

AUSTRALIAN SPACE

OUTLOOK

2024 EDITION

OPENING INTERVIEW

Enrico Palermo
Head, Australian Space Agency

INTERVIEW

**Major General
Greg Novak**
Defence Space Commander

OP-ED

**Katherine
Bennell-Pegg**

First Astronaut Trained under
the Australian Flag

ARTICLES

Roo-ver Prepares
for Moon Mission

Cyber in Space:
The Good, the Bad
and the Ugly

Equatorial Launch
Australia: A Company
on a Mission

Electro Optic Systems
Steps up its Tracking
Capabilities

Technology Safeguards
Agreement Opens the
Door for Growth

Streamlining Regulations
can Propel the Space
Sector to new Heights



SPACE TRAINING IN AUSTRALIA • ONE GIANT LEAP FOR AUSTRALIAN YOUTH



Real-world research. Out-of-this-world outcomes.

Australia has joined the global effort to return to the Moon and onto Mars, leading the world in robotics and autonomous systems. QUT is at the forefront, adapting its terrestrial expertise to global space missions and building a world-class lunar facility to test new technologies.

Our real-world research is trusted by industry partners to build robots and autonomous vehicles to explore new frontiers while improving life on Earth. QUT researchers work with NASA Rover Missions identifying chemicals at a tiny scale, searching for signs of ancient life.

QUT and its partners have developed technologies that could guide lunar rovers to land on the Moon from 2026. We're building a logistics robot for cargo transfer on the Lunar Gateway, which will orbit the Moon and provide support for deep space exploration. Work with world-leading researchers to research, develop and build your next commercial space venture.

To find out more about partnering with QUT, visit qut.edu.au/industry-research-partnerships

**the university
for the real world**



Contents



42



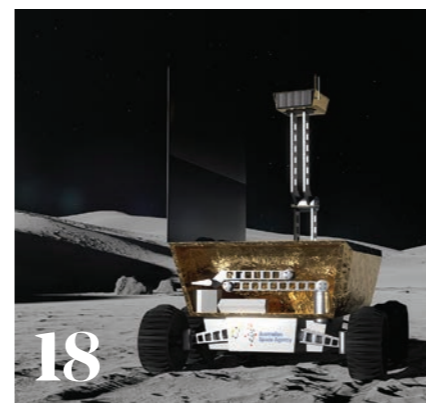
13

AUSTRALIAN SPACE AGENCY ENTERS SCALE UP PHASE 13

It is time to stop viewing it as a new organisation with potential and, instead, consider some of its achievements.

AUSSIE ROO-VER PREPARES FOR MOON MISSION 18

One of the flagship projects for the Australian Space Agency and for the wider Australian space industry is the Moon to Mars initiative.



18

OP-ED: KATHERINE BENNELL-PEGG 22
'What would my 10-year-old self be thinking right now?'

KBR: THERE FROM THE BEGINNING OF SPACE FLIGHT 26

Global engineering services provider KBR has a 50-year track record of working on space flights and has been involved with every manned NASA mission, so it is well placed to play a strong role in supporting the development of Australia's space industry.



22

SPACE COMMAND ENHANCES AUSTRALIA'S DEFENCE CAPABILITY 29

Although Australia's Defence Space Command is a "young command", it cannot be considered a start-up because it is leveraging decades of work by Defence and the civilian sphere.

CYBER IN SPACE: THE GOOD, THE BAD AND THE UGLY 38

Space industry cyber threats and solutions.

EQUATORIAL LAUNCH AUSTRALIA: A COMPANY ON A MISSION 42

Equatorial Launch Australia scored a major first for the domestic space industry in 2022 when NASA used the company's Arnhem Space Centre for its first-ever launch from a fully commercial spaceport.

ELECTRO OPTIC SYSTEMS STEPS UP ITS TRACKING CAPABILITIES 48

As space becomes more crowded with satellites, particularly in lower orbits, the tracking of space objects and debris has become critical.

TECHNOLOGY SAFEGUARDS AGREEMENT OPENS THE DOOR FOR GROWTH 51

Australia's collaboration with the US space industry can move to new levels after the signing of the Technology Safeguards Agreement between the two countries in October 2023.

ONE GIANT LEAP FOR AUSTRALIAN YOUTH 54

OGLA has made a huge impact over the last 12 months delivering programs such as Aerospace Camp, Aerospace Academy, the Global Space Challenge and much more.

FROM CLASSROOM TO COSMOS: SPACE TRAINING IN AUSTRALIA 58

Upskilling people sufficiently to be effective contributors to the space industry requires a balance between training organisations instilling the industry essentials and companies delivering training specific to their business.

UNLOCKING THE STARS: HOW STREAMLINING REGULATIONS CAN PROPEL THE SPACE SECTOR TO NEW HEIGHTS 62

In our quest to boldly go where no one has gone before, we, collectively, need to be reminded of our duty to proceed with caution and respect.



29



54

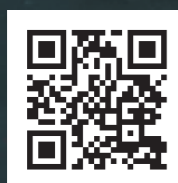
FIND SPACE IN ADELAIDE

SOUTH AUSTRALIA -THE PRIME PLACE FOR SPACE IN AUSTRALIA.

Home to the Australian Space Agency, Australian Space Discovery Centre, Mission Control Centre and over 100 space-related organisations, South Australia is at the forefront of the nation's space endeavours.

A centre-of-gravity for space activity, South Australia is pushing the frontiers of innovation, driving collaboration, developing new technologies and growing an enduring sovereign space capability.

Explore the possibilities now at SASIC.SA.GOV.AU



To the Moon and back

The gravity of lunar missions and South Australia's blazing trail.

Lunar missions offer an astronomical amount of valuable knowledge and far-reaching benefits for Earth.

Through programs like NASA's Artemis Missions, South Australia is utilising space technology to develop world-leading innovation for better outcomes on Earth.

Under the Australian Space Agency's Moon to Mars Trailblazer initiative, two consortiums have been granted \$4 million each for the development of lunar rovers, designed to collect lunar soil in a major step toward sustainable human presence on the Moon.

A key partner in both consortiums is the University of Adelaide, contributing

expertise from programs such as the Australian Rover Challenge (ARCh), testing of lunar rover prototypes, student internships and PhD research.

The ARCh event, held annually in South Australia, is noted as the most technically complex rover challenge in the world. It sees university students from around the globe battle it out in a full-scale Lunar mission, using semi-autonomous rovers designed and built by themselves.

"The competition aims to provide solutions that aid long-term human habitation on the moon and other planets," says Associate Professor Rini Akmeiliawati of the Robotics and Automation Research Group and ARCh

judge at the University of Adelaide. "The program provides space mission experience for future scientists, engineers and astronauts, and uniquely places South Australia at the frontier of technological innovation and capability building in remote robotics testing and design."

To aid in the research and development of lunar rovers, March 2024 saw the University of Adelaide unveil a new large-scale rover testing facility at its Roseworthy campus. Among other things, the Roseworthy site will enable research regarding human-robot exploration, with teams of rovers, flyers and astronauts working together.

Associate Professor John Culton, Director of the Andy Thomas Centre for Space Resources at the University of Adelaide, is championing this new development.

"The new facility allows our researchers and industry partners to move from our globally unique North Terrace Extraterrestrial Environment Simulation Lab to full scale field trials in a 4,000m2 instrumented test range, complete with a rover workshop and mission control."

One of the Trailblazer consortia, the ELO2 Consortium, includes another two trailblazing South Australian-based companies—Inovor and Saber Astronautics.

"The Moon to Mars Trailblazer program is leading the way in space exploration and advanced manufacturing and helps us propel South Australia forward in this space," says Ben Adams, Chief Operating Officer, Inovor Technologies. "The benefits of this initiative extend widely, and not only contribute to global advancement, but also to the sustainability of life on Earth."

While Moon to Mars is a national program, South Australia brings a unique mix of specialised expertise across industry and academia to the table, and the contribution from the state is only expected to increase in Stage 2.

"South Australia is at the forefront, and Inovor is proud to be a key part of this ecosystem which will make a critical contribution to this mission and all future lunar missions," says Adams. ●

AUSTRALIAN SPACE
OUTLOOK

Advertiser Index

Australian Centre for Space Governance	10, 11, OBC
Blacktree Technology	33
CyberOps	30
Defence SA	4, 5
EOS Space Systems	8, 9
Equatorial Launch Australia	12
iLAUNCH Trailblazer	16, 46, 47
Indian Ocean Defence & Security	52
KBR	7
MITRE Australia	28, 36, 37
Queensland University of Technology	IFC, 1, 24, 25
RMIT University	20, 21
Senetas	34
University of New South Wales	50



Asia-Pacific Headquarters
PO Box 16
Bankstown NSW 1885

Publisher & CEO
Ross W. Jobson

Managing Director
David Sanis | david.sanis@faircount.com.au

Business Development Manager
Angela Lyos

Subeditor
Kym Dunbar

Writers
Katherine Bennell-Pegg, Lachlan Colquhoun, Michael Davoren, Rick Doblinovic,
Simon Galbally, Kelly Yeoh

Art Director
Erin Rollestone

Production Coordinator
Jake Brysha | production.sydney@faircount.com.au

Printing
Graphic Print Group

Front Cover Image: Katherine Bennell-Pegg, Supplied

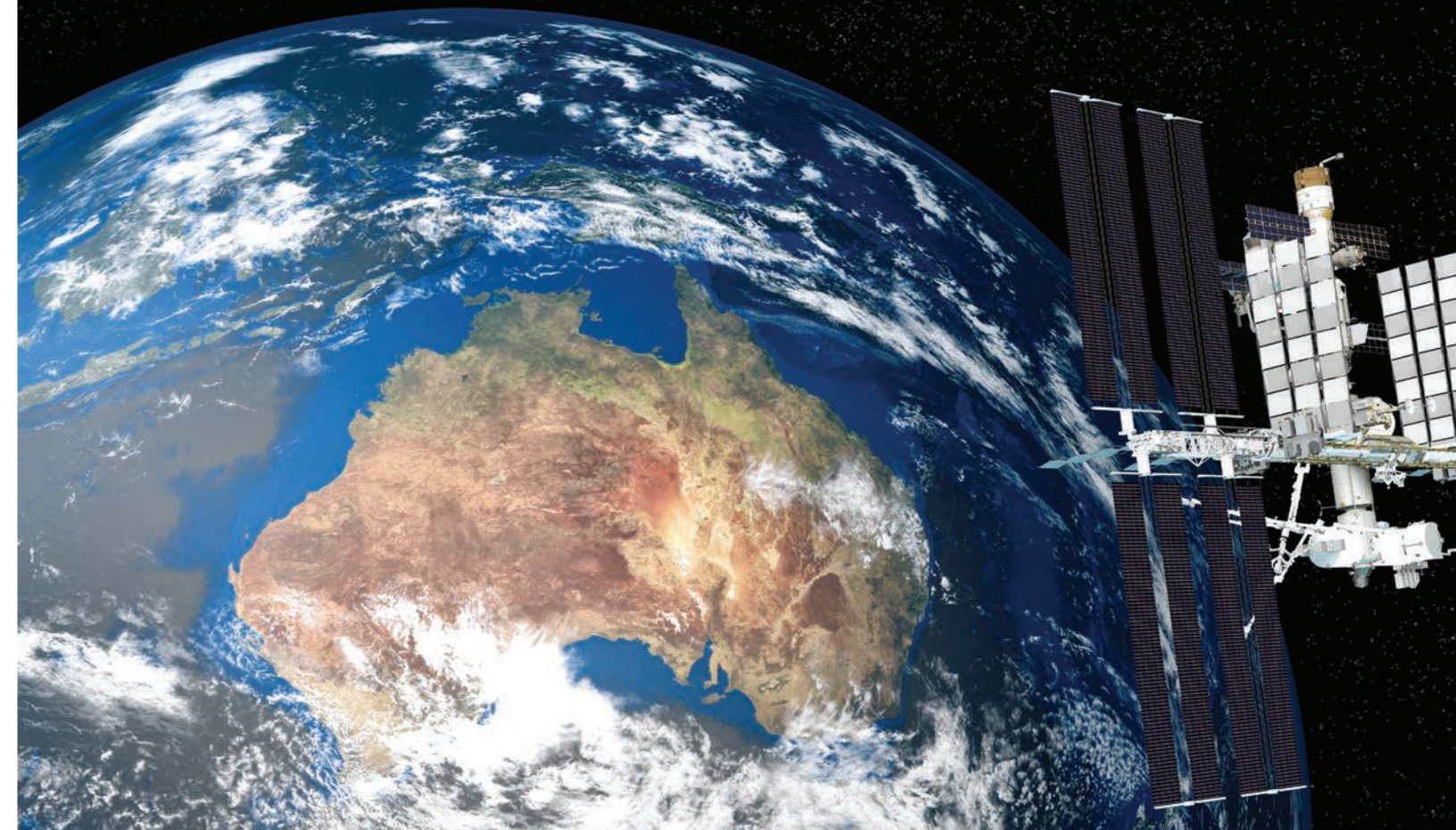
SPECIAL THANKS

The publisher would like to thank the Australian Space Agency for their editorial assistance with some sections of the publication.

©Copyright Faircount Media Asia Pty Ltd. All Rights Reserved. Reproduction of editorial content in whole or without written permission is prohibited. Faircount Media Asia Pty Ltd. does not assume responsibility for the advertisements, nor any representation made therein, nor the quality or deliverability of the products themselves. Reproduction of articles and photographs, in whole or in part, contained herein is prohibited without expressed written consent of the publisher, with the exception of reprinting for news media use. None of the advertising contained herein implies endorsement by the Australian Government and Australian Space Agency. The views expressed in these articles are those of the authors and not necessarily Australian Government and Australian Space Agency. Printed in Australia.



The Team Behind the Mission®



Iron Stallion provides proven and persistent space domain awareness to stay ahead of modern threats by supporting users to determine in real-time what they should focus on and why.

From the forefront of space innovation to the front lines of national security, space situational awareness begins and ends with KBR's sophisticated digital intelligence, cyber and defence technology solutions.

kbr.com

We see further

Advancing Australia's sovereign space capabilities.

