLOS/autonomous flights, AAM and electric vertical take-off and landing (eVTOL) vehicles. Initiatives include development of Australia's Uncrewed Aircraft System Traffic Management system, regulatory modernisation and providing industry support.

The Queensland Government is promoting opportunities for utilisation of the QFTR under the Australian Government's \$35.7 million Emerging Aviation Technology Partnerships program.

The Aerospace Roadmap will continue to focus on UAS as a priority, with critical activities and opportunities outlined under Strategy 1 to Grow Queensland's aerospace industry and create high-value, knowledge-based jobs.

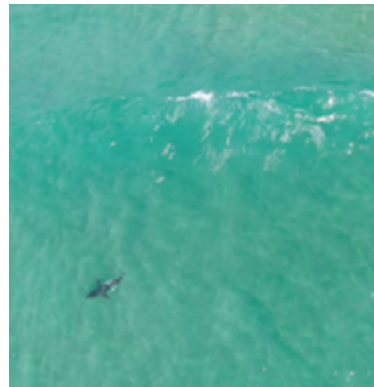
CASE STUDY 1 – Surf Life Saving Queensland

The Queensland Government partnered with Surf Life Saving Queensland to deliver the SharkSmart drone trial. Launched in South East Queensland in September 2020, the trial has expanded to include North Queensland in June 2021. Drones monitored the water to detect sharks and gathered data on shark movements and behaviour. If a dangerous shark was spotted, drone pilots would notify the life savers on patrol to warn water users and temporarily close the beach if needed (SharkSmart drone trial | [SharkSmart daf.qld.gov.au](https://www.daf.qld.gov.au)).

Trial locations included:

- › South East Queensland (19 September 2020 to 4 October 2021): Sunshine Coast region—Coolum North, Alexandra Headland; Gold Coast region—Main Beach, Burleigh Beach; North Stradbroke Island – Main Beach
- › North Queensland (June 2021 to November 2021): Cairns region – Palm Cove and Townsville region – Alma Bay, Magnetic Island.

The trial is now complete and under evaluation. The evaluation will inform the future use of drones as a shark bite mitigation tool in Queensland. During the trial, a total of 185 sharks were sighted, including 35 large sharks over 2 metres resulting in four beach evacuations.





CASE STUDY 2 – Queensland Flight Test Range (QFTR)

In an Australian, Indo-Pacific and Southern Hemisphere first, the Queensland Government has invested \$14.5 million to deliver the foundation stage of a commercial common user drone flight test, trial and evaluation facility at Cloncurry Airport, bringing aerospace R&D, growth of high-technology industry and more jobs to Queensland. The facility supported more than 100 jobs during construction and brings ongoing benefits to the region.

Regulatory considerations dictate the size, speed and flight range of drones that can be tested at the facility. Initially, small to medium-sized drones are to be tested, allowing for the gradual planned expansion of accessible airspace, subject to user requirements.

The world's largest aerospace group, The Boeing Company, was the first organisation to conduct operations at the QFTR, with the test facility a catalyst for expanding Queensland's and the nation's sovereign drone capability.

CASE STUDY 3 – Trusted Autonomous Systems Defence Cooperative Research Centre (TAS DCRC)

The partnership with the TAS DCRC is making the assurance and accreditation of new Autonomous systems more accessible for industry. This includes funding the TAS DCRC to undertake the National Accreditation and Support Facility Pathfinder Project, which will lead to the establishment of a new independent, third-party entity offering world-class assurance support and consultancy services.

Selected ongoing projects by TAS DCRC include:

Justified Autonomous Uncrewed Aerial System (UAS) Effects (Queensland and Commonwealth Next Generation Technology Fund (NGTF) Funded)

The project aims to research and develop autonomous live reconnaissance effects assessment using Artificial Intelligence (AI) and machine vision for day and night UAS operations over land. The system aims to advise operators on the legal and ethical aspects of fire support missions in near-real time. The project is led by Skyborne Technologies

and Cyborg Dynamics Engineering with UQ and Defence Science and Technology (DST) Group.

Detect and Avoid Design, Test and Evaluation (DT&E) standard

A new TAS DCRC project will develop a Detect and Avoid Design, Test and Evaluation standard for low-risk, uncontrolled airspace outside the airport environment. The DT&E standard will create a process acceptable to allow the safe integration of uncrewed aircraft into the National Airspace System. The current process to ensure compliance with the See and Avoid requirements detailed within the Civil Aviation Regulations 1988 (Cth), as they relate to Beyond the Visual Line of Sight (BVLOS), involves labour-intensive stakeholder engagement. The standard will allow for a high-level of safety, verification and validation, simulation and testing to demonstrate compliance. Once CASA has approved this standard, uncrewed aircrafts will have greater access and flexibility to operate in Australian airspace.



Growth drivers

Rapidly changing global supply chains, technology and market conditions have all affected recent aerospace industry directions.

There was significant global aerospace growth between 2014 and 2018, with the civilian aerospace sector growing from US \$314.9 billion to US \$838 billion. Significant future growth was projected in the next decade.^v

The largest contributors to this value were commercial aircraft, engines, and component original equipment manufacturers (OEM) and MRO services to commercial aircraft.

However, in 2019, the growth of the global commercial aerospace sector slowed due to aircraft production related issues, order cancellations, and fewer orders.^{vi}

While the sector was expected to recuperate in 2020, the COVID-19 pandemic significantly impacted commercial aerospace. International border closures and travel restrictions throughout 2020 and 2021 severely limited passenger traffic, which in turn affected aircraft demand. In its latest prediction, Deloitte notes that global passenger traffic may not return to pre-pandemic levels before 2024.^{vii}

Most aerospace companies operate across the civil and military aerospace markets. Many are investing in research and development to deliver new solutions, create new markets and expand growth opportunities.^{viii}

In addition, the shift in the aerospace manufacturing effort to emerging economies, has been encouraged by sustained government support

for this sector through policy implementation or subsidisation.

There are a number of key growth drivers which influence the Queensland context. Additionally, the recent focus on sovereign capability and the increasing importance of bilateral and multilateral relationships in the current geopolitical environment is a stimulant for growth in the aerospace sector.



Global fleet demand

During the last decade, the commercial aerospace sector has experienced above-average growth rates, driven by passenger demand for air travel, rapidly increasing living

standards in the Indo-Pacific region, along with an accelerated equipment replacement cycle.

By 2030 the global middle-class is forecast to grow to 5.3 billion, of which 3.5 billion will be in Indo-Pacific alone.^{ix}

Population growth and global economic shifts from West to East are tipped to drive further demand for luxury items such as air travel.