What makes EOS unique in the space industry?

EOS stands out due to our unique capabilities, especially in laser technology. We contribute significantly to the Australian space domain and defence industry. We're also expanding our global presence to meet the challenges posed by the increasing number of objects in space, contributing to Australia's assured access to space.

That sounds incredibly complex, how does this technology contribute to space domain awareness?

Our optical systems are able to track small, dim, near, and distant objects very accurately, which is particularly useful in supporting defence activities and understanding potential adversaries' actions and behaviors in space. We fill gaps in global tracking capabilities and provide services to enhance the safety of flight, which is vital for both military and civilian purposes.

Could you elaborate on the range of your tracking capabilities?

We run a network of taskable active (laser) and passive optical sensors that operate 24/7/365 with highly dynamic schedules adapting to short-term and planned tasking orders for global customers. Our sensors are high fidelity, allowing for detailed inspection of space activities, such as satellite proximity operations and manoeuvres.

Are there any areas where EOS is leading globally?

What sets EOS apart is our unparalleled ability in daytime tracking and high energy laser ranging. Optical systems typically

face challenges in high sun conditions, but our systems function exceptionally well even under such conditions, making us leaders in this field. Additionally, we design, build and, operate our own systems, which means we can custom design new capabilities to meet evolving requirements.

Environmental protection in space is becoming increasingly important. How is EOS addressing the issue of space debris, and could you tell us more about your collaboration with EX-Fusion?

Space debris is indeed a growing concern, and EOS is at the vanguard of developing technologies for laser debris removal. Our collaboration with EX-Fusion, a Japanese start-up at the forefront of laser fusion technology, aims to explore the usage of high-power laser technologies from laser fusion to address this problem. Our combined expertise in optical tracking, laser ranging, and high-power lasers positions us to pioneer next-generation space debris tracking and clearing technologies.

Finally, what kind of expertise does your team bring to these tasks?

We have a diverse team with skills in mathematics, physics, mechanical and electronics engineering, laser physics, optomechanical systems, optical design, software, and astrodynamics. It's a broad skill set that all comes together to enhance our capabilities.



EOS contributes significantly to the Australian space domain and defence industry.

James Bennett,
EVP – EOS Space Systems





10

Building a national approach to space

The Australian space sector faces a choice in 2024. Next year, in 2025, we will be hosting the International Astronautical Congress (IAC), the world’s largest gathering of space professionals, and it will only be eight years since we hosted it in 2017. It is rare that a country is selected to host the IAC twice in such a short period of time, and the Australian space sector—private, government and academia—has an opportunity to put its best foot forward. We, therefore, must make a choice about who we are as a space nation—and all of us in the sector have a responsibility in this choice.

The last few years have arguably been dominated by a competition

between Australian states and territories as to which place is the best “space” to be. Bipartisan politics at the federal level and voices from the private sector are decrying that the government has underfunded or not sufficiently supported a fledgling industry. The focus has been on building an industry for the sake of a space economy, and not on the societal benefits of space technologies, nor the ways in which Australia and Australians depend on these technologies.

As we prepare to welcome the world’s space sector to our shores, we need to move away from a splintered, internally competitive approach, and towards a

coherent “Team Australia” approach as to why we invest in and develop space technologies, and what we have to offer our international partners.

We must demonstrate to the world that we have come a long way since 2017. The establishment of our Australian Space Agency in 2018 and the Defence Space Command in 2022 are institutional achievements, but their existence alone is not enough. Australia must be able to show that it is a valuable partner in space programs, a trusted partner in the Asia-Pacific region, and a contributor to the space technologies that are making a difference to the biggest issues of the 21st century.

A national narrative

What we need is a clear national narrative about ourselves as a space nation. And this is not necessarily the sole responsibility of government institutions. It is something that all stakeholders in the space sector contribute to and communicate.

A narrative is a storyline of connected events that gives meaning to those events. A national narrative is one that connects our enduring values and identities as a nation, to big events. Events like bushfires and floods, or sporting achievements, or farewelling a recognised national Indigenous leader. In countries like the US, Canada and Japan, space policies are designed around strong national narratives which endure across changes in government. The space agencies, Defence space divisions, and private sectors in those countries draw on these enduring national narratives to ensure consistent investment and public support in space technologies. This includes emphasising the societal benefits of space technologies.

From this coherent national approach, it becomes clear that space activities form part of their strengths as a nation. Sharing the benefits of sovereign and commercial space technologies is part of their geopolitical interactions with other nations. The importance of space technologies for various domestic sectors like mining, agriculture, fisheries, trade and IT are expressed in policies and investment decisions within those sectors. And societal benefits of space technologies for responding to climate change, wildfires, communication and education needs are communicated consistently.

In Australia, it may be challenging to identify enduring national values or identities as we find ourselves dealing with big questions around Indigenous representation, access to housing and education, the challenges faced by remote, rural and regional Australians, and our diverse ethnic demographic. But there are ways to communicate how space technologies can contribute to solving these issues, and this is the opportunity for our sector moving forward.

Understanding values

The Australian Centre for Space Governance (ACSG) was established in 2022, in part to respond to this very need. The ACSG is a national knowledge capability made up of space humanities experts from across six universities. We aim to advance Australia’s interests in space and to advocate for responsible space governance.

The ACSG recently undertook the most comprehensive public opinion poll ever in Australia, to understand how much Australian residents know about the benefits of space activities to life on Earth, and about what Australia does in space. We also wanted to know which space activities Australians think we should prioritise.

The data from this survey is informative. Public understanding and support are necessary for major investment into space activities and for knowing where there are gaps that can help us adjust the messages we are putting out as a sector. This data also helps us understand where there might already be a national narrative.

What we learned is that 20% of Australian residents have never heard of the Australian Space Agency. We also learned that launch and astronauts are not part of a national identity or narrative—at least not yet. Most respondents (84%) had never heard of WRESAT [Weapons Research Establishment Satellite], which was launched from Woomera in 1967, making us the third nation in the world to launch a satellite. Most respondents (63.3%) had not heard of Australian born astronauts Andrew Thomas and Paul Scully-Power. On the other hand, respondents generally think space is important for national security, and that Earth observation is important for climate change, agriculture, mapping, weather prediction, and Indigenous land and water management. Developing satellite capabilities was ranked the highest priority.

The strongest association that respondents had with Australian space activities was the 2001 movie *The Dish*. A story that demonstrates a typical Australian narrative of the underdog. And a story that we can build on as we prepare to host the

2025 IAC. Our institutions may be young, but we are an innovative nation with a rich and diverse population full of talent and a wide range of skills, and we are ready to contribute to solving the world’s challenges through space partnerships.

Societal benefits, critical infrastructure and national priorities

The focus for the space sector moving forward must be on messages about the societal benefits of space technologies and space data, and the ways in which space technology can help secure the things we care about and need in Australia. This will help inform decision making. It will also ensure those decisions align with what the public wants and values.

This includes the ability to respond to climate change and contribute to a thriving economy, from food security and a competitive agricultural sector to sustainable management of land and waters, and from national security and stability in the Asia-Pacific region to the ability to respond to bushfires and floods. If this becomes our national narrative, it will be clear to our own citizens and government why space matters, and to our international partners why they should engage with us, and what we have to offer.

Space is not a choice. We already depend upon space-based technologies for our daily lives and our national needs. The choice is what we focus on. Do we try to outdo each other or lift each other up?

The sector has a responsibility to lead this national narrative. The ACSG is here to help. We host workshops for government and together with industry, we provide training and education, and advocacy for advancing Australia’s interests in space in the 21st century through our policy papers and podcast. Reach out to us if you want to become part of this national narrative. ●



IMAGES: Supplied

11

THE ARNHEM SPACE CENTRE



AUSTRALIA'S SPACEPORT AT 12°

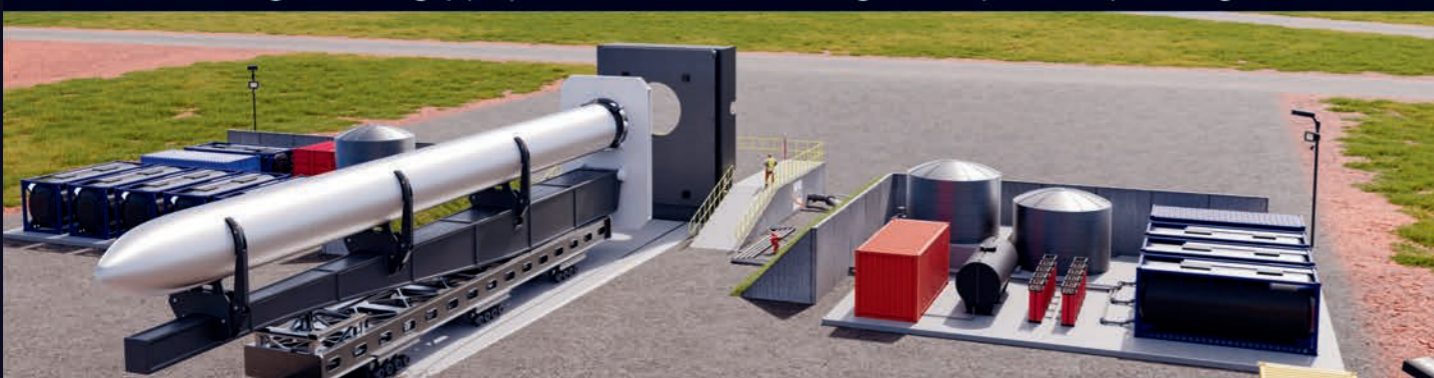
Maximise your mission success

Featuring the world's most advanced NewSpace small to medium rocket launch pads and servicing multiple orbit options, the Arnhem Space Centre enables our customers to leverage the positive benefit of Earth's rotational velocity - reducing fuel amounts and costs and increasing payload capacity - maximising our customers' mission success.

Access to space

- World's first multi-user commercial spaceport
- Commercial and defence
- Equatorial location - 12 degrees south of the equator
- Our experienced team works alongside you to support your access to space

Engine testing | payload and mission management | mission planning



The Arnhem Space Centre is owned and operated by Equatorial Launch Australia.

Contact us today to discuss your launch needs.

For website and socials scan below.



It's just rocket science.

For thousands of years
made sense of the
Today we continue
to provide real impact
Using our unique location
transforming and growing
space industry.



Australia
in space

Australian Space Agency enters scale up phase

By Lachlan Colquhoun

The Australian Space Agency (Space Agency) was created five years ago and Enrico Palermo agrees that it is time to stop viewing it as a new organisation with potential and, instead, consider some of its achievements.

"You always want to go faster, but if I reflect on what has happened in five years I think there has been a dramatic development of Australia's space ecosystem," says Palermo, who has headed the Space Agency for the last three years.

"During that time we've seen many new entrants into the ecosystem, and we've leveraged our talent base to create some very special technology we can offer the world.

"So, I think we can say, we are now in the scale up phase and there have been some great signals of that in the last year to 18 months."

Palermo points to the launch of NASA rockets from the Arnhem Space Centre, and the granting of a facility launch licence to Gilmour Space in Queensland as indicators of the industry's maturation.

"Also, in the last year, we had the head of NASA, the UK Space Agency and Japanese Space Agency all come to Australia within a period of six months," he says.

"I think that's a signal that some of the main players in the global industry want to collaborate with us."

Palermo, himself, is an example of the leveraging of home grown space industry talent who had to go overseas in search of opportunities before returning to help build a domestic industry.

From receiving First Class Honours in mechanical engineering at the University of Western Australia, he pursued his passion for the space industry overseas at a time when Australia had little to offer in the sector.

This led to an international career at Virgin Galactic as the project engineering manager in Mojave in the US and then 11 years at The Spaceship

Company in California, the last five as executive vice president and then president, before becoming Chief Operating Officer at Virgin Galactic.

Space heritage

Returning to Australia in early 2021, Palermo has been at the helm of the Australian space industry for over three years, which is more than half of the Space Agency's existence.

In that time, momentum has been building with the development of commercial launch facilities and the growth of Australia's 'space heritage', with an increasing number of Australian technologies and payloads flying to space from the local ecosystem of component makers and suppliers.

Palermo also points to the launch of Australian satellites from offshore launch facilities such as the launch of the Skykraft satellites which, when that program began in 2022, was Australia's biggest ever satellite launch.

This has recently been superseded by the Optimus satellite launch in March this year, with the Space Machines Company satellite launched from the Vandenberg Space Force Base aboard a SpaceX Falcon 9 rocket as part of the Transporter 10 mission.

The Optimus satellite is an Orbital Servicing Vehicle designed by Space Machines that aims to reduce space debris while also offering a unique taxi style service of physically moving other satellites into new positions.

"We are certainly seeing the cadence of these records being broken with new payloads, new sensors and new ground station technologies.

"So we are seeing that space heritage growing all the time and that growth is reaching all the way back into our supply chains."

Investing in the industry

Over its five years, the Space Agency has invested in over 70 projects as part of its mission to foster that heritage and ecosystem.

Through the projects, the Space Agency has invested in technology uplift, developing supply chain opportunities, and international partnerships, with many projects advancing Australia's capabilities and the Government's priorities in

advanced manufacturing, robotics and automation, artificial intelligence (AI) and quantum technologies.

"We've also put in some critical infrastructure around the nation which is now being leveraged for commercial opportunities.

"One good example is the Fugro's SpAARC [Australian Space Automation AI and Robotics Control Complex] in Western Australia, which is a co-investment by Fugro, the Space Agency and the WA Government."

The Space Agency invested in SpAARC through the Space Infrastructure Fund, supporting Fugro to create a world-class facility to train, test and control remote and autonomous operations in space and in other harsh environments, such as under the sea.

In many cases it's about leveraging space data services to drive meaningful and important benefits for citizens of Australia and those in the region.

"Our role is multi-faceted. We shape and we help build a national capability, and we do that through our programs and advice across government, keeping tabs on developments and understanding the requirements of government.

"The other big role for us is being a 'front door' if you like. That means we are here, both domestically and internationally, to create opportunities for Australian industry, academia and government through our relationships to the world's space agencies."