The focus on innovation to develop new technologies is driving long-term improvements to reduce costs and increase efficiencies such as safety, passenger comfort, cost, fuel efficiency, noise emissions, freight and passenger capacity, and range capability of aircraft.

In the helicopter market, expanding industrial applications for the use of helicopters and rapid technology advances will see substantial growth in demand. It is estimated that the global civil helicopter fleet will grow to 37,000 by 2036 and 61,000 additional helicopter pilots will be required worldwide by 2038.^x

Demand for MRO

As a result of the impact of COVID-19, thousands of aircraft have been taken out of service globally. The Aviation Week Network anticipates most aircraft to be reactivated in the 2022–2031 period. Twin aisle aircraft are expected to experience the slowest return to service, due to the persistent constraints on long distance, international travel.

As the aviation industry begins to ramp up, the expected demand for MRO services will be heightened and is anticipated to surpass the pre-pandemic record.

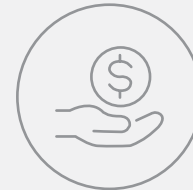
Growth drivers



Global fleet demand



Emerging technologies



Growing defence budgets



Demand for maintenance, repair and overhaul



Regional demand for training



Global sustainability trends

Regional demand for training

As economies in the Indo-Pacific region expand and thousands of new commercial aircraft come into service and air traffic returns to pre-COVID levels, there will be unprecedented demand for qualified pilots, technicians and engineers. Boeing has predicted that 763,000 new civil aviation pilots, 739,000 new maintenance technicians and 903,000 new cabin crew members will be needed to fly and maintain the global fleet over the next 20 years.^{x1} The forecast is inclusive of the commercial aviation, business aviation and civil helicopter industries and assumes air traffic will recover to 2019 levels within the next few years.

With around 35% of global demand coming from the Indo-Pacific region, this opens up exceptional

opportunities for Queensland's training providers and education services.

Growing defence budgets

Defence force research and development and procurement activities are significant contributors to the aerospace industry revenues. Demand in the military aerospace industry hinges mainly on global governments' security and operational needs and fiscal limitations. Globally, the aerospace industry is expected to benefit from growing defence budgets in North America, Europe and Asia, which are being refocused to meet emerging national security threats and the geopolitical environment.



Global sustainability trends

Key global sustainability trends in the aviation sector will drive technological change and investment. Organisations such as the International Air Transport Association (IATA) and the International Civil Aviation Organisation (ICAO) support a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector and recognise the need to mitigate emissions from air transport.

Industry-led international civil aviation targets have been set to achieve carbon neutral growth of CO₂ emissions from 2020 and a 50% reduction of net CO₂ emissions by 2050. Innovation, research and development and technical expertise will be required to meet these ambitious targets. Opportunities for Queensland include the development of new engines with improved fuel efficiency, new aircraft technology and materials and sustainable aviation fuels.

Emerging technologies

Emerging technologies, such as uncrewed aerial systems — which encompass uncrewed aerial vehicles, remotely piloted aircraft systems (RPAS) and autonomous systems — are finding a growing number of applications across a broad array of traditional industries, such as automated crop and pest monitoring.

Economic modelling proposes that medium uptake of drone applications by existing and new industries has the potential to deliver almost \$15 billion of net economic benefit nationally — \$3.8 billion to Queensland over the next 20 years. The modelling indicates that Queensland's drone industry could potentially grow by around \$8.3 billion over the same period.^{xii}



Image courtesy of Insitu Pacific

Further, the adoption of drone application in the delivery of government services such as police, firefighting, environmental management has the potential to realise around \$300 million in savings over the next two decades.^{xiii}

The economic modelling suggests that Queensland's traditional economic sectors (agriculture, mining and resources, and construction) will be the main beneficiaries from the adoption of drone technologies, addressing various productivity challenges faced by these industry sectors. The modelling includes modest levels of drone adoption in the transport sector with a new application such as food, parcel and pathology delivery services.

The growth of drone application in various industry sectors has many challenges including safety, privacy and noise.

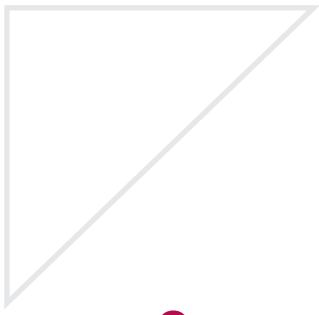
The Queensland Hydrogen Industry Strategy 2019-2024 is a five-year plan to grow a sustainable hydrogen industry that supports renewable resources, creates jobs

and strengthens our economy. There is increasing worldwide interest and development of hydrogen applications in the aerospace sector.^{xiv}

Opportunities for hydrogen include use as an aviation fuel, as fuel cell technology for uncrewed aerial vehicles (UAV) or ground operations vehicles and remote power systems for energy security and isolated operations. Hydrogen operations result in lower thermal and acoustic signatures than internal combustion engines making them an attractive option for defence applications. Major global companies such as Airbus, Boeing and British Airways have announced plans to integrate hydrogen into their activities.

The flight duration extension and rapid changeover of fuel canisters make hydrogen of interest for UAVs. Queensland-based Hover UAV have partnered with Doosan Mobility Innovation (DMI) for joint-marketing and development of hydrogen UAV solutions in Australia and New Zealand.





Queensland aerospace industry snapshot

Queensland companies have broad capability across military and civilian aerospace, with expertise ranging from UAS design and manufacture, MRO, electronic systems integration and modelling and simulation.

Queensland's aerospace firms are widely recognised for their expertise and training across the advanced engineering and manufacturing technologies.

The slow growth of the global commercial aerospace sector in 2019, together with the impact of the COVID-19 travel restrictions throughout 2020 and 2021, has impacted Queensland's aerospace sector. Queensland now contributes 26% of aerospace businesses to the national total.

Despite the reduction, Queensland continues to be a major hub for the aerospace industry in the Indo-Pacific region. The reputation and expertise of Queensland's aerospace firms remain well-positioned to take advantage of emerging opportunities in the region.

As growth returns to the sector, Queensland's aerospace sector is forecast to grow by more than \$53 million each year through to 2025-26 and employ around 5400 people directly, and many more indirectly.

Rather than focusing on high-volume markets, Australia has developed expertise in specialised high-technology, high value-add and highly-skilled manufacturing that uses advanced design, processes, materials and technologies.

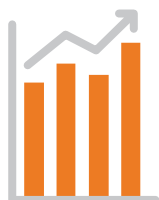
Queensland is one of only a few locations in the world with the full range of technical capabilities needed to assemble, test and maintain advanced military and civil helicopters.



Queensland is home to **26%** of the nation's aerospace businesses – 274 enterprises

24%

of Australia's growing UAS industry is located in Queensland



Queensland's aerospace sector's economic contribution is forecast to grow by

\$53 million +

each year through to 2025-26



Queensland is currently home to the **Army Aviation Centre at Oakey** and three RAAF bases including **RAAF Base Townsville** and Australia's largest defence airbase – **RAAF Base Amberley**



Queensland is home to the Army Aviation Centre at Oakey and three RAAF bases, which continue to provide significant opportunities for the aerospace industry. The three bases: RAAF Base Amberley, RAAF Base Townsville, and RAAF Base Scherger in the Cape York Peninsula collectively employ more than 8750 uniformed and civilian personnel.

Queensland is home to many subsidiaries of the global prime aerospace contractors and a significant number of Tier 2-5 companies, demonstrating capabilities across the entire span of the global aerospace industry.

Companies such as Boeing, Airbus, Raytheon, Cobham Aviation Services, GE Aviation and Northrop Grumman have regional headquarters and substantial military and civil aerospace business in Queensland. Other Queensland-based firms operating in the aerospace sector include Ferra Engineering, L3Harris, TAE Aerospace, Flying Colours and Heat Treatment Australia (HTA).

The presence of numerous major defence contractors gives local firms further commercial opportunities.

As a result, participating small and medium-sized Queensland

businesses have an opportunity to be linked into global supply chains and to capitalise on large contracts for supply to defence projects.

Queensland's aerospace sector is currently exporting products and services at an estimated \$148 million per year.

The Queensland companies participating in the Joint Strike Fighter (JSF) Program have leveraged local supply chains, capabilities and information. These include Ferra Engineering, Heat Treatment Australia, L3Harris and TAE Aerospace.



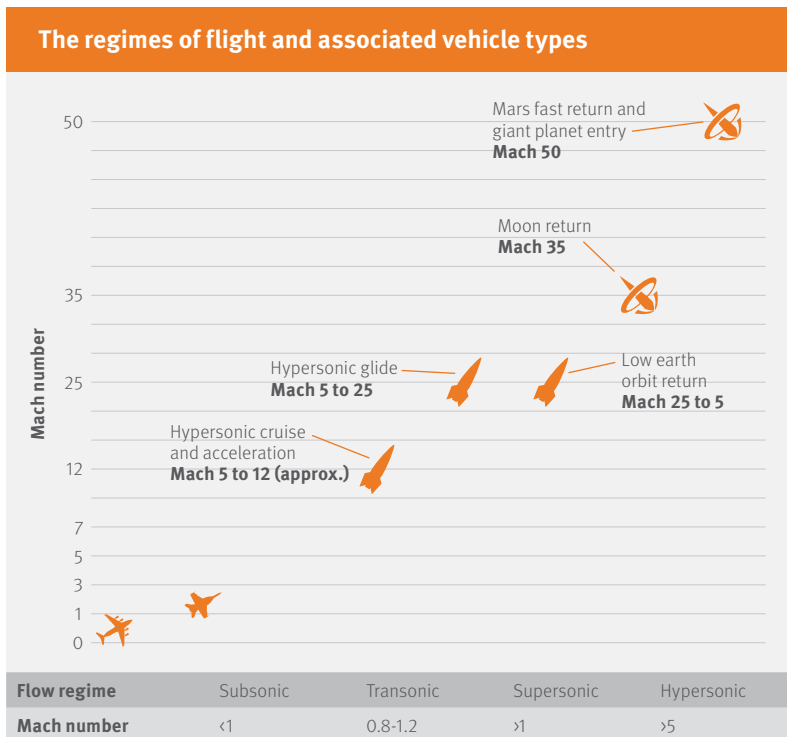


Image courtesy of Department of Defence

Queensland's highly regarded research agencies with specialist expertise in aerospace related research and development include:

- › the **Aerospace Autonomy group within the Centre for Robotics at Queensland University of Technology (QUT)**, which conducts research into airspace integration technology (detect and avoid, uncrewed traffic management, and air traffic analysis), single and multiple UAV navigation and target detection in Global Positioning System (GPS)/ Global Navigation Satellite System (GNSS) denied environments, platform autonomy (large scale flight planning, fault detection, sensor coverage, and aerial manipulation), cognitive onboard decision making and technologies for multi-UAS integration decision making, fault tolerance, and human factors).
- › **UQ's APOAH**, a world-leader in hypersonic technology and reusable rocket research with hypersonic wind tunnels/tubes.
- › **University of Southern Queensland (USQ), Institute for Advanced Engineering and Space Sciences** focuses on hypersonic propulsion systems, rocket fuel development, astrophysics, machine-learning and advanced materials. USQ operates the world's longest duration free piston hypersonic tunnel, the only one of its kind in Australia.
- › **Defence Science and Technology Group** hypersonics research program supports the development of hypersonics, in particular the supersonic combustion ramjet (scramjet) propulsion to enable sustained high-speed flight in the atmosphere.^{XV}
- › **Queensland Micro and Nanotechnology Centre and Advanced Design Prototyping Technologies Institute (ADaPT) at Griffith University** and the **Queensland Centre for Advanced Materials Processing and Manufacturing (AMPAM) at UQ**, delivering leading-edge research on new-generation engineering materials, smart functional materials and advanced manufacturing technologies.

Hypersonic flight



Hypersonic flight is flight through the atmosphere at speeds above Mach 5.0, more than five times the speed of sound. This equates to flight speeds between 1700 and 47,000 metres per second (6000 to 170,000 kph). The diagram (above) shows the Mach number regimes and the associated applications. Hypersonic flight has significant applications for defence programs and space travel, access and exploration. It is enabling technology for many transformational developments.

Hypersonics research has been ongoing since the start of the space race between the Soviet Union and the United States during the 1950s and 1960s. Queensland has played a major role in developing the Scramjet air breathing propulsion technology which is now on the cusp of commercial and military viability. The HyShot, HIFIRE and Scramspace international flight programs all

originated from Queensland and led to significant advances in air-breathing hypersonic propulsion. The State Government has long played a proactive and supporting role in these developments through the Smart State Research Facilities Fund, the Advance Queensland Research Fellowships (AQRf) and other initiatives. The recently formed Brisbane company Hypersonix Launch Systems is developing a revolutionary access to space system using Scramjet concepts developed at UQ. UQ's APOAH is a world-leader in hypersonic technology and reusable rocket research with a hypersonic wind tunnel/tube.