Evolving framework

The experience of the last five years, Palermo says, has shown how, without a Space Agency or equivalent organisation in place, Australia could have missed out on opportunities both in the multilateral sense and bilaterally.

"Now we represent Australia's space related interest in the QUAD grouping through the Space Working Group, and also the United Nations Committee on

the Peaceful Uses of Outer Space.

"Because we have the Agency, that is why we have a Rover program. It's why we were able to send Katherine Bennell-Pegg to the European Space Agency to undertake basic astronaut training in Germany, the first person to undertake astronaut training under the Australian flag.

"And we also have an important role to develop a responsible space sector in Australia, and we do that through our role as the regulator for space launches and returns, and that is a framework that continues to evolve as activities ramp up."

Then, there is the communication with the wider public, which explains the goals and possibilities of the sector while also inspiring younger people to think about a career not just in the space industry but other emerging critical technology areas.

All these functions come together to create the right conditions for growth and they are much more than delivering grant programs.

A large number of the new space initiatives are created to have an impact on the Earth in areas such as agriculture and environmental monitoring.

"In many cases it's about leveraging space data services to drive meaningful and important benefits for citizens of Australia and those in the region.

"Skykraft, for example, has a constellation of satellites but their mission is to improve air traffic management for the global community.

"Fleet Space Technologies—which the Agency has also invested in—is an Adelaide-based satellite company helping to drive the transition to green energy by disrupting how you search for critical minerals, in a passive and non-invasive way using their ambient noise technology combined with AI and space communications."

Impact of digitalisation

Palermo also observes the major changes that have taken place in the space industry over the last few years, and these have had an impact on fostering local start-up companies.

Satellites have become much smaller in size, while their digital capacity has increased with miniaturisation, and this has occurred as low orbit communications have proliferated.



All this has created an environment of 'democratising' space to the extent that small start-ups with great ideas, and a first mover advantage in a niche area of space, can enjoy recognition and success and scale up more quickly.

"The backdrop has really been a global shift to a commercial space ecosystem where things that were traditionally the preserve of the world's major superpowers become enabled through digitisation, lower cost launch and better analytical tools.

"This all contributed to the ability of small nimble teams to do some big things, and we have some great examples of this."

Palermo cites the University of Melbourne's SpiRIT nano-satellite as an example, which shows how the Australian space sector is collaborating internationally. The Space Agency supported the project with almost \$7 million in grants.

The landmark SpiRIT nano-satellite mission was successfully launched in December 2023 from the Vandenberg Space Force Base in California aboard a Falcon 9 rocket and entered a polar orbit 513km above the Earth.

SpiRIT is the first Australian satellite to carry a foreign space agency's scientific



A prototype of the SpiRIT satellite at the University of Melbourne's Melbourne Space Laboratory.

instrument as its main payload, namely the Italian Space Agency's HERMES X-ray detector.

The HERMES X-ray detector is designed to search for bursts of gamma rays, which are created when stars die or collide and emit more energy than an entire galaxy for a moment.

SpiRIT was developed by a consortium led by the University of Melbourne, comprising Inovor Technologies, Neumann Space, Sitael Australia and

Nova Systems in Australia, as well as the Italian Space Agency, Italian National Institute of Astrophysics, Fondazione Bruno Kessler, the University of Tuebingen, and their partners for the HERMES payload development.

The satellite is designed to fly in low Earth orbit for two years in a Sun-synchronous polar orbit, where the satellite travels from north to south over the poles and is tuned so it always faces the sun at a similar angle.



iLAUNCH

Accelerating
space
innovation



The **Innovative Launch, Automation, Novel Materials, Communications, and Hypersonics Hub Trailblazer** is a \$180 million program building Australia's enduring space capability through the commercialisation of projects, a fast-track accelerator, and skills development to build the workforce of the future. Supported by the Australian Government. **Find out more** at ilaunch.space

University of Tasmania's Greenhill Observatory where a new antenna, co-funded by the Australian Space Agency, was officially opened in January 2023.



Another highlight of a very busy 2023 was the activation of a new \$2 million communications antenna at the Greenhill Observatory in Tasmania.

The facility is a partnership between the Space Agency, which invested through the Space Infrastructure Fund and the University of Tasmania (UTAS).

The new 7.3m antenna is the southernmost antenna of its kind in the world, and the new infrastructure will help Australia further develop its capability in space situational awareness, which is the monitoring and tracking of space based objects in orbit.

Given Australia's geographical location, the facility can play a leading role in this increasingly critical field and as the number of satellites continues to increase.

The antenna will be operated by a team from UTAS, which is the only university in the world that operates a continental-scale array of antennas.

Palermo also cites the creation of the new Innovative Launch, Automation, Novel Materials, Communications and Hypersonics (iLAUNCH) Trailblazer at the University of Southern Queensland as another milestone for the industry.

In collaboration with the Australian National University, the University of South Australia and over 20 industry

partners, iLAUNCH's mission is to collaborate on space research and address critical gaps to accelerate the development of the space manufacturing sector.

The \$180 million program will invest in space industry research, commercialisation and manufacturing over four years.

Palermo makes the point that iLAUNCH was funded through the Department of Education, demonstrating that the development of the space industry is a whole-of-government commitment.

In the same vein there is the Australian Research Council Centre for Excellence in Plants for Space, which aims to create on-demand, zero waste, high efficiency plants to address sustainability challenges not just in space, but also on Earth.

Located at the University of Adelaide, the centre has received \$35 million funding over seven years.

"What will come out of it are technologies to support human exploration into the solar system, but also, importantly, how we can drive food security on Earth.

"It's really one of the most significant global initiatives on this issue."

The research centre has also been selected to be part of efforts to grow

plants on the Moon for NASA's Artemis III mission.

Defence collaboration

There is also a defence dimension to Palermo's role as head of the Space Agency, and he cites what he says is a productive relationship with Space Command, which now comes under the Joint Capabilities Group.

"There's many things which are in a critical alignment, from Earth observation, communications and position, navigation and timing.

"And these all exist in an increasingly congested environment, so it makes sense for us to align and work together.

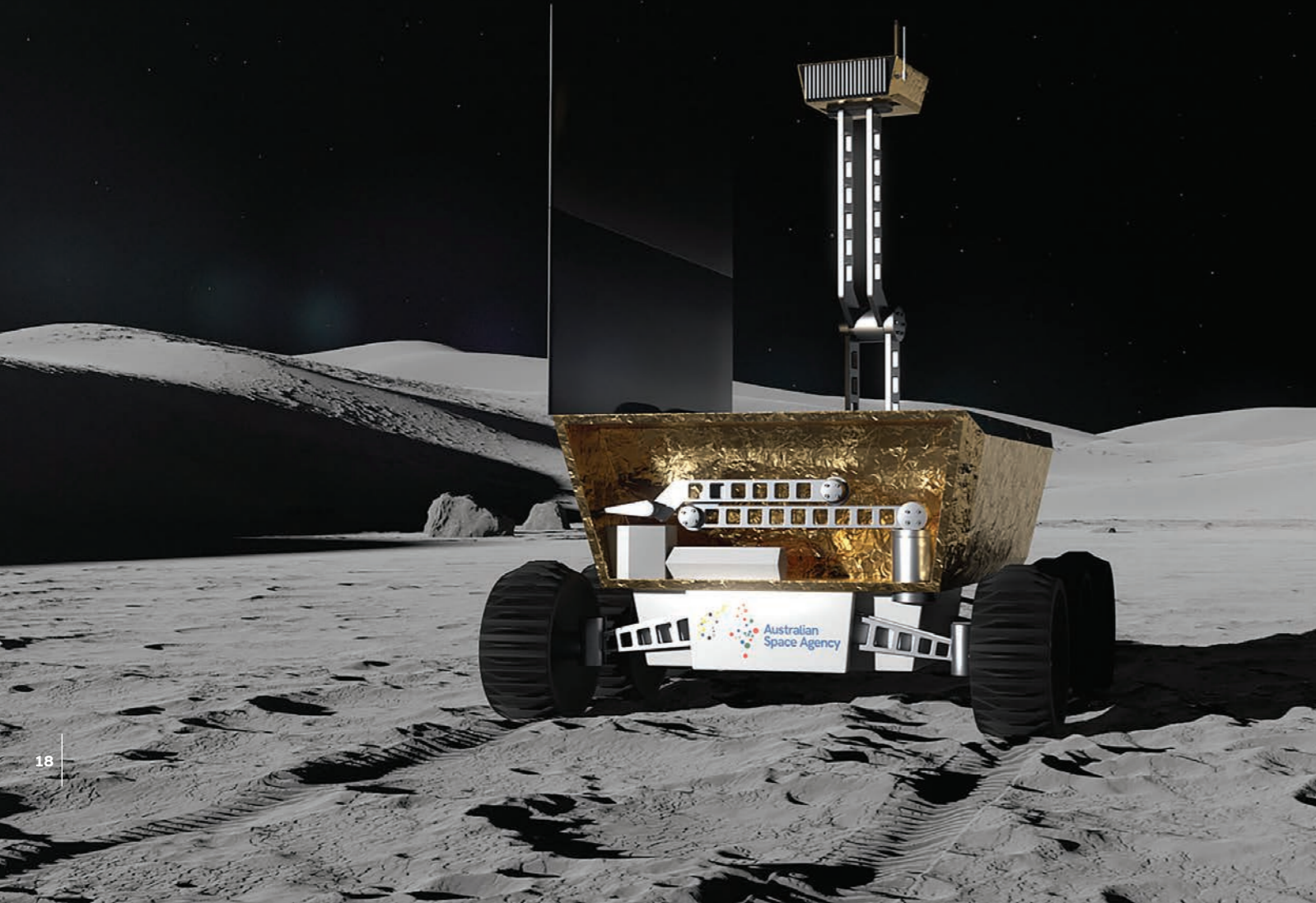
"We do that, but at the same time it's very clear that we are a civil agency and continue to interface with civil agencies."

Palermo makes the point that, like Space Command, the Space Agency is not "burdened by legacy" as it finds ways to collaborate.

Australia does, however, have a heritage in space which cannot be ignored and that can inspire the industry today.

"We were one of the first nations to launch a satellite into space from our own shores.

"So we were there at the beginning of the space age and have been there in various ways ever since, and we should be very proud of that history." ●



18



19

Aussie Roo-ver prepares for Moon mission

By Lachlan Colquhoun

One of the flagship projects for the Australian Space Agency (Space Agency), and for the wider Australian space industry, is the Moon to Mars initiative.

The initiative is Australia's contribution in collaboration with NASA's goal of establishing sustainable exploration on the Moon through the Artemis human exploration program and to use this to prepare a mission to Mars.

Australia is a founding signatory to the Artemis Accords, a set of principles to guide the safe exploration firstly of the Moon and then into space beyond, and the Space Agency created Team Artemis Australia to lead the nation's contribution.

This is focused not only on Australia's first Moon mission, but on international collaboration, technology transfer and, ultimately, investment into the wider space industry.

The Moon to Mars initiative comprises three programs, with the Trailblazer program involving the design and development of an Australian-made

rover vehicle that will go to the Moon with NASA as part of Artemis.

The rover will transport lunar regolith to a NASA facility on the Moon for oxygen extraction, a key step in establishing a sustainable human presence on the Moon.

The technology leverages Australia's proven experience in remote mining technology currently in use in parts of Western Australia and is one of Australia's most ambitious robotics projects.

"The Australian Government, through the Agency, has also invested in 10 projects through the Moon to Mars

initiative's Demonstrator Mission Grants program totalling \$40 million in grants," says Enrico Palermo, Head of the Space Agency.

"These are very significant programs in key areas, not just the rover but in areas such as future ground infrastructure for optical communications, autonomous navigation and quantum clocks."

One of the milestones of 2023 was the naming of the rover vehicle with a typical Australian name—Roo-ver.

Roo-ver was named after a competition that saw more than 8,000 entries, with the chosen name entered by Siwa a young girl from New South Wales.

"Our lunar rover deserves to be named after something iconically Australian, reflecting the Aussie spirit as we launch into this new endeavour," said Siwa.

"A kangaroo is part of the Australian coat of arms and it's time for Australian



science to take the next leap all the way up into space."

Two Australian consortiums—AROSE and ELO2—are working on early stage Roo-ver concepts, and Stage Two will see one design selected.

Each consortium has received \$4 million to reach a preliminary design review milestone for the rover.

ELO2 unveiled a prototype of its design

at the 16th Australian Space Forum in December 2023. The prototype utilised 3D printing processed by Brisbane-based metal additive company Titomic, while RMIT University in Melbourne was also a leading contributor.