In recent years, developments have come in quick succession thick and fast, with the Defence Science and Technology Group (DST Group) supporting long-term collaborative hypersonic programs with UQ and

USQ, Defence's new \$14 million Australian Hypersonics Research Precinct in Brisbane, and novel propulsion systems. The Queensland funded AQRf's have spawned multiple international projects including the US Multidisciplinary University Research Initiative (MURI), experiments/simulations of the Boundary Layer Transition (BOLT) flight test project and projects with Defence, commercial and research institutions such as National Aeronautics and Space Administration (NASA), Japan Aerospace Exploration Agency (JAXA), European Space Agency (ESA), United States Air Force (USAF), Boeing and Lockheed Martin, and several leading overseas universities, such as Oxford, Colorado, Texas A&M, Michigan and Centrale Supélec (Paris).

Hypersonic flight will, in the future, mean cheaper and easier satellite launches, better telecommunications networks, more accurate weather prediction, advanced agricultural and environmental optimisation and management, enhanced search and rescue capability, secure sovereign defence capability and, eventually, commercial intercontinental passenger and medical emergency flights at hypersonic speeds.

A further highlight of the hypersonic research in Queensland is its contribution to workforce capability development. Graduates and experts who have participated in the Queensland hypersonics program have not only developed the aforementioned hypersonic technologies, many have gone on to become research and industry leaders in defence, aerospace, and the space industry worldwide (DTSG, NASA, German Aerospace Centre (DLR), RocketLab).



Opportunities for growth

The global market outlook for aerospace presents many domestic and international export opportunities for Queensland in the short, medium and long-term.

Queensland's aerospace industry is well-placed to meet the projected increases in demand for aviation and aerospace goods and services in the Indo-Pacific region.

Key opportunities for supply chain and export opportunities in the Indo-Pacific region include education and training, advanced manufacturing and design, high-value MRO, engineering services, innovation and research and development.

The opportunities for aerospace growth and development are unchanged and will come from the opportunities outlined below.

Civil aerospace MRO

The aerospace MRO market in the Indo-Pacific region is expected to grow in the medium to long-term.

Aside from providing opportunities to grow the value of existing MRO services, the expansion of the air fleet in the Indo-Pacific region will present new opportunities for Queensland's aerospace industry.

Queensland's aerospace companies have a broad and technically sophisticated range of capabilities. This makes them well-equipped to successfully compete in selected high-value niche MRO opportunities, such as providing services for gas turbine engines, emerging technologies and advanced engineering services.

As aircraft design and technology advances, the number of technicians with the skills and knowledge required to sustain older aircraft

models diminish. Queensland is home to the core of Australia's ageing aircraft technology and know-how. It is an area in which the state can excel, and demand for MRO services for older aircraft is likely to become a lucrative niche market to target.

Research and development

Similarly, Queensland's strong research and development capability and innovative companies will position the state to capitalise on opportunities that arise from the push toward environmentally friendly, fuel-efficient, quiet aircraft. The trend is driving innovation in aircraft structures, on-board systems, engines, materials, and low-carbon, sustainable aviation fuels.

Niche manufacturing

There are significant opportunities for Queensland's precision manufacturing expertise, vacuum brazing and heat treatment for avionics and components and large-scale super alloy casting for jet engines.

Key aerospace skills

Queensland boasts a number of world-class training businesses, offering training for pilots, technicians and engineers.

For example, Aviation Australia was established by the Queensland Government in 2001 to support the development and growth of aviation and aerospace industries in both the Australian and international markets. Aviation Australia provides training across a broad range of aerospace qualifications at four campus locations across Australia.

The growth in demand for aerospace services and aircraft in the Indo-Pacific region and the projected demand for thousands of newly trained and qualified pilots and technicians provides a substantial opportunity for Queensland to grow this sector.

Opportunities for providing training and education services will cover both training provided in-country and for international students who come to Australia to complete their training requirements.



Image courtesy of Hypersonix

Female Aircraft Maintenance Engineering program (FAME)

Aviation Australia, Queensland's public provider for aviation training, launched the FAME initiative in 2022.

FAME, is a unique program designed to increase female participation and diversity in aircraft maintenance. FAME is establishing a community of female aircraft maintenance engineers not limited by company boundaries. These students are building a network across Australia and long term, sustainable relationships with like-minded women that will become a hallmark of FAME.

FAME students study towards a Certificate IV in Aeroskills in Brisbane and Cairns through Aviation Australia's institutional program, before being

employed as an apprentice or trainee aircraft maintenance engineer. The strength of FAME is its direct partnership with and sponsorship by industry. Throughout their training students are connected with industry partners where they can network with potential employers to explore future opportunities, undertake work experience and participate in additional practical training and social events. The 2022 FAME intake of 20 students is the largest number of female students undertaking engineering training in one cohort with Aviation Australia.





Image courtesy of Department of Defence



Defence aerospace investment

Over the next decade, tremendous opportunities will emerge in the defence sector.

Australia is growing its defence sector capabilities in response to changing security environments. Consequently, the increased investment in this sector is creating opportunities for aerospace businesses in Queensland in areas where they have significant existing capability including helicopter training, turbine engine MRO and aircraft systems integration.

The majority of Defence engine MRO providers are based in Queensland, including TAE Aerospace, Asia Pacific Aerospace (APA) and Standard Aero.

The establishment of the TAS DCRC headquarters in Queensland is providing the platform to create game-changing technologies and positioning the state as

an international UAS centre of excellence and the go-to-location for the next generation of defence projects.

Uncrewed aerial systems – UAS

Autonomous and remotely piloted systems have emerged as a market disrupter and a dynamic growth industry this decade across the globe.

This growth is a result of the increasing number of applications for UAS and AAM in areas such as infrastructure monitoring, agriculture, mining and resources, government services, defence, E-commerce and deliveries, urban/regional air mobility and recreational use.

Space technologies

Queensland's research organisations are undertaking important projects across a broad range of areas that will have future aerospace

applications. In particular, many of these technologies have application for space technology as well as broader uses in civil and military aircraft.

Queensland researchers are key partners in a cooperative research program with the USA and Boeing to understand hypersonic flight technology and explore its potential for next generation aeronautical systems.

This will place Queensland in a prime position to capitalise on the commercial space market as it develops and matures.

Queensland is also involved with cutting-edge research across a broad array of disciplines that have significant implications for aerospace. These include research and development of nanotechnology applications and the utilisation of composite materials like graphene.

Queensland is in a prime position to capitalise on the commercial space market as it develops and matures.



What is graphene?

The Queensland Micro and Nanotechnology Centre at Griffith University is undertaking innovative research on graphene and its commercial applications.

Highly flexible, lighter and stronger than steel, and with excellent thermal and electrical conducting properties, graphene is the new wonder material with endless applications.