The Roo-ver is expected to be a compact vehicle weighing around 20kg with the dimensions of a travelling suitcase. ●

IMAGE: Supplied

Impact in Sea, Air, Land, Space & Cyber

AI/ML | Big Data | Quantum | Photonics | Industry 4.0 | Cyber | Global Relations & Security | Ethics | Training & Education | Supply Chain & Logistics

Multi-Disciplinary Material Science & Sustainment

- Additive Manufacturing
- Advanced Materials
- Coating
- Composites
- DSTG Joint Chair
- Structural Integrity
- Sustainment

Information, Sensors & High Speed Flight Systems

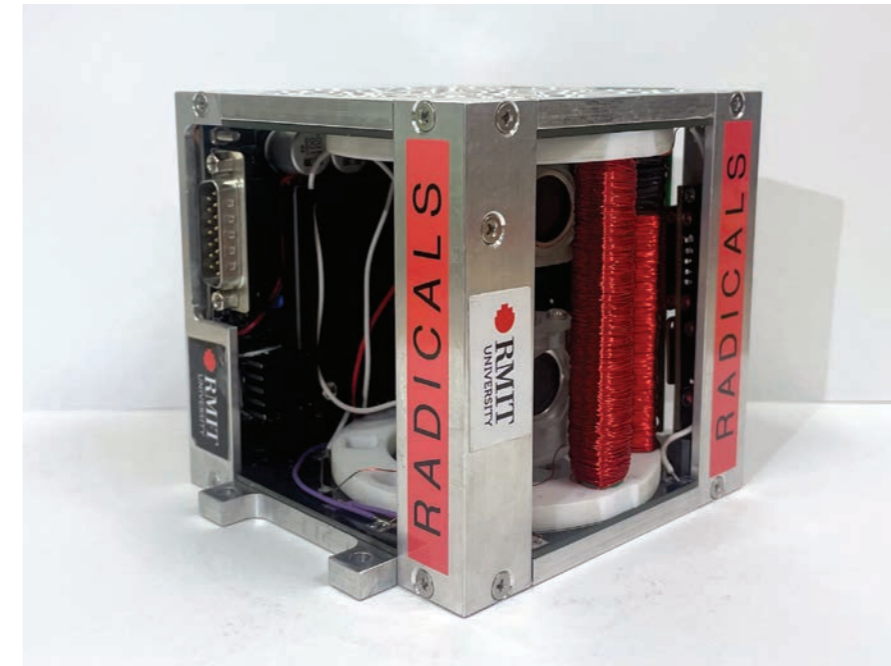
- Advanced Sensors
- C3
- Detection & Tracking
- DSTG Joint Chair
- Energy Storage
- Integrated Intelligence
- Propulsion Systems
- Quantum-assured PNT

Trusted Autonomy & Cyber/Physical Systems

- AI, ML & HMI
- Autonomous Systems
- Digital Twins
- Flight Testing
- Modelling & Simulation
- Rapid Prototyping
- Virtual Prototyping
- Wind Tunnel



CRICOS: 00122A | RTO: 3046



RMIT's RADICALS payload is ready to blast off!

By Associate Professor Gail Iles

Australia is enjoying recent success with its space missions that are progressing the nation's expertise in the regime of low Earth orbit. But not all space missions require launching satellites into orbit.

Sounding rockets are used for testing and scientific measurements with sub-orbital rocket launches following a parabolic trajectory with part of the flight path taking place in space. Typically, any instruments or experiments on board remain inside the rocket, and the payload compartment is often maintained at standard temperature and pressure.

RMIT has secured a launch slot on a sounding rocket with the Swedish Space Corporation (SSC) in early 2024. Utilising a MAPHEUS rocket provided

by the German Aerospace Centre, RMIT will launch the RADICALS [Radiation Deflector of Ionising Charges using a Lorentz Shield] payload into space reaching a peak altitude of 250km. The flight is short, 12 minutes, but that is long enough to take some exciting measurements.

The RADICALS payload, built in the School of Science and supported by the RMIT Space Industry Hub, is a radiation shield designed to deflect charged particles away from the inside of a spacecraft. The goal is to deploy these shields on large, metres-wide, human-rated orbiting space stations. But for now, the RADICALS experimental prototype is a mere 1U payload (10x10x10cm) to fit inside the sounding rocket. The Esrange Space Centre, managed by SSC, lies within the Arctic Circle providing the ideal spot for landing and recovering all pieces of the rocket in this sparsely populated region.

The RADICALS team tested the payload at the Australian Nuclear Science and Technology Organisation's Centre for Accelerator Science in Sydney in 2023, demonstrating successful operation of all systems and the shield under bombardment by high energy particles. This raised the technology readiness level of the payload from 4 to 6. But these targeted energies do not represent all radiation types that satellites experience in space. There is only one place to go for that and that is outside our atmosphere. Esrange is perfect for this testing due to its proximity to Earth's magnetic pole. Here RADICALS will be exposed to the full extent of the Sun's solar winds and Galactic Cosmic Radiation.

In addition to RADICALS, the RMIT Space Industry Hub is a key backer of the ELO2 consortium to build a prototype rover, striving to be Australia's first rover to explore the lunar surface. This ambitious project hopes to deliver the Roo-ver to NASA in support of the Moon to Mars Mission.

Another exciting project, with Enable Aerospace, is the Universal Payload Racking System (UPRS) Flight Qualification and Demonstration. The project team aims to finalise the UPRS designs, complete qualification testing of hardware for human-rated space flight and conduct a demonstration for Sierra Space.

Both projects, funded by the Australian Space Agency under the Moon to Mars initiative and Trailblazer programs boast an impressive list of partners from primes, small and medium enterprises and universities including RMIT, represented by space researchers Dr Graham Dorrington and Professor Ceas Bil.

The RMIT Space Industry Hub connects Victoria's world-leading research and solution providers with the challenges and opportunities of the global space sector. The Hub hosts the Victorian node of the SmartSat Cooperative Research Centre (CRC), which connects Victorian capability with the national ecosystem and serving as a delivery vehicle for projects that align with CRC research priorities. ●

<https://www.rmit.edu.au/partner/hubs/space-industry-hub>



OP-ED: KATHERINE BENNELL-PEGG

‘What would my 10-year-old self be thinking right now?’

That ran through my head most days, as I realised my childhood dream of becoming an astronaut. The reality though was so much greater than I could have ever imagined.

When I was young, I wanted to be an astronaut for the adventure. But, after more than a decade working in space—and 13-months training to become an astronaut—that vision has evolved, because of the role space plays in making life better here on Earth.

The work and research involved in going to space has enormous impact in tackling real-world issues from climate change to improving our physical wellbeing.

My training, with the European Space Agency in Germany, covered space station and payload engineering, scientific labs, medical training, human and robotic spaceflight operations, languages and survival training (winter, fire, water). We also completed parabolic flights, training in a human centrifuge, hypoxia and hypobaric chambers, and diving to prepare for spacewalks.

Our class visit to NASA’s Johnson Space Center in the US was another highlight. We trained in the full-scale mock-ups of the International Space Station pressurised modules and vehicles, and the Neutral Buoyancy Lab.

While in the US, I also met with major space organisations like Blue Origin, Axiom and Collins Aerospace—taking the opportunity to promote Australian know-how and technology that could contribute to what they do.

It was the opening of these doors—and the chance to showcase what Australian scientists and engineers can contribute to global missions—that has been central to my past year.

I was thrilled to welcome an Australian delegation to the European Astronaut Centre, to build Australian connections with our international partners across all facets of the industry, particularly human

spaceflight, applied space medicine and life sciences.

Each delegate showcased their unique Australian capabilities, and opportunities for collaboration with European partners and beyond.

The visit highlighted to a global audience the cutting-edge technologies and research that Australia can offer. By sharing ideas and collaborating with international partners, our Australian space organisations can enter new supply chains to deliver more innovation and economic development at home.

To be the first astronaut trained under the Australian flag is a true



Background
Katherine Bennell-Pegg, 39, is Australia’s first astronaut. The space systems engineer graduated from the European Space Agency’s (ESA) Astronaut Corp in April 2024, following 12-months of training. Katherine is one of six people to be trained from 22,500 eligible applicants for ESA’s astronaut intake in 2021.

honour. I am excited, not just for me but for what my training and experience can unlock for Australian scientists, engineers and operators, and all the value that can bring for our nation more broadly.

I am also humbled by the opportunity to inspire young Australians to pursue STEM [science, technology, engineering and mathematics] careers and to demonstrate that they too can reach for the stars.

There have been a few ‘pinch-me moments’ that I hope have cut through.

Seeing the Australian flag on my flight suit and becoming the first non-American to be fitted into the Collins

prototype spacesuit (which could be worn by astronauts on the upcoming Artemis missions) were both occasions when I really took stock.

I am often asked, when will I fly? The answer to that is unknown.

But, what I do know is that I am bringing home incredible knowledge on human spaceflight.

If I can use that insight to create further opportunity for Australian organisations, and to inspire more young people to lift their aspirations and pursue a career in STEM, that is something I am proud of.

And it is something my 10-year-old self would be blown away by. ●



24

25

Space Technology Precinct lunar testbed nears completion

The centrepiece of the \$7.9 million QUT [Queensland University of Technology] Space Technology Precinct—and Australia’s largest covered facility for testing field robotics and equipment in realistic Moon conditions—is on track to be completed this year.

A lunar testbed, the first of its kind in Australia, is currently under construction near the Herston Road entrance of the QUT Kelvin Grove campus, with an official opening likely early in 2024.

The 19m x 11m lunar testbed will be capable of simulating multiple planetary environments to support robotics, sensing and other research applied to space.

The leader of the QUT Space Precinct development, Associate Professor Thierry Peynot, from the QUT Centre for Robotics, said a vehicle, for example, would be able to go through its paces in realistic Moon conditions with an arena containing simulated

regolith (fabricated moon dust), slopes and boulders.

“The lunar environment, for example, is incredibly challenging. It has no atmosphere; exceptionally fine, charged and reactive dust that sticks to everything; 300-degree temperature variations and two hundred times Earth’s radiation,” Professor Peynot said.

“It is not possible for us to replicate all of those particular conditions

but the use of fabricated moon dust in the facility will provide a realistic surface and terrain for a rover to navigate across, along with the optical properties that are crucial to test robotic perception.

“The lunar testbed will also have a gantry crane which will enable us to simulate the level of gravity on the Moon—which is 1/6 of the Earth’s gravity—by holding up some of the weight of the vehicle as it navigates across the testbed.

“We will also have the ability to use sunlight, realistic lighting conditions and high ceilings to facilitate tests to simulate the atmosphere of Mars for testing drones.

“Such testing does not apply to the Moon, which has no atmosphere and thus offers no way to fly drones, for example.”

Director, Industry Engagement, Ali Buchberger said the lunar testbed will be a place for QUT and companies to innovate together.

“Going back to the Moon and on to Mars is a massive team effort. We hope this facility will play a small part in shaping the future of space exploration,” she said.

Professor Peynot said robotics, mechatronics, electrical engineering, renewable power engineering and industrial design students would use the facility, and there was potential for use by students and research groups studying astrobiology, planetary surface exploration and computer-human interactions.

“Community visitors will also be encouraged to observe simulations—on some special occasions—from a public viewing platform as part of QUT’s commitment to STEM [science, technology, engineering and mathematics] outreach,” Professor Peynot said.

Research Engineering Facility (REF) Manager, Andy Keir said a dedicated research engineering support team would be relocated from the QUT Da

Vinci Precinct at Brisbane Airport to the facility, which will have office spaces and an onsite workshop.

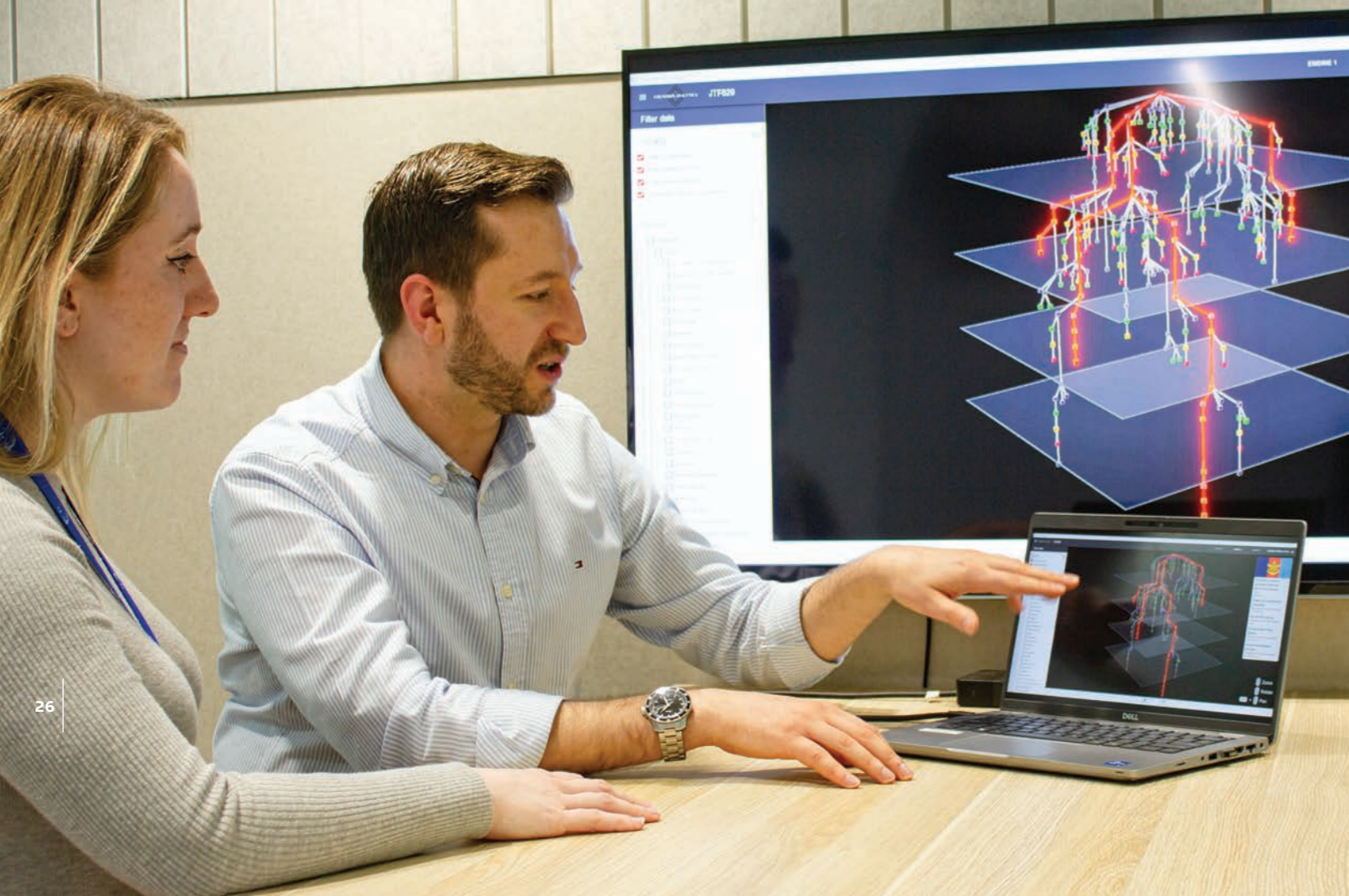
“Some of the REF team who provide drone and aviation enablement to university researchers will relocate to the new facility,” he said.