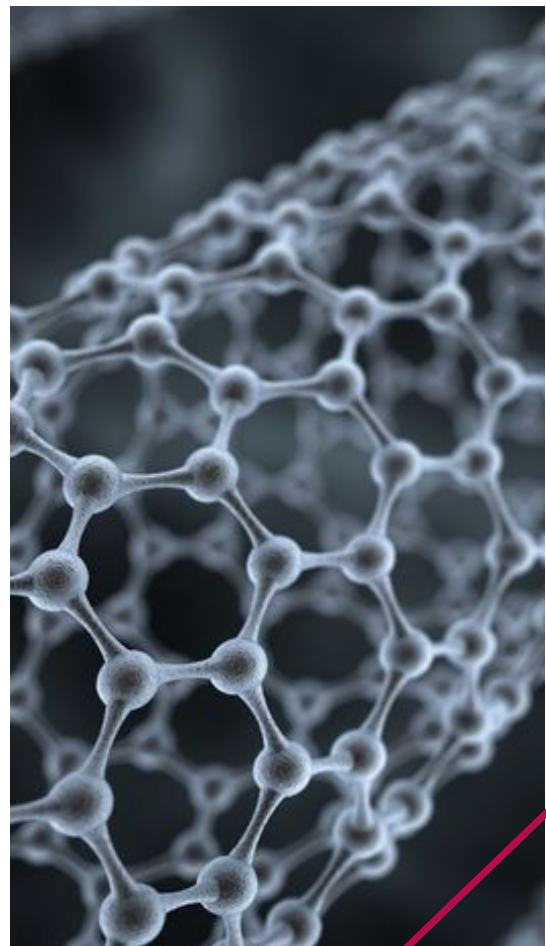
Graphene's unique electrical, optical and mechanical properties make it a potentially transformational technology in a wide range of fields such as electronics, medicine, aerospace, energy and solar, materials and communications.

Graphene's remarkable properties have huge potential for application in the aerospace industry as it is incredibly strong, yet lightweight and flexible at the same time.

At a single atom layer thick, graphene may be the future key to developing the strongest aeroplane to date.

Aviation specialists believe that, used as an ultra conductive covering on aircraft, graphene could prevent a plane's wings from overheating. It could also protect it from potentially devastating damage caused by lightning storms and improve fuel consumption through weight reductions.

Aerospace researchers in the United Kingdom (UK) have already trialled graphene coatings for aircraft wings and are pleased with the initial flight test results. The next stage of their research will look at successfully incorporating graphene into aerospace composite materials.





TAE Aerospace supports Joint Strike Fighter

TAE Aerospace is the leading provider of MRO services for complex gas turbine engines in Australasia, and provides services to military, commercial and industrial engine operators globally. The company was established in Queensland in 2000, and has since expanded rapidly, growing from 6 to nearly 400 employees across multiple countries, with over 120 based in Queensland.

TAE Aerospace is Australia's sovereign military gas-turbine engine through-life-support provider. It is contracted to deliver engineering, maintenance and logistics services for the RAAF's F/A-18 aircraft engines – both the Hornet and Super Hornet – and BAE Systems Hawk Lead In Fighter Trainer. TAE Aerospace also supports the engines used in the F-35 Joint Strike Fighter (JSF). In 2015, the company was assigned as the Indo-Pacific regional MRO and upgrade depot with responsibilities for the F-35 JSF engine not only for the RAAF but for other operators. With the first aircraft arriving in Australia in 2018, and all 72 expected to be fully operational by 2023, TAE Aerospace continues to consolidate long-term expansion plans for its operations and highly-skilled workforce.

TAE Aerospace was also the first Australian company to develop aluminium vacuum brazing technology and is one of only a few companies worldwide able to provide the process. Aluminium vacuum brazing is a leading-edge manufacturing process for fusing aluminium components together, resulting in lightweight, high-strength, reliable end products. Since 2011, this capability has enabled TAE Aerospace to deliver multiple advanced liquid-cooled electronics enclosure and heat exchanger parts for the F-35 Lightning II JSF aircraft being acquired by multiple Air Forces, including those being acquired by the RAAF.



Key industry challenges

While the opportunities for the aerospace industry are significant, and the Queensland Government is determined to achieve the ambitious vision developed for the sector, there are also some challenges that need to be addressed.

The defining challenge across the aerospace industry globally is the impact of the COVID-19 pandemic and the speed at which the industry can recover. This will no doubt bring opportunities to the fore as the industry regroups, realigns and prepares for the future de-carbonisation of aviation.

This roadmap, initially prepared after consultation across a broad range of individuals and businesses involved with the aerospace sector, has been revised, although key industry challenges continue to include:

Compliance with regulation and certification requirements

The aerospace industry is subject to a complex and extensive regulatory framework. Aviation and aerospace regulations are managed by the Australian Government and administered by the Civil Aviation Safety Authority (CASA). Internationally, the main regulatory agencies are the Federal Aviation Administration and the European Air Safety Authority.

The aerospace industry is experiencing rapid changes in technology but the regulatory system can appear to be cumbersome and unresponsive to industry advancements. Concerns raised by industry included slow responses from regulatory agencies as new technologies emerge, and the need for a more internationally harmonised approach to regulation. Aerospace businesses are subject to high costs associated with compliance and certification, so time delays in responding to new technologies and advances can significantly impact the industry.

The harmonisation of aerospace regulations with overseas jurisdictions will maximise export, training and trade opportunities.

Attracting and retaining relevant skills and meeting training needs

Industry is experiencing shortages of skilled engineers and are concerned that the shortage will increase within five to six years — particularly at senior technician, graduate and post-graduate levels — in the aerospace manufacturing base. The decline in the number of high school students enrolling in science, technology, engineering and math (STEM) subjects, and the ongoing decline of students seeking qualifications in these disciplines will increase future skills shortages.

Industry also identified the opportunity to broaden the skills base of engineers and technicians looking to work within the aerospace sector, so they can obtain management and business related skills. This is important to ensure that appropriate career opportunities are available, and businesses can respond to future needs.

Marketing Queensland's aerospace industry capabilities

A frequent challenge raised in consultation with industry was the difficulty in making the capabilities of the Queensland aerospace industry understood globally.

Given the high-level of global competition in this sector, this means getting out and being seen. Promotion of the industry's capabilities and the benefits of Queensland as a preferred destination for aerospace is critical to growing the industry's access to global supply chains.

There is a need for the industry to ensure it can identify emerging opportunities to broaden access to global supply chains, selling to a wider range of aircraft and equipment manufacturers across a broader front of defence and civil platforms.