“This will allow them to be closer to their user base, as well as providing an opportunity for greater engagement with other members from the REF team, as there will also be some of the Robotics and Autonomous Systems team, presently at Garden Point campus, who will also relocate.

“Through these staff, REF will be able to provide enablement of the activities that will occur at the Space Technology Precinct, including design and manufacturing, systems integration, rapid prototyping and data analysis.”

The facility will be formally named at a later date. The construction is on track to be completed later this month, with an official opening next year. ●

IMAGES: Supplied



26

KBR: There from the beginning of space flight

By Lachlan Colquhoun

Global engineering services provider KBR has a 50-year track record of working on space flights and has been involved with every manned NASA mission, so it is well placed to play a strong role in supporting the development of Australia's space industry.

In 2023, NASA selected KBR to provide mission and flight crew operations support for the International Space Station and future human space exploration, while KBR's Iron Stallion enterprise space domain awareness tool is the latest generation of the company's longstanding work in high level data analysis.

The company supports NASA's work with the Hubble Space Telescope located out of the Goddard Space

Flight Centre in Maryland, which is home to NASA's largest combination of scientists and technologists who build spacecraft, instruments and develop new technologies.

With Australia's relatively young space industry gaining momentum, KBR can bring its proven expertise in space to Australia and play a significant role in developing both defence and civilian capabilities, and work with local companies to build a strong ecosystem.

Izaak Gurney, KBR's Canberra-based Senior Program Manager of Space, Cyber and Information Systems came to his current role after a decade long career in the Navy and Defence in Australia, working with data and information systems.

"My defence experience positions me really well to lead KBR here in Australia in its work with all things space, cyber and information," Gurney says.

"KBR of course has been there pretty much since the beginning, so I think we are able to put our hands on our hearts and say we are subject matter experts in space, with a long track record of technological innovation and support."

Space, says Gurney, is playing an increasingly prominent role in the military domain, and commercial and civilian applications also often have a military context.

The most well-known of these is the use of the Starlink internet service by Ukraine to mobilise intelligence and direct its fleet of drones, which have had a major influence on the conflict.

Gurney describes space as an "increasingly contested domain", and says KBR has an obligation to make sure that it "remains secure for access".

For a company like KBR, this means that it provides "very clear guidelines and advice" on how its products can be used.

A product like Iron Stallion, for example, has both civilian and military applications and is leveraged in both areas.

Iron Stallion is an enterprise space command and control solution which "ingests and absorbs" multiple data sources and delivers a front end with a number of proprietary tools, both classified and unclassified, to provide orbital and space analysis.

As an information-based product, it can be used to manage traffic in space. This involves collision assessment and avoidance and re-entry management.

The solution leverages proprietary algorithms developed by KBR and analyses "hundreds of thousands of data points".

"We have one customer who has ingested dozens of data sets, so the magnitude of the information they are dealing with is enormous," says Gurney.

"In the past you might have just employed and trained up a group of incredibly smart people to do this

analysis, but now we are faced with data on such an incredible scale, and we need data processed and analysed as fast as possible."

The space industry is dealing with the "Kessler syndrome", first identified in the late 1970s as a scenario where the density of objects sent into low Earth orbits is such that collisions between satellites and space debris becomes increasingly likely.

"We are putting an increasing amount of traffic into space, so the tracking and coordination of these objects has become a major concern.

"There is no way you want your multi-million dollar payload to collide with an object which is only millimetres long, because the consequences can be significant and, in the commercial area, that can mean a lot of unhappy shareholders."

KBR has a growing footprint and is currently the eighth largest defence contractor in Australia.

Most recently the company was selected to equip the Royal Australian Navy with a more modern and cyber worthy Fleet Information Environment. The 12-month contract will provide the Navy with faster, more capable and more secure computer-based information systems.

MINERVA (SEA 2273) is vital in ensuring that the Australian Defence Force can operate in contested, congested and degraded information environments.

This contract builds on the work KBR has done with the Joint Command and Control Systems Program, connecting the Australian Defence Force to the information it needs and supporting mission planning capabilities.

Mission planning systems draw on highly efficient software and supporting technologies to enable detailed, integrated planning, precise execution and post-mission debriefing. These systems play a crucial role across the full lifecycle of the Australian Defence Force's operations.

KBR has supported the Australian Defence Force for more than six decades through a broad range of capabilities, and this relationship is increasingly moving into the space domain.

"The Australian context is quite unique in that we've got the Australian

Izaak Gurney,
Senior Program
Manager of
Space, Cyber
and Information
Systems, KBR



Space Agency with a very clear civilian mandate but, equally, we have the likes of the Australian Space Command in the defence area," says Gurney.

"So, from nascent beginnings, Australia has some advantages in terms of developing its space industry, and I think that KBR can bring some of those technical services that we provide to mature agencies such as NASA and be a strong contributor.

"We provide technical solutions but also services and we're quite proud of the fact that we are an integrator, so that means that whether it's a KBR specific solution or whether KBR is a subcontractor to another prime, we are confident in our ability to deliver and integrate those services because we've done it and continue to do so."

Australia is well positioned geographically for the delivery and recovery of payloads from space, and environmental conditions are "quintessential" in having the right combination of factors for ground control stations to control space payloads.

"That in itself makes Australia a unique value proposition," Gurney says.

"There are quite a number of Australian space start-ups which have momentum, but you also have companies like KBR here that have a demonstrated history in solutions and services.

"So I think that in the Australian context we've got a lot to offer." ●

27

IMAGES: Supplied

SOLVING PROBLEMS FOR A SAFER WORLD[®]

MITRE IS A NOT-FOR-PROFIT, PUBLIC-INTEREST COMPANY that applies systems and mission engineering to deliver whole-of-nation solutions to complex security challenges on earth and in space. As trusted advisors, we are accelerating transformational innovations to stay ahead of the threat and ensure a sustainable, secure, and resilient space domain.

MITRE | Australia



Royal Australian Navy Lieutenant Jason Wang, Staff Officer to Director General Space Operations, at the Space Command offices, Canberra.

Space Command enhances Australia's Defence capability



Major General Greg Novak

By Lachlan Colquhoun

Major General (MAJGEN) Greg Novak says that although Australia's Space Command is a "young command", it cannot be considered a start-up because it is leveraging decades of work by the Department of Defence and the civilian sphere. Space Command was raised in January 2022 and originally headed by

Air Vice-Marshal (AVM) Cath Roberts, who handed over to MAJGEN Novak in December 2023. The Command transitioned from the Royal Australian Air Force in July 2023 and is now integrated in the Australian Defence Force's Joint Capabilities Group. "The message I am passing on is that Space Command wasn't created from scratch or as a greenfield project. "We've long had pockets of excellence in a number of areas relating to space and they go right across our defence enterprise.

IMAGE: CPL Jacob Joseph / defence.gov.au

Securing the Space Domain: CyberOps' Innovative Approach

Founded in 2016, CyberOps has assembled a team with decades of collective experience in national and global technology and advisory roles to help service the growing needs of the defence, space and cyber industries. Based in Adelaide's innovation precinct, Lot Fourteen, CyberOps delivers innovative services and provides expert advice to a wide range of small to large customers at a competitive price.

In a world where cyber-attacks are becoming increasingly sophisticated and widespread, securing critical infrastructure, especially in the evolving Australian space industry,

good cyber security practices are more essential than ever. This is true for both product, services and supply chains.

In 2019, CyberOps sought and was awarded innovation funding by the Department of Defence to develop a space cyber framework and a space security architecture. Since then, CyberOps has been awarded further grants to develop a series of testing, training and simulation products to improve the space cyber capability in Australia. In line with this, CyberOps became one of the first Australian members of the Space Information Security Advisory Centre, leads technical teams in global events such

as the NATO led cyber wargames and recently founded the annual Australian Space Cyber Forum.

CyberOps has built an innovative passive radio frequency sensor network that tracks satellites, which has evolved into a product called SpacelQ. CyberOps now generates space domain awareness (SDA) data to offer to Australian Space Command and the wider global SDA ecosystem, contributing to the safety of the space domain.

In summary, CyberOps straddles the defence and space markets as a data provider, and an expert security advisor.



Ms Bella Hatty from the Australian Space Agency and Major Dustin O'Donnell from US Space Force working at the Commercial Operations (JCO) cell, Adelaide.

CYBER OPS

SPACE

CYBER

DEFENCE

Space Cyber Testing, Training & Simulation Range

Passive RF Sensing

SpacelQ™ Sensor Management

Security Governance, Policy, Technical Assessments & Architecture

cyberops.com.au - sales@cyberops.com.au

“Some of these pockets within Defence have long histories, going back decades, and they have supported Defence with very specific and expert capabilities, such as satellite operations and communications.”

MAJGEN Novak came to the Space Commander role from a 30-year Army career, where he was most recently the Commander 6th Brigade, responsible for delivering specialised intelligence, electronic warfare, military policing, ground-based air defence and engineering effects across the integrated force.

With a background in signals, MAJGEN Novak also spent several years as a liaison officer to the United States Strategic Command at a time when that command included space capabilities, which later evolved into its own operation as the US Space Command.

“I am very fortunate to have been around Defence’s space enterprise in various roles for some years, and for the chances I’ve had to work in the fields of

satellite communications and space-based intelligence,” he says.

“I’m doing my best to bring that background experience into my current role, and I’ve said it publicly many times—I love what I do and there’s nowhere else in Defence I’d rather be.”

Rapid change

Space is a domain, says MAJGEN Novak, where change and technology has moved rapidly in recent years and that has had a dynamic impact on the way Defence “organises personnel and how you train those personnel”.

He is also of the view that space is “critical to the generation and application of military power across all domains.”

“I think that is especially the case in contemporary operations, and I’m also including cyber with space.”

“I can call out examples pretty readily in communications, intelligence, surveillance and reconnaissance, positioning, navigation and timing and

how they support targeting.

“They all depend heavily on space capabilities and extend beyond Defence and become a national endeavour which touches all levels of government.”

MAJGEN Novak acknowledges the strong contribution made by AVM Roberts in setting up Space Command and “building its identity and consolidating Defence’s space capabilities under a single headquarters”.

The next milestone in maturing the Command was the release of the Defence Strategic Review (DSR) in April 2023, which set the agenda for an ambitious reform of Australia’s Defence posture and structure.

From a space domain-perspective, the DSR built on the Defence Space Strategy released in 2022, and also the 2020 Force Structure Plan which allocated funds for space technologies.

The Defence’s Space Strategy also had its origins in the foundational Space Power eManual published in 2022,



Lieutenant Colonel Kevin Hamilton at Space Command at Space Command Headquarters in Canberra.

"I have regular engagement across government, and I've had a number of Australian space industry stakeholder meetings which the Australian Space Agency have either facilitated or supported.

"I have seen firsthand a number of really tangible examples of what Australia's space industry can bring to the table and I've seen some great successes.

"My takeaway is that we have a really vibrant, innovative and active commercial space sector and that is really important, and is going to remain so, and is a strength for us looking into the future."

A key area of focus for MAJGEN Novak, in his dialogue with the civilian and commercial space sector, is around data and the range of data that is collected from a variety of sources.

"I am always looking at how might we integrate that data into what we do.

"I'm keen to make sure that we are fully leveraging the capabilities and

assets in the commercial sector as part of a national enterprise, rather than Defence in isolation."

Space Command's current approach is an "aggregated" one, where Defence may take payload space on civilian satellites or leverage intelligence and data in the military domain.

We need to design, develop and deliver a professionalised space workforce.

Those payloads controlled by civilian operators have the "feeds and the capabilities and outputs from the satellite processed and analysed accordingly".

Team sport

In advancing the Defence Space Strategy, MAJGEN Novak also makes the point "we are not alone" and no one

entity will be able to achieve their goals and space objectives in isolation.

"Space is the epitome of a team sport.

"Contributions are routinely supported and bolstered by cooperation from across other government agencies, across industry and academia and also our growing international partners, and that is the best way I think we can position ourselves to keep pace with such a rapidly changing environment.

"And of course, there are also our allies, many of who also have long histories of their own endeavours in space."

All of this should result in a "domain focused" approach which, in terms of Defence, is "centrally managed and centrally applied".

While much of his focus is on "strategy realisation", MAJGEN Novak also says that a lot of his work will be on developing the space workforce.

"We need to design, develop and deliver a professionalised space workforce.

which outlined the military context for Australia's space efforts.

"For the military, access to space systems and services is critical to enabling military capabilities and activities," the eManual states. "Defence recognises the importance of this environment as both an essential enabler of military terrestrial operations and an operating domain in its own right."

Going forward, up to \$7 billion has been earmarked through to 2030 for investment in sovereign military satellite communications, and \$2 billion has been provided through to 2038 for space situational awareness capabilities.

There are also future commitments to satellite communications assurance and "contested space terrestrial operations".

There are five priority lines of action under the Defence Space Strategy:

1. Enhance Defence's space capability to assure Joint Force access in a congested and contested space environment.
2. Deliver military effects integrated across whole-of-government and with allies and partners in support of Australia's national security.
3. Increase the national understanding of the criticality of space.

4. Advance Australia's sovereign space capability to support the development of a sustainable national space enterprise.

5. Evolve the Defence Space Enterprise to ensure a coherent, efficient and effective use of the space domain.

Space: A peer domain

MAJGEN Novak says the key to delivering on these priorities is the recognition that space is a distinct domain alongside cyber, and the traditional domains of maritime, land and air.

"Space is now a peer domain, and we are actively contributing to the ADF [Australian Defence Force] but also realising that the capabilities we can bring need to be integrated.

"This gives me a clear vision, that we are here to prepare our space power to secure Australia's interests.

"A big part of that is we are a train and sustain organisation, we train space forces and assure their readiness and we assign them for operations."

As Space Command matures, MAJGEN Novak invokes the theme of Australia's strong legacy in space and its history of collaboration with key partners.

"There are the pockets of excellence I mentioned, and we have really active

engagement globally and across government on how to develop our space policy.

"We are engaging more and more on the behaviours and rules of space, even as far as electromagnetic spectrum management which impacts so much of what we do in space.

"These are examples I frequently call out, and they are building on our long standing and well-established space capabilities which predate the raising of Space Command by a significant number of years."

MAJGEN Novak also recognises that Space Command is part of the wider and rapidly developing Australian space industry ecosystem, and he works closely with the Australian Space Agency.

"I've said that we have to modernise Defence's space capabilities and things are moving so fast that we can't take our foot off the pedal.

"We have to have the ability to adapt to technology development, and that means we need to be engaged with not only our international counterparts but also with our own industry."

Space Command has a number of programs running with industry partners focused on innovation and research.

Mission Critical High Performance UHF SATCOM Systems

WINNER
Defence Business of the Year

BLACKTREE TECHNOLOGY
www.blacktree.com.au
T + 61 8 6245 2120

**NEW
INNOVATION**

GUARDIANS OF THE GALAXY.

SPACE AGE NETWORK ENCRYPTION FOR STELLAR SECURITY.

Now defence-grade network encryption from terrestrial to celestial.

SENETAS
SECURITY WITHOUT COMPROMISE

CYBER SECURITY

TRUSTED GLOBALLY.
PROTECTING THE WORLD'S
MOST SENSITIVE DATA.
PROUDLY MADE IN

AUSTRALIA

PROTECT NETWORK DATA
CERTIFIED ENCRYPTION

CypherNET

ALL NETWORKS.
QUANTUM READY.
MAXIMUM PERFORMANCE.



STOP SIGNATURELESS ATTACKS
PATENTED CDR ANTI-MALWARE

Votiro Zero Trust

PREVENTS SIGNATURELESS ATTACKS
AND ZERO DAY EXPLOITS.
ALL FILE TYPES.



Senetas Global
T: +61 (0)3 9868 4555
E: info@senetas.com

senetas.com
info@senetas.com



Personnel working at the Commercial Operations (JCO) cell, Adelaide.



“But to do that I have a preliminary task to understand what the space establishment is across defence and what are the positions we need, and with what expertise and experience.”

While the headcount of Space Command is a current focus, MAJGEN Novak says it was clear that the workforce would ultimately come from the “wider Defence enterprise”.

“They will be in Joint Operations Command, Capability Acquisition and Sustainment Group, as well as the services.

“I need to be able to bring people into the domain through lateral recruiting from other areas of Defence employment, or maybe even related fields in industry.

“We need to train those people with the skillsets they require, and we must have a career path for them so they can continue to progress in rank, both as Defence Space professionals and as representatives of their parent service.”

This emerging category of space professionals would have a range of skills, from space system specialists and operators—some of whom had already been embedded in the US and

UK—to operations and plans staff to intelligence.

“I would make the point though that for a young command, which has just transitioned from the Royal Australian Air Force to the Joint Capabilities Group, I am very comfortable with our current staffing and skillsets.

“I’m really confident that there is a strong foundation for us to grow into where we need to be to meet future requirements, and we’ll be getting a better understanding of what the Command needs as we mature.”

Space Command was already working closely with the Defence Science Technology Group, which has a physical presence alongside Space Command in its headquarters and was collaborating on data projects involving artificial intelligence and machine learning.

International collaborations

Another important dimension to the idea of space being a “team sport” is Australia’s collaboration with allies and partners, not just with traditional space partners such as the US and UK but with counterparts in New Zealand, France, Germany and Japan.

Much of this collaboration occurs through the Combined Space Operations (CSPO) Initiative, created as a multinational partnership in 2014 to generate and improve cooperation, coordination and interoperability to sustain freedom of action in space. In December 2023, the membership CSPO increased to 10 nations, bringing Japan, Italy and Norway into the Initiative.

“In this forum we regularly engage with counterparts, not only to improve combined space endeavours, but also in discussions aimed at promoting responsible behaviour in space,” says MAJGEN Novak.

“There are global rules common for us all, and we want to make sure we have an accessible space domain which is secure and stable and enables us to pursue our interests.

“So, there are a number of bilateral and multilateral engagement forums where I participate, either virtually or through travelling, but it’s really about identifying the areas where our interests align, understanding who has capabilities that can support others, and how we can work collectively.”



Pioneering space cybersecurity: Collaborative efforts for a safer and connected cosmic frontier

Space domain awareness (SDA), an enhanced understanding of the space environment resulting from monitoring space objects, shows how important space is to modern society, affecting governments, businesses, academia and the public. The broader foundation of space situational awareness (SSA) is also needed more than ever. With the blurring of the lines between commercial space systems and support to national security, the SDA/SSA dynamic has become inextricably intertwined. The trilateral AUKUS partnership between Australia, the UK and the US provides a model framework for SDA collaboration to secure the space environment and combat space debris and risks to space-based assets. Collaboration and coordination among the Space AUKUS partners will address this evolving

security challenge to ensure the safety and stability of their shared space assets and operations.

Contemporary space challenges present a rare opportunity to establish a new international coordinating approach for space use, especially when cooperating with governments like Australia that cherish space freedom. This approach creates multinational information architectures, common vocabularies, and data dictionaries that promote collaboration and foster international space information-sharing transparency and trust.

Good security practices require traceability across information security, operations, communications, transport and personnel security. The challenge with security is its application. Without adequate implementation, a security profile with weak links will not protect commercial systems from sophisticated

state actors. Without physical, personnel, trusted supply chains, cyber, certification and accreditation, mission assurance, safety management, security and sustainability processes/procedures, minimal security measures will not deter more sophisticated bad actors. Leveraged security standards and practices help improve cyber capacity in Australia's growing commercial space industry.

MITRE supports cybersecurity and critical infrastructure and has extensive expertise in space-related cybersecurity interdependencies, from space systems to national vital infrastructure. MITRE subject matter experts have taught international organisations commercial space recommended practices to build a safe and resilient space essential infrastructure.

The United States Space Priorities Framework and the 2023 National

Cybersecurity Strategy emphasise the importance of unfettered access and freedom to operate in space, which is vital to advancing security, economic prosperity and scientific knowledge. Both commercial and government entities must work together to counter security-related threats to national and commercial space assets. In Australia, the continued development of new commercial infrastructure also creates opportunities to address cybersecurity risks.

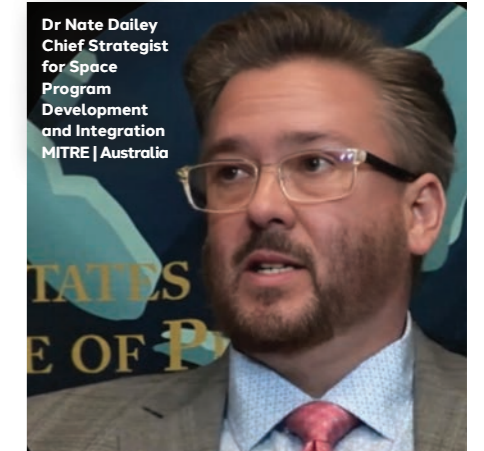
Organisations and methods to protect space links to critical infrastructure are emerging to assist and guide commercial and international satellite owner-operators. These include national and international standards-development organisations, risk management guidance from the National Institute of Standards and Technology (NIST), and the Space Information Sharing and Analysis Center. Risk management guidance for satellite owner-operators includes technical references, cybersecurity control catalogues and IT Risk Management Frameworks. NIST also published the Cybersecurity Framework (CSF) for commercial space businesses, describing an exemplary method for applying the CSF to commercial satellite operations.

Sector-based information sharing and analysis centres (ISACs) collaborate via the National Council of ISACs. The Space ISAC provides industry's principal channel for collecting, analysing and disseminating information about potential and actual threats to space systems. Membership represents many of the country's leading space industry participants, including MITRE as a founding member, and maintains active liaison relationships with various government components. A new operations centre, opened in May 2022, facilitates real-time information validation and analysis of space system threats and overall situational awareness.

A trusted and symmetric space information sharing ecosystem is another concept to improve critical infrastructure and commercial space industry outcomes. Information sharing supports activities such as communicating mission-relevant cybersecurity information and on-orbit close-proximity



Dr Braden McGrath
Director
MITRE |
Australia



Dr Nate Dailey
Chief Strategist
for Space
Program
Development
and Integration
MITRE | Australia

operations such as refueling. The need to widely share information—bilaterally, or even multilaterally (such as data associations)—is critical and has certain advantages over traditional information-sharing designs. Further, the shared information must be trusted internationally.

MITRE's ATT&CK-based tools have improved cyber defences for the United States Air Force (USAF) by providing a foundational analytical framework for defensive cyber operations. The use of these tools by USAF cyber operators supports the US Cyber Command and Air Combat Command. By leveraging the success of ATT&CK-based tools, like the USAF and thousands of other organisations and companies worldwide, Australia's space industry can enhance its cyber defence capabilities and protect its assets from potential threats.

The Australian Defence Space Command has recognised SDA as a cornerstone space control program. By sharing data and leveraging each nation's unique advantages, a US-Australian collaboration can contribute significantly to the rapidly growing need for enhanced global SSA and traffic coordination. This shared data includes preventing collisions, mitigating risks posed by space debris and responding to threats to space-based assets.

In a 2022 jointly conducted study, MITRE and the Aspen Institute provided several recommendations relevant to the importance of a comprehensive, whole-of-nation approach to address shared challenges in commercial, civil and military space. Recognising the importance of space for national

and economic security, organisations like MITRE and the Aspen Institute initiated cross-sector space stakeholder forums focused on securing space and maintaining technological advantage. Participants from various sectors, including industry, government, academia, nonprofits, and federally funded research and development centres, contributed to identifying challenges and recommendations.

Recognising the complexity of involving various international and domestic actors becomes crucial in partnering with Australia to globalise SDA. As nation-states possess sovereignty over their respective space activities, commitment to global SDA may require more than simple input. Aligning international efforts with domestic policy may necessitate new models for participatory decision making.

Both the US and Australia's national and economic security heavily rely on the security, resilience and sustainability of their respective space systems. The commercial, civil and military stakeholders of both countries face shared challenges, such as the absence of responsible behavioural norms in space, outdated regulatory frameworks and insufficient complementary technical infrastructure. By partnering, Australia and the US can leverage shared expertise, resources, and commitment to address these challenges and ensure a secure and sustainable space environment for both nations and the growing number of spacefaring nations and international commercial ventures. ●

<https://mitre.org.au/australia@mitre.org>

Cyber in space: The good, the bad and the ugly

Space industry cyber threats and solutions

**By Simon Galbally,
Senetas Corporation**

The Good: Space industry critical infrastructure

The Australian space industry is not simply another industry vertical. It is a fast growing (7% per annum) component of our critical national infrastructure that adds value to other industries. Growth is driven by its technologies, increasing investment, international partnerships and Australia's geographic advantage. It contributes, according to IBIS World, AU\$5.7 billion to gross domestic product (GDP). Made up of some 800 businesses and more than 15,000 employees, the space industry also includes 56 education and research institutions and directly involves around 24 government agencies.

The critical importance of the space industry to Australia's economy reaches throughout the national infrastructure—from the defence force to

telecommunications, every industry relies on it. The space industry's broader indirect GDP impact includes its role driving innovation, creating high-skilled jobs and supporting economic growth in related industries. It is a critically important industry. The space industry's importance demands state-of-the-art cybersecurity.

The economic prospects for the industry are best illustrated in the Space Foundation's estimation that the global space industry reached US\$428 billion in 2020. The World Economic Forum estimates the global space industry may be worth US\$1.8 trillion by 2035.

The space industry's growth is not just a good news story. It is an important story about the industry's contribution to our critical national infrastructure. It supports industries such as telecommunications, agriculture, logistics, aviation and mining through to services such as communications, imagery and location positioning. Space industry capabilities are essential to weather forecasting, vegetation and land use monitoring, national security, emergency services, and surveying and mapping. There

are important uses in government agencies, such as Geoscience Australia's internationally recognised for Digital Earth publishing data derived from space. There is even a new capability to manoeuvre and manage space debris through the work of the Space Environment Research Centre.

That is a lot of economic good to protect from cyber threats and bad actors seeking to steal technologies and data as well as to harm space operations and services.

Space industry is not immune to catastrophic cyber-attacks

The space industry's complex mix of meshed data networks and interconnected data, software, and working with other connected devices to communicate and compute expose it to catastrophic harm. Increasing data communication in space provides an infinite number of attack surfaces exposing Australian economic, national infrastructure and defence security interests to increasing cybersecurity vulnerabilities.

Due to its rapid development of technologies and the significant economic, defence and scientific nature of its space missions, the space

industry faces serious cyber threats and persistent cyber-attacks by a range of bad actor types. It is a high value target with vulnerabilities that must be addressed to avoid catastrophic harm to space assets, launch controls, missions and communications systems. Vulnerabilities primarily arise from:

1. Failures to implement risk management-based cybersecurity strategies. Both cyber-attack likelihood and the impact severity rate are high risk factors that demand high levels of priority and cybersecurity investment to ensure preparedness and resilience.
2. Space organisations' use of complex data networks due to their many interconnected systems, such as satellites, ground assets, communication networks and datacentres. Space missions and asset management involve mixed data network protocols and complex topologies. These complexities increase their vulnerabilities.
3. Dependence upon legacy IT and cybersecurity systems that may not have been designed with current cybersecurity risks in mind, exposing them to greater threats.
4. Supply chains expose the industry to cyber vulnerabilities. The industry relies on the global supply chains for components, technologies and services. Suppliers and partners may introduce cybersecurity vulnerabilities through compromised products/services.
5. People pose a significant risk to space organisations' cybersecurity. Behaviours among employees, contractors, suppliers and/or partners with access to systems and sensitive data may inadvertently or maliciously compromise cybersecurity.

Addressing these issues requires an holistic and strategic risk management approach, including investments in risk assessments, cyber defences, people, training, technology and a 'cybersecurity first' culture. Cybersecurity must be seen as fundamental to business operations and space missions to safeguard critical assets, protect sensitive/valuable data, and protect space missions and other operations.