Image courtesy of Department of Defence

Actions to date

Trusted Autonomous Systems Defence Cooperative Research Centre

The 2017 decision by the Department of Defence to locate Trusted Autonomous Systems Defence Cooperative Research Centre (TAS DCRC) headquarters in Brisbane was based on Queensland's depth of capabilities. TAS has over \$170 million dollars (inclusive of cash & in-kind contributions) invested to date into industry-led projects and supporting common good activities into ethics, law and assurance of autonomy. TAS-funded, Queensland grown SMEs Cyborg Dynamics Engineering and Skyborne Technologies have partnered with University of Queensland and Defence Science and Technology Group to develop artificial intelligence to enhance the legal and ethical human decision-making of live reconnaissance and fire support missions. Another project is based on using Queensland grown advance autonomy platform technology led by Boeing Defence Australia to examine the application of machine learning techniques on board a set of uncrewed coordinating aircraft systems to better understand and respond to complex operational environments. The TAS DCRC is also leading a Queensland Government supported Assurance of Autonomy effort to unlock Queensland and Australian industry capacities to apply autonomous systems innovation into operational capabilities and develop assurance accreditation processes for autonomous systems. TAS DCRC hosted its national Accelerating Trusted Autonomous Systems Symposium in Townsville in April 2021 and has another Symposium Accelerating Cross-Domain Autonomy Symposium in June 2022.

Advance Queensland

The Queensland Government's Advance Queensland initiative is a key driver of economic growth and job creation, particularly in our regions. It is driving innovation opportunities for Queensland innovators and companies to compete globally, attract investment and reach new markets. Advance Queensland is investing in innovation to support new skills and talent, help transform existing industries, create new industries, strengthen sovereign capability and prepare Queensland for tackling the challenges of tomorrow. Advance Queensland focuses on building Queensland's strengths, growing our regions' unique competitive strengths to compete globally, scaling up local solutions for new markets and investing in science and technology. This includes unlocking opportunities for both our traditional and emerging industries through new applications of our resources and skills.

Advance Queensland has supported the development of Queensland's aerospace industry and will continue to focus on our strengths in autonomous systems, artificial intelligence and robotics. Queensland aerospace companies that have participated in Advance Queensland initiatives include The Boeing Company and its subsidiary Insitu Pacific, Evolving Machine Intelligence Pty Ltd, CB Aerospace Pty Ltd, Skyborne Technologies, V-TOL Aerospace Pty Limited, SkyNet Satellite Communications.

Avalon Airshow

The Queensland Government is a regular participant at the biennial Avalon Airshow, hosting a stand with Queensland industry partners to promote Queensland as one of Australia's leading aerospace and air defence destinations. Avalon is the Indo-Pacific region's most prestigious aviation, aerospace and air defence event and presents an unrivalled opportunity to showcase Queensland as an international aerospace destination and promote Queensland's capabilities, products, technologies and services to a highly targeted international audience.

Skilled workforce

Queensland has a highly skilled, motivated and employment-ready workforce. World-class tertiary facilities and a network of vocational education and training providers will ensure that the training and skills needs of the aerospace industry will be met into the future.

Workplace training programs can be designed and delivered through a number of universities with aerospace-specific programs or registered training organisations, which work with aerospace firms to tailor courses to particular skill requirements.

The Queensland Government has been active in supporting both current and future aerospace training needs by working with private stakeholders to establish programs that provide pathways for careers in aerospace. The Queensland Defence, Maritime, Aerospace and Space Skills implementation plan focuses on the challenges to engage and attract, and train and retain a highly skilled, STEM proficient workforce that can react quickly and effectively to expand and refocus operations in-line with demand. Addressing the skilling challenges for tomorrow's workforce will be reliant on the ongoing collaboration between employers, industry, vocational and tertiary institutions, peak bodies and government.

Aviation Australia was established by the Queensland Government in 2001 to support the development and growth of aviation and aerospace industries in both the Australian and international markets. Aviation Australia provides training across a broad range of aerospace qualifications, at four campus locations across Australia (Brisbane, Cairns, Melbourne, Darwin and Perth), and a college in Riyadh, Saudi Arabia. In 2022, Aviation Australia launched the Female Aviation Maintenance Engineers (FAME) program to increase female participation to help meet the growing demand for engineering skills in industry.

Aviation Australia

Aviation Australia is a world-class registered training organisation, established by the Queensland Government in 2001. It offers a wide range of courses for those aspiring to careers in aviation including engineering, cabin crew, pilot and remote pilot training, with campus locations in Brisbane, Cairns, Melbourne, Perth and Darwin, and a college in Riyadh, Saudi Arabia. For those already leading a successful career, it provides the opportunity to upskill or gain professional development, with a variety of short courses. It is a partner with airlines and aerospace companies, governments, defence forces and regulatory authorities, with graduates working worldwide.

Aviation Australia hosts the nation's only aviation careers expo at its Brisbane campus located adjacent to the international airport. Visitors to the Expo can explore the many employment opportunities available within the aviation industry and connect with representatives from Australia's leading commercial airlines, the ADF and a range of training providers to get expert guidance on a career in the aviation industry.

The Queensland Defence Science Alliance (QDSA)

Established in 2021, the government has partnered with seven leading Queensland universities, industry partners, and the DSTG to establish the Queensland Defence Science Alliance (QDSA). This alliance fosters collaborative research and development opportunities between defence industry and the tertiary academic sector to enhance Queensland's capability pipeline to rapidly translate ideas into reality within the Defence enterprise in support of Australia's sovereign industrial priorities.



STEM strategy in Queensland state schools

A focus on STEM within Queensland state schools is a priority area of the Queensland Government's Advancing Education action plan. By building teacher capabilities and engaging more students in STEM learning, and working in partnership with industry, universities and the community, Queensland students can help meet the increasing demand for STEM graduates in knowledge-intensive industries such as aerospace. The Queensland Government has developed strategies to increase participation in STEM in schools and universities to address industry skills providing more than \$81 million (2018-2021) through Advancing STEM in Queensland primary schools to lift student engagement and outcomes in STEM.

These include:

- › access to a STEM champion in every region
- › engaging students in STEM learning through real-world coding competitions, opportunities to work with industry experts and connecting students across the state through STEM hubs and virtual academies
- › promoting the participation of girls in STEM learning and career pathways through the STEM Girl Power Initiative
- › implementing digital technologies and STEM-specific resources to develop critical and creative thinking, and problem solving in Queensland students.

Advance Queensland – increasing participation in underrepresented groups by:

- › STEM funding for female researchers at Queensland universities and other publicly funded research organisations
- › STEM.I.AM program for Aboriginal and Torres Strait Islander students at Queensland Universities.

Aerospace Gateway to Industry Schools Program

The Queensland Government worked with private stakeholders to establish the Brisbane-based Aviation State High School and the Aerospace Gateway to Industry Schools Program. Selected Queensland secondary schools (government and non-government) engage and partner with aerospace industries, tertiary education, and training providers to inspire students to consider a skilled, diverse, and sustainable career or pathway into the exciting aerospace industry sector.