The Bad: Cyber threat landscape

Together with advancements and benefits the space industry provides Australia's critical national infrastructure, it faces increasing cybersecurity challenges and threats. When examining cyber threats to the industry, it is important to consider the cyber threat and attack experiences in the US and EU space industries due to their greater industry sizes and attraction to bad actors—existing and emerging vulnerabilities—the bad and the ugly!

Globally, space industries have increasingly become high-value cyber-attack targets of lone wolf, state-sponsored and criminal syndicates. Moreover, each bad actor type has become significantly more sophisticated and well resourced. There are no rules. How then does cybersecurity deal with such threats?

The answer is threefold. It begins with 'security-first principles'. A cybersecurity strategy that includes a mix of cyber policies, risk assessments, resourcing and investment commitments to threat identification, threat prevention and data protection. It is not sufficient to simply 'tick boxes' or stick to the 'same old' security technologies that are proven not to be resilient to today's persistent and much more sophisticated threat technologies. Thirdly, no organisation should just rely on vendors' security patch updates adding vulnerabilities, costs and systems' downtime. The frequency of IT vendors security patches is indicative of their products' security weaknesses.

Recently, ASIO's director general, Mike Burgess stated that "encryption enables our economy", reflecting on encryption's critical role in data protection throughout the economy—from citizen privacy to protection of intellectual property (IP), defence and government secrets.

Space industry organisations have many attack surfaces exposing their space and ground assets and space operations to significant cyber threats. Space missions generate huge volumes of valuable data, including telemetry, scientific observations, and military and space operational information. Attack

surface vulnerabilities risk catastrophic harm; for example:

1. Unencrypted IT&T and OT data networks carrying satellite and other data and mission/asset operation controls.
2. Denial of service attacks on mission critical networks, such as satellite communication networks or navigation systems, denying critical services, including telecommunications, GPS navigation and weather forecasting, with mission consequences.
3. State-sponsored and commercial competitor espionage (e.g., network eavesdropping) or sabotage attacks to gain an advantage or harm space capabilities, thus even posing a threat to national security.
4. Supply chain cybersecurity flaws exposing space organisations (and the industry) to vulnerabilities, such as in technologies and assets supplied.
5. Weaknesses in access and control systems enabling hackers to gain unauthorised access to satellite systems, or other space assets, potentially disrupting critical communication networks, harming missions or even exposing sensitive data to theft.

Obviously, direct and indirect costs of successful cyber-attacks to the global industry range from enormous to eye-watering.

NASA has been targeted, including attempts to compromise mission-critical systems and steal sensitive data. Consequently, NASA implemented robust end-to-end network encryption protocols; performs regular cyber-drills; and collaborates with government agencies and industry partners to share threat intelligence and best practice cybersecurity.

Cyber-attacks on the European Space Agency (ESA) include its satellite communication networks and other assets. Since then it has adopted strict cybersecurity policies such as end-to-end encryption, threat detection, incident response planning and secure supply chain practices.

However, the US and EU space industries continue to face relentless

cyber-attacks, demanding increased vigilance and investment in state-of-the-art cybersecurity. In the eyes of bad actors, the riches are too great to ignore—from data and IP theft to sabotage and operational disruption.

US and EU space industries have experienced supply chain vulnerabilities that bad actors exploited to infiltrate space systems and harm mission-critical operations. Reported serious successful cyber-attacks on US and EU space assets and operations include:

- In 2018, NASA data breach. Unauthorised individuals accessed one of its servers containing personally identifiable information.
- In 2019, NASA's Jet Propulsion Laboratory. Hackers breached the agency's data network gaining access to sensitive data about space missions and Mars exploration projects.
- In 2019, the US Department of Defense reported supply chain vulnerabilities in space industry satellite components. This highlighted risks to national security.
- In 2020, the ESA disclosed a data breach on its ExoMars mission exploring Mars for signs of life. Its network was breached compromising sensitive scientific mission data.

Space industries are prime targets for espionage and state-sponsored cyber threats aimed at stealing IP, gaining a strategic advantage or disrupting/denying space activities. The strategic importance of space assets highlights the criticality of state-of-the-art cyber defences.

As other industries' reliance on space technologies (e.g., satellite communications) increases, addressing cybersecurity vulnerabilities remains the critical imperative for ensuring the integrity, resilience and security of space exploration efforts.

The Ugly: Quantum computing cyber threats

The expected computational power of quantum computers holds enormous potential for the space industry by enabling advanced data analytics, simulations and modelling, spacecraft design optimisation, enhanced sensing and navigation.

However, quantum computing in the hands of bad actors also presents new and greater cybersecurity risks, causing implications that are being addressed by regulators (e.g., the US *Quantum Computing Cybersecurity Preparedness Act, 2020*). By harnessing the benefits of quantum computing while preventing its threats, the space industry will unlock new opportunities in space exploration and scientific discovery.

Quantum computing, with its quantum mechanics-based information processing holds great promise for transforming space exploration. However, along with its benefits come significant threats that must be addressed in any space organisation's cybersecurity strategy and cybersecurity solutions.

The threats of quantum computing to conventional mathematics-based cryptography, public encryption key infrastructure and communications protocols requires quantum-safe encryption. Simply, cybersecurity solutions must be 'quantum safe'. Quantum-safe encryption components are:

1. Quantum resistant algorithms
2. Quantum key distribution
3. Quantum random number generation.

Cybersecurity risks arise from quantum computing's ability to break existing conventional encryption protocols—to decrypt sensitive data transmitted among spacecraft—which threatens mission security and confidentiality. Threats to satellite communications lead to communication blackouts, interference with navigation systems and compromised data transmission.

Quantum-safe encryption will be essential to the future security of space communications and sensitive data transmission among spacecraft, ground stations and mission control. It is important now because much space industry data is long-life, requiring quantum-safe encryption today to provide long-term protection against future quantum threats.

CIA Principles: Confidentiality, Integrity and Availability

The CIA [confidentiality, integrity and availability] principles are the foundation of cybersecurity and essential to protecting systems and



data from unauthorised access, modification, disruption or theft. An effective cybersecurity strategy will be based on these three principles:

- a. Confidentiality** requires information to only be accessible by authorised parties. It prevents unauthorised access, disclosure or theft of sensitive data. Data encryption, access control and secure communication protocols are required.
- b. Integrity** ensures that data remains accurate, complete and trustworthy throughout its lifecycle, while at rest (stored), in use and in motion across data networks. It requires safeguards to prevent unauthorised data modification, deletion or corruption. Security tools, such as encryption, hashing, digital signatures and version control help maintain data integrity and detect unauthorised changes.
- c. Availability** ensures that data is accessible and usable as required. It involves security that prevent business disruptions, downtime or denial of service attacks that will impair access to critical systems.

Zero trust cybersecurity: Protecting assets and operations

Preventing cyber-attacks and protecting space organisations' data require a 'zero trust' approach to cybersecurity. The critical cybersecurity strategy features necessary to safeguard space assets and operations are:

1. 'Military-grade' end-to-end encryption protocols for secure and authenticated data transmission across all networks and data storage prevents risks of unauthorised access, malware and data breaches. Authenticated end-to-end encryption should be applied across all communication networks—channels, satellite links and ground-based systems. Why military-grade? Because the most secure encrypted networks use authenticated end-to-end encryption technology and recognised security certifications, e.g., FIPS Level 3 (US) and Common Criteria EAL4+ certified (EU) as proven suitable for defence and government use.
2. A comprehensive cybersecurity strategy and practices necessary to reduce the likelihood of successful cyber-attacks.
3. Processes to share cyber threat intelligence and cybersecurity best practices within the global space industry.
4. A secure supply chain is essential to reducing attack surface vulnerabilities. They must include thorough periodic risk assessments and due diligence reviews of suppliers and other vendors and partners. This will enhance industry expectations of security transparency and accountabilities.
5. Planned incidence responses and regular cyber drills achieve more effective cyber-attack responses and avoid catastrophes—rather than being caught by surprise.

As the Australian space industry grows, the risk of cyber-attacks should be a primary business and investment priority. Failure to ensure the cyber resilience of space assets and operations will be enormously damaging financially and

Organisationally. Organisations must build a culture of cybersecurity awareness and vigilance. This should include standards specific to the space industry, including business and regulatory compliance requirements.

reputationally. It is certain cyber-attacks are here to stay.

In any industry, preventing successful cyber-attacks requires proactive cybersecurity strategies and investments in attack prevention and data protection—through threat prevention and surveillance technologies and end-to-end encryption. Importantly, cybersecurity plans should not be limited to preventing cyber-attacks. It must also account for protecting the data in the event of a successful data breach. Only end-to-end encryption provides that last line of defence to ensure breached data is useless in the hands of unauthorised parties.

Just as the space industry's technologies and capabilities have grown rapidly, so too have bad actors' weapons. It is a fact of crime that the criminals are always one step ahead.

The looming biggest cybersecurity threat is quantum computing. Like all new technologies that offer significant benefits, in the hands of bad actors quantum computing is considered by experts to be the biggest cybersecurity threat in history.

This remarkable Australian industry may well experience the good, the bad and the ugly. ●

Arnhem Space Centre
Horizontal Integration Facility



Arnhem Space Centre
Advanced Launch Pad

Equatorial Launch Australia: A company on a mission

By Lachlan Colquhoun

Equatorial Launch Australia (ELA) scored a major first for the domestic space industry in 2022 when NASA used the company's Arnhem Space Centre (ASC) for its first-ever launch from a fully commercial spaceport.

While that was a significant coup, the three sub-orbital NASA launches were only the beginning for ELA and its plans to develop the Northern Territory-based ASC into a major centre for international launch customers, leveraging advantages such as its 12 degrees south proximity to the equator and the adjacent logistics services in the Gove and Nhulunbuy areas.

ELA's stated goal is "to become the pre-eminent multi-user commercial space launch company, providing world-class launch services supporting launch, recovery and testing of space vehicles and payloads flown to and from all space orbits."

In November 2023, ELA lodged plans for a major expansion of the ASC site, which would see it grow from a single launch site and comprise seven space launch complexes (SLCs) over the facility's 300ha, operated under a 40-year lease agreement signed in 2017 with the Gumatj Corporation and the Northern Land Council.

The Spaceport of the Future designs for the new SLCs comprise a state-of-the-art horizontal integration facility (HIF) and launch pad designs, known as the ASC Advanced Launch Pad (ASCALP).

ASCALP, which uses innovative technology able to adapt to any NewSpace rocket, will enable all seven SLCs to launch any rocket with very little notice or configuration change.

The company believes this design is the most advanced NewSpace small to medium rocket launch pad in the world today and will help to meet rapid-responsive launch needs in the future. The design also significantly minimises the damage created by rocket plumes, substantially increasing the reusability of the launch pads.

ASCALP will accommodate all current class NewSpace small launcher rockets up to approximately 450,000kg launch weight, including up to 3,000kg payload weight.

The pads will provide advanced thermal and acoustic protection

damage mitigation aspects, advanced environmental and safety aspects as well as detailed and comprehensive support services integration.

"Every element of this ASCALP is designed to improve the safety and efficiency of launch," says Michael Jones, ELA's Chairman and Group CEO.

"It is also designed to make the operation of the Arnhem Space Centre much more efficient and cost-effective. The use of a proprietary interface plate element seamlessly mating a rocket to the pivot base of the pad allows each rocket to be launched from the standard launch pads anywhere on the ASC site.

"This has multiple advantages, including having all seven Space Launch Complexes at the ASC able to launch any rocket with very little notice for configuration change."

Servicing international customers

Jones says 'Site One' was "effectively set up for NASA" in what was also NASA's first Australian launch in 25 years and was ideal for the sub-orbital launches the space agency needed to

carry out, but new sites were needed to accommodate larger rockets and higher orbits and to deliver on the company's vision of launching rockets at an average frequency of once a week.

He says ELA will "break even" at 11 launches a year, but his ideal "sweet spot" was 55 each year and for that the facility needed major development.

"We can continue to use that site we used for NASA, but bigger launches need different safety ratings, particularly if you are using solid fuel rockets," Jones says.

"The other launch pads are necessary to service the international customers who will come here.

"When they arrive at the ASC, they need to have all the facilities available to them."

International companies are already making plans to use the ASC and there is a promising pipeline.

Jones says the ELA message to international companies is to do "two and away", meaning that the companies should do two launches from home sites before coming to Australia.

"It's useful from both perspectives for them to have de-bugged a few things before they come to us, and that two and away sequence is what we are working on at the moment."

In August 2023, South Korean INNOSPACE signed a contract to fire commercial orbital rockets from the site, with the first of 12 launches planned for 2025.

ELA has signed a multi-year, multi-launch contract with the Korean company, which plans to launch rocket variants each carrying payloads of between 50kg and 500kg into low Earth orbits.

Another company planning to use the ASC is US firm, Phantom Space Corporation, which has worked with the US Department of Defence.

In February 2024, ELA announced it had signed a Memorandum of Understanding with Singaporean company Equatorial Space Systems (ESS). ESS plans to use the site for a series of launches initially with the Dorado family of sub-orbital rockets and then the Volans rockets, which have

a payload capacity of up to 500kg. Initially, ESS will leverage the same launch pad used by NASA in 2022.

Another four Asian rocket companies have indicated their interest in launches from the site and have made inspection visits to the ASC.

"I'm thrilled to see this level of interest from Asian-based launchers," says Jones.

"It makes sense due the flexibility of orbits and launch directions from our site plus the ease of access to the ASC which simplifies logistics for our customers from this region, and of course other aspects like similar time zones and favourable weather

conditions are also conducive to a seamless launch campaign.

"As well as Asia, we've had strong interest from Europe and the US too."

A domestic tenant also on site is the Bureau of Meteorology (BOM), with ELA providing a location for an automatic balloon launching facility for the BOM.

The plans also include a three story building as mission and launch control. Jones describes the building as "visually stunning" and says it will be the ASC's flagship building including, eventually, a visitor centre.

"We're trying to build to a cost with lightweight construction, with materials that are good for the environment, but I

have always said that it doesn't have to be a box—we are a spaceport, so let's have some interesting design shapes.

"So what we have is quite visually stunning I think, and this flagship building is also in the area where we will have our accommodation camp."