These initiatives have proven essential in meeting the Queensland Government's aim of transitioning young people from school to work while completing school and gaining formal qualifications.



Queensland Government funding programs have been instrumental in the development and support of the:

QANTAS Group Pilot Academy

The Qantas Group Pilot Academy officially opened in January 2020 and is located on the Darling Downs at Toowoomba's Wellcamp Airport. Construction of the academy created around 100 jobs, while also supporting an additional 300 jobs along the construction supply chain. At full capacity, the academy will train up to 250 pilots a year, with up to 160 new jobs created in training and support roles. The academy offers a range of CASA licences and ratings. Students can live onsite in world-class accommodation when training for their flying qualifications.

QANTAS Group Flight Training Centre

The Qantas Flight Training Centre, located at the Brisbane Airport precinct, houses flight simulators across a range of aircraft types including the Boeing 787, 767 and 737, as well as Dash 8 Q400. The Flight Training Centre trains QANTAS crews at their home base. The Flight Training Centre supported an estimated 47 construction jobs and created at least 18 direct new jobs and has capacity to train up to 900 new pilots each year.

Jet Aviation Australia (formerly Hawker Pacific)

Jet Aviation Australia, a global aviation firm located at Cairns Airport, is contributing to the growth of the aviation sector in Cairns with its \$4.5 million hanger expansion. Increasing its hangar facilities by 50% positioned Jet Aviation Australia to compete for heavy maintenance work, particularly on turboprop and jet-powered commercial aircraft, from Australia, New Zealand, Asia and Pacific nations enabling the work to be secured in Queensland, where it may otherwise have gone to Asia or Europe. Already a significant employer in Cairns, Jet Aviation Australia's expansion has created an additional 40 highly skilled jobs, including local apprenticeships.

Ansett Aviation Training

Ansett Aviation Training established its Brisbane Simulator Training Centre at Brisbane Airport to house Australia's only ATR 600 flight simulator and other simulators including the Fokker F100. The Centre created eight highly specialised jobs and offers training for the world's most popular medium aircraft in the growing Indo-Pacific region. The simulators each provide an average of 4000 training hours per year, with the capacity to train 2000 pilots annually, each of whom is expected to visit the facility about three times a year.





Alliance Airlines Maintenance Facility

Alliance Airlines' \$60 million aviation MRO facility at Rockhampton Airport will maintain the company's growing fleet of aircraft. Alliance Airlines will onshore the major maintenance activities previously carried out overseas. The MRO facility will create 98 new long-term jobs, including 81 highly skilled aircraft maintenance engineers by 2024 and boost the Queensland economy by almost \$195 million over the next 10 years. Alliance Airlines is undertaking additional wet leases, and is growing its fleet of Embraer E-190 aircraft to add to its large fleet of Fokker aircraft. The MRO facility is expected to be a catalyst for further regional development, attracting high-value speciality freight and logistics suppliers and a range of aeronautical support companies, including suppliers of avionics and aerospace technologies, engine maintenance, wheels, tyres, brakes and landing gear, interiors and upholstery and cabin accessories.

MRO Australasia

MRO Australasia is the latest showcase in a global series of aviation industry MRO events convened by the Aviation Week Network, bringing together aerospace industry champions from Australia and the Oceania Region. The inaugural MRO Australasia conference held in Brisbane in 2020, positioned Queensland as an aerospace industry leader. The two-day conference attracted more than 280 attendees from the MRO community to learn about the crucial issues that impact the MRO business in this region. The event is the leading Australasian platform for supplier and decision-maker networking, and an opportunity for buyers to learn, test and purchase new MRO solutions and services. A further two conferences are planned for the future.

Defence and Aerospace Industry Development Fund

The Queensland Government Defence and Aerospace Industry Development (DAID) Fund has offered financial support to more than 60 SMEs who are sharing in more than \$750,000 of matched funding to achieve internationally recognised certifications to increase their competitiveness for supply chain opportunities.

Addressing the challenges and opportunities

Queensland's strengths



Capability and expertise



Proximity to growing markets



Large areas of airspace



World-class R&D

Challenges and opportunities

Key strategy 1

Grow Queensland's aerospace industry and create high-value, knowledge-based jobs

Key strategy 2

Enhance Queensland's level of industry capability to access new national and global supply chain opportunities and international markets

Key strategy 3

Promote Queensland as a preferred destination for aerospace capability, servicing both national and global markets



Accessing global aerospace supply chains



Promoting capability



Compliance with regulation



Promoting capability



Attracting and retaining a skilled workforce

Priority actions

Priority actions 1.1, 1.2 and 1.3 supported by 14 sub-actions



Priority actions 2.1 and 2.2 supported by 8 sub-actions



Priority action 3.1 supported by 4 sub-actions



Queensland Aerospace 10-Year Roadmap and Action Plan

VISION

By 2028, the Queensland aerospace industry will be recognised as a leading centre in Australia and South East Asia for aerospace innovation in training; niche manufacturing; maintenance, repair and overhaul (MRO); and uncrewed aerial systems (UAS) applications for military and civil markets.

Strengths



Large existing range of capability and expertise across the sector



Proximity to the large and growing markets of the Indo-Pacific and the Middle East



Large areas of airspace suitable for training, development and testing activities



World-class research and development agencies

Challenges



Compliance with regulation and certification requirements of domestic and international markets



Availability of relevant skills and ensuring training meets the needs of industry as aerospace technologies evolve



Marketing the Queensland aerospace industry's capabilities



Accessing global aerospace supply chains

Key Strategy 1

Grow Queensland's aerospace industry and create high-value, knowledge-based jobs

Priority 1.1

We will work with Queensland industry and research organisations to grow Queensland as an international hub for uncrewed aerial systems (UAS) by:

- 1.1.1** continuing to position Queensland as an UAS centre of excellence in the Indo-Pacific region
- 1.1.2** pursuing opportunities for innovative application of UAS technologies through facilitating collaboration between the Trusted Autonomous Systems Defence Cooperative Research Centre (TAS DCRC) and other research institutions and industry
- 1.1.3** supporting Queensland-based SMEs' access to UAS research, development, and testing services
- 1.1.4** continuing engagement with the Commonwealth-State Drones Working Group and contribute to the National Emerging Aviation Technologies (NEAT) Policy Statement
- 1.1.5** promoting opportunities for the utilisation of the Queensland Flight Test Range (QFTR) under the Australian Government's Emerging Aviation Technology Partnerships Program.

Priority 1.2

We will work with industry to assist Queensland businesses to target emerging capability areas such as UAS, niche manufacturing, training, MRO, space, hypersonic technologies and other Defence sovereign industrial capability priorities by:

- 1.2.1** targeting Australasian and South East Asian markets for export of UAS, niche manufacturing, niche MRO capabilities, and space and hypersonic technologies
- 1.2.2** working with the MRO industry, the R&D Sector and relevant training organisations to develop a pathway for growth driven by innovation and emerging technologies
- 1.2.3** supporting developments in Queensland's hypersonic and other emerging technologies
- 1.2.4** facilitating engagement and collaborative opportunities between aerospace and space industry leaders with education and training organisations to identify and address future industry skilling and re-skilling needs and promote career pathways.

Priority 1.3

We will assist Queensland small-to-medium enterprises (SMEs) access defence contracts directly and through supply chain opportunities by:

- 1.3.1** partnering with key defence stakeholders, to attract major defence projects with inter-generational sustainment horizons to Queensland
- 1.3.2** providing assistance through the Defence and Aerospace Industry Development Fund to adopt contemporary manufacturing processes and obtain compliance with internationally recognised industry certifications and accreditations such as ISO 9100
- 1.3.3** promoting awareness of funding programs offered by other Queensland Government and Commonwealth Government agencies
- 1.3.4** connecting SMEs with capability development services and programs offered by the Commonwealth and other third-party providers
- 1.3.5** maintaining ongoing engagement with the Australian Defence Organisation and industry peak bodies such as the Australian Industry & Defence Network (QLD).

Key Strategy 2

Enhance Queensland's level of industry capability to access new national and global supply chain opportunities and international markets

Priority 2.1

We will work to secure a greater portion of national aerospace work, including in regional Queensland, by:

- 2.1.1** working with aerospace prime contractors to identify suitable Queensland businesses to join their defence and civil supply chains, strengthening Queensland's participation in emerging and sovereign capability in national and international projects such as F-35 JSF program
- 2.1.2** utilising the Defence Industry Hubs to engage with businesses to increase their aerospace industrial capabilities
- 2.1.3** delivering capability development programs across Queensland and working with key partners to expand and identify other services critical for industry capability development.

Priority 2.2

We will work with the aerospace industry to assist Queensland businesses to enter global supply chains by:

- 2.2.1** providing facilitation services for aerospace businesses to access new and/or expanding markets
- 2.2.2** providing support to identify and capitalise on supply chain opportunities
- 2.2.3** encouraging collaboration between industry and research organisations
- 2.2.4** facilitating businesses to access and adopt skilling and reskilling programs, innovation and emerging technologies
- 2.2.5** advocating for the harmonisation and alignment of Australian standards and regulations with international regulations and certifications to assist industry to remain internationally competitive.

Key Strategy 3

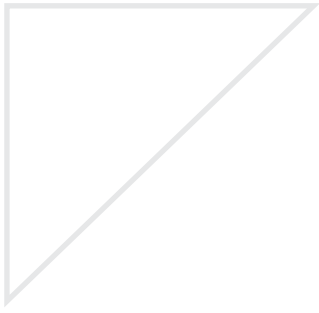
Promote Queensland as a preferred destination for aerospace capability, servicing both national and global markets

Priority 3.1

We will promote Queensland industry capability to national and international civil and military aerospace markets by:

- 3.1.1** promoting Queensland as a national and international destination for traditional aerospace capabilities as well as emerging sectors including UAS, niche manufacturing, training, MRO, space, hypersonics and testing new technologies

- 3.1.2** showcasing Queensland aerospace industries internationally by working with Team Defence Australia, Trade and Investment Queensland, and across Queensland Government agencies, to maximise opportunities for Queensland aerospace businesses to access new and expanded markets
- 3.1.3** supporting significant regional aerospace conferences and events in the region
- 3.1.4** stimulating Queensland MRO export opportunities through participating at targeted international events such as MRO Asia-Pacific.



Notes

ⁱ Asia-Pacific, 2022 Fleet & MRO Forecast presentation to Aviation Week Network Conference in Singapore, September 2021

ⁱⁱ KPMG Australia's Aerospace Industry Capability; Research and Economic Modelling of the Aircraft, Manufacturing and Repair Services Industry in Australia 12 June 2019

ⁱⁱⁱ Queensland Space Industry Strategy 2020-2025, February 2020

^{iv} Queensland Government, Queensland Drones Strategy, June 2018

^v Aerodynamic Advisory and Teal Group Corp 2018 (<https://www.tealgroup.com/index.php/pages/press-releases/53-global-aerospace-industry-worth-838-billion-according-to-aerodynamic-advisory-and-teal-group-corporation>)

^{vi} Deloitte Access Economics, 2020 global aerospace and defense industry outlook (<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/energy-resources/us-2020-global-aerospace-defence-outlook.pdf>)

^{vii} <https://www2.deloitte.com/us/en/pages/manufacturing/articles/global-aerospace-and-defense-industry-outlook.html>

^{viii} Deloitte Access Economics, 2021 aerospace and defense industry outlook (<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/manufacturing/us-2021-eri-aerospace-defense-industry-outlook.pdf>)

^{ix} Asia Pacific 20 year Forecast 2019 (<https://www.iata.org/pressroom/pr/Pages/2016-10-18-02.aspx>)

^x Statista (<https://www.statista.com/statistics/814836/helicopters-fleet-size-worldwide/>)

^{xi} Boeing Pilot and Technician Outlook 2020–2039, October 2020 (https://www.boeing.com/resources/boeingdotcom/market/assets/downloads/2020_PTO_PDF_Download.pdf)

^{xii} Deloitte Access Economics, Economic Benefit Analysis of Drones in Australia, 23 October 2020

^{xiii} Queensland Hydrogen Industry Strategy 2019-2024

^{xiv} DSDILGP, Economic Advisory Estimates, March 2021

^{xv} Defence Science and Technology Group, 2021

Glossary

ADF	Australian Defence Force
AEWC	Airborne Early Warning and Control
CASA	Civil Aviation Safety Authority
Defence	Australian Defence Organisation comprising of both the military and public service elements
HIFiRE	Hypersonic International Flight Research Experimentation
ISR	Intelligence, surveillance and reconnaissance capability
MRO	Maintenance, repair and overhaul
MRTT	Multi role tanker transport
NGTF	Next Generation Technologies Fund
OEM	Original equipment manufacturer
QUT	Queensland University of Technology
RAAF	Royal Australian Airforce
RPAS	Remotely piloted aircraft systems
STEM	Science, technology, engineering and mathematics
TAS DCRC	Trusted Autonomous Systems Defence Cooperative Research Centre
TIQ	Trade & Investment Queensland
UAS	Uncrewed aerial systems
UAV	Uncrewed aerial vehicle
UQ	University of Queensland
VSAT	Very small aperture terminals





Image courtesy of Cloncurry Mustering Company





Queensland
Government