Ultimately, the ASC will have accommodation for up to 200 people, or seven companies each with 10 to 15 people, as well as ELA staff "working around the clock".

Currently, staff and clients need to take the 30-minute drive from the nearest town of Nhulunbuy, a settlement of around 3,300 people which already has good facilities and infrastructure from its history as a bauxite mine and aluminium refinery. In addition to accommodation, there is access to an airstrip and a deep water port.

Mining giant Rio Tinto is winding down its operations in Nhulunbuy and its full-time staff will be replaced by fly in fly out workers until the company finishes its activities later this decade but, by then, the ASC should be in full swing and the focus of the town could switch from mining to space.

Value proposition

As it prepares for the transformational growth of the ASC, ELA released its HIF designs in January this year, which outline its value proposition to launch vehicle providers and payload customers.

Developed after a review of previous launches and extensive international research and analysis, ELA will offer resident launching companies a long-term, multi-launch residency and the exclusive use of an SLC comprised of one standard HIF and up to two launch pads fitted with the new ASCALP technology.

Each of the seven SLCs are to be set up as restricted access areas providing launch companies secure, sole access and commercial confidentiality during their residencies as well as compliance with ITAR [International Trade in Arms Restrictions], MTCR [Missile technology Control Regime] and TSA [Technology Safeguards Agreement] security requirements.

"Our approach from day one was to stand in the shoes of our clients and look at everything they need to enable them to have a successful launch campaign from the ASC," says Jones.

Takeaways from global space industry events

Much of Michael Jones' time is spent travelling overseas visiting customers but also attending and speaking at global space industry events.

By early 2024, Jones had already visited SpaceCom, the Global Spaceport Alliance and Space Mobility—all in Florida—and also Satellite Innovation in California's Silicon Valley.

"The events in Florida were interesting because it's the first time I've gone to a US Defence or institutional based briefing, and there were some unclassified briefings done and they were mind bending and mouthwatering at the same time," Jones says.

"My big takeaway is that the US Defence organisations are really looking to do a lot more space in Australia."

One driver for this was diversity, because the US currently has "most of their eggs" in the Vandenberg or Kennedy bases in California and Florida and they want to use different locations.

"Another driver is the access to different orbits as they increase their intelligence, surveillance and reconnaissance capabilities beyond the GEO [Geostationary Equatorial Orbit] satellites they have relied on in the past.

"I got a clear message that they are very committed to doing stuff here in Australia, and I had some good discussions with the US Defence Innovation Unit and other Space Force entities."

There were also discussions on "where space is going from a commercial perspective".

"My big prediction is that the handset to space mobile communication will integrate with the NBN as we now use it, but also go directly with applications such as WhatsApp, which uses data and not cell towers," says Jones.

He predicted a "son of Starlink" service which geared handsets to space communications and suggested this would be "the next big thing in space".

On satellites, Jones believes that the size of the payload requirements is increasing, and this will drive a move from small to medium-sized rockets.

"We're also going to be seeing a lot of in-space servicing, and that will mean private companies building private space stations such as the planned Voyager Station," says Jones.

"So, for us, this means bedding down our current plans, and making sure we have that capability for launch of small to medium-sized rockets."



Michael Jones,
Chief Executive
Officer, ELA

"The SLC concept and the HIF design is far more detailed and complex than first meets the eye and will set the standard for launch operations in the future.

"The innovative designs were born from extensive and comprehensive international research on current and past spaceport service offerings and deep discussions with customers on their current and future launch needs, while also considering the needs of regulators, commercial partners and ELA as the spaceport operator."

Logistics support

In addition to developing launch capabilities, ELA also seeks to differentiate its offering to its customers on the basis of its expertise in logistics.

Recognising the challenges posed in transporting large and sophisticated equipment long distances to a remote location, the company aims to provide end to end logistics support from a customer's home base to the launch site.

"Our message to our customers is—you bring the rocket and we'll take care of everything else," says Jones, whose previous roles include managing one of Australia's largest logistics operations.

"We look at their problems and recognise that we need to provide a compelling and comprehensive solution so we can remove any impediment to them doing business with us.

"So we look at every aspect. How do we plug in their computers? How does their software work? What is their telemetry data stream, what is the coding in their encryption and what fuels they are using?"

ELA also considered how many staff customers would be bringing with them, how many desks they would need, how many offices with the aim of ensuring the working conditions were both pleasant and workable.

"If our customer is based in France, for example, we'd turn up to their headquarters and pick up nine containers, ship them to Rotterdam and

they'd be on their way to Darwin via Singapore.

"There will be biosecurity checks in Darwin and from there it needs to go to Gove by coastal freighter, and then to the site next to their horizontal facility and they will come and unlock them and we'll help them unload."

Currently, ELA is sourcing liquid oxygen for rocket fuel from a manufacturer in Townsville, but there is a "crossover point" where it becomes worthwhile for the company to manufacture liquid oxygen on site at the ASC.

"That point is in the future, but we have quotes from three different companies to build that facility for us," says Jones.

"So what we do is a multi-faceted operation and we think of all these factors for our customers because we want to make it as simple and as easy as possible for them to come and launch from here. We want them to bring the rocket, and we will take care of everything else." ●



Projects launched in 2023

1. Successfully completed a NASA capsule re-entry mission which saw the return of samples from the 4.6 billion year old asteroid Benu with Rocket Technologies International and UniSQ.
2. Qualified the Space Machines Optimus first-generation space transport and servicing platform for flight with ANU.
3. Using virtual twins to revolutionise composite aerospace vehicle repairs with UniSQ, MEMKO and Boeing.
4. Developing carbon composite technology to reduce satellite mass with New Frontier Technologies at ANU.
5. Establishing an advanced manufacturing facility at UniSA with VPG Innovation that will design and deliver stronger, more durable satellite and hypersonic vehicle structures using additive manufacturing.
6. Revolutionising optics with VPG Innovation and SMR for Earth observation at UniSA.
7. Development of radio thermal isotope generators for multiple lunar night survival with entX and UniSA.
8. Maturing reliable and consistent long-term power sources for spacecraft where solar energy cannot be relied upon with entX and UniSQ.

47

IMAGE: Supplied/NASA

46

Creating institutional change to accelerate Australia's innovation agenda

The Innovative Launch, Automation, Novel Materials, Communications and Hypersonics (iLAUNCH) Hub Trailblazer is a \$180 million program building Australia's enduring space capability through the commercialisation of projects, a fast-track accelerator, and skills development to build the workforce of the future. In the first half of operations in 2023, the Australian Government Trailblazer Universities Program provided investment and resources to accelerate Australia's innovation agenda at speed and at scale. World-class research teams have joined together from the University of Southern Queensland (UniSQ), the

Australian National University (ANU) and the University of South Australia (UniSA) to form the iLAUNCH Trailblazer. Together, these three regional universities and more than 20 industry partners are remodelling how we engage to commercialise cool ideas into space hardware.

Why iLAUNCH is different from other research and development organisations
The iLAUNCH Trailblazer is creating institutional change in bringing together SMEs, large industries and universities to better link research needs and approaches. "By normalising how institutions and business work together, our goal is to

rapidly translate R&D through to space qualification within a three-and-a-half-year period," says iLAUNCH Executive Director, Darin Lovett.

iLAUNCH is accelerating space innovation in Australia through this expeditious translation of world-class research from technical readiness level (TRL) 4—lab testing and validation of a prototype—through to TRL 8 where the system is incorporated into commercial design and qualified through tests and demonstration. All in a more compressed timeline, with a results driven outcome.

Utilising \$50 million of investment by the Australian Government, alongside a further \$130 million from the institutions, partners and the CSIRO,

iLAUNCH expects to see \$3.6 billion in net economic benefit by 2040.

First year projects
Assistant Minister for Education, Anthony Chisholm, officially launched this Trailblazer on 6 July 2023. "Currently our manufacturers are reliant on international space industries and launch facilities to send these systems to space—but we're changing that. This project supports Australian companies to compete on a global scale and capitalise on commercial opportunities by using Australian resources and technology from start to finish."

In the first year of operation, iLAUNCH Trailblazer commenced eight projects and committed over \$100 million in total project value. A second funding round was open in November 2023, with expressions of interest oversubscribed and, at the time of printing, proposals have been selected to progress to funded opportunities.

Skilling the Space workforce of the future
Trailblazer, industry and university partners are employing more people

in the space industry, with 60 new positions being created, including 20 new ones for PhD students.

The focus of iLAUNCH is not just industry. Alongside universities and industry partners, they are investing in future skills development from primary school to tertiary level, using Space to inspire and develop the regional workforce of the future, including through STEM [science, technology, engineering and mathematics] partners One Giant Leap's Global Space Challenge and Makers Empire's Kids in Space. For tertiary students, iLAUNCH has partnered with the AROSE Milo Mission Academy for Lunar Exploration to offer 20 student places to the world-renowned program and sponsoring a team participating in the Australian Youth Aerospace Association's Astra Program. iLAUNCH Chief Technology Officer, Dr Joni Sytsma, is developing micro-credential courses at the UniSQ and mentoring at industry and academic workshops with the CSIRO and ANU.

Together, we will build trusted relationships and develop a greater commercialisation capability across both universities and industry. ●



Head of Air Force Capability, Air Vice-Marshal Cath Roberts AM, CSC, inside the EOS control room at Mount Stromlo Observatory, Canberra.

Electro Optic Systems steps up its tracking capabilities

By Lachlan Colquhoun

As space becomes more crowded with satellites, particularly in lower orbits, the tracking of space objects and debris has become critical.

According to the Index of Objects Launched into Outer Space maintained by the United Nations, there were 11,330 individual satellites orbiting the Earth at the end of June 2023, a 37% increase since January 2022.

In 2022, a record 2,474 objects were launched into space, and this was followed up by around 1,400 in 2023.

Canberra-based company EOS—Electro Optic Systems—was founded in 1983 and has grown to be one of the leading global providers of space tracking services, operating and building telescope infrastructure and precision optical instruments.

With the number of objects in space growing so fast, EOS is well-positioned to leverage its long-standing expertise and implement new technology to continue to be a major player in

this rapidly expanding and critical area of space tracking services and infrastructure.

Dr James Bennett, Executive Vice President of Space Systems at EOS, explains the company's evolution, beginning with the construction of satellite laser ranging systems and facilities around the world.

"We have progressed into debris laser ranging using high energy lasers, which we have been doing for over two decades. We have constructed two autonomous observatory facilities in Australia, located at Mount Stromlo

in the ACT and Learmonth in Western Australia," says Bennett.

"The tracking systems we build are not only highly precise and accurate but also applicable to a broader range of activities, such as directed energy, missile tracking, and optical communications.

"We specialise in space situational awareness, space domain awareness, space sustainability, and space control, and we've grown to be a service provider ourselves, in addition to building systems for customers."

Bennett says EOS is looking at implementing high energy laser ranging facilities at various locations around the world.

EOS signed a Memorandum of Understanding in October 2023 with Japanese company EX-Fusion to explore the use of high-power laser technologies, developed for laser fusion purposes, to address the space debris issue.

"EX-Fusion's work in laser-powered nuclear fusion complements our expertise in lasers and high-accuracy laser beam delivery to space and presents the potential for innovative solutions to the space debris problem," says Bennett.

Satellites, explains Bennett, vary in their manoeuvrability capabilities and, for some objects, there is no alternative but to intervene by "nudging one or both of the objects so they can pass safely".

The force needs to be sufficient to exert enough momentum for the object to change its trajectory, even by just a few centimetres per second in velocity.

"This is a debris mitigation strategy rather than remediation. While future debris removal missions will remove debris from orbit, ours is a mechanism that can assist in the meantime to stabilise the debris growth."

The "sweet spot" for this debris mitigation technology lies in the crowded low Earth orbit space environment where the risk of collisions is greatest.

The partners hope to integrate their technologies by the end of 2024 or in 2025, prove their combined capability, and then progress to building out a network.

"This is highly specialised, and there are few, if any, companies out there doing what we are doing," says Bennett.

"There is something of a race to see who gets there first but, in terms of capability, EOS has all of the required technologies: accurate and reliable automated laser beam director telescopes and observatory systems, high-power laser systems, control system software and mission systems software."

These capabilities were recognised last year when EOS' subsidiary, EOS Defense Systems (EOSDS) USA, was awarded two contracts to provide space tracking services to the US government.

EOS provides these services to the National Oceanic and Atmospheric Administration (NOAA) government agency's Office of Space Commerce.

The first contract provides commercial debris laser ranging data for NOAA's Open Architecture Data Repository, with the second contract providing passive electro-optical observations.

The EOSDS USA team, based in Huntsville, Alabama, will be supported by EOS Space Systems providing services from the Australian ground-based facilities at Mount Stromlo and Learmonth.

In Australia, EOS works in both the civilian and defence domains, providing space domain awareness services.

In 2019, EOS signed a Joint Statement of Strategic Intent and Cooperation with the Australian Space Agency to foster "discussions, collaboration and engagement", leveraging the company's expertise in space situational awareness to help foster the domestic space industry.

At that time, the EOS network operated six sensors, across the two locations, capable of acquiring over 10,000 high precision space object tracks each week. The goal is to achieve 100,000 tracks per week by the middle of this decade.

EOS has also welcomed Lieutenant General John James Frewen and Major General Greg Novak to tour their Mount Stromlo facility and see their capabilities in space domain awareness.

"We do work very closely with Defence, and we also collaborate with Australian industry and academia

Dr James Bennett, Executive Vice President of Space Systems, EOS



to field new technology using our infrastructure," says Bennett.

"In the delivery of space domain awareness, there are a few Australian companies participating in these activities, so we work with some of them to provide combined Australian solutions, which is a new thing, and it is growing.

"It is quite different from when I joined the space industry about 13 years ago, because there are new players, and they are coming with good capabilities, and working together can achieve a better outcome."

Bennett's work was recognised in 2020 when he was named as Scientist of the Year in the Space Connect Australian Industry Awards.

He is passionate about developing a pathway for talented Australians to work in the local space industry.

"There is still a substantial skills shortage, but if we are to retain our best and brightest here in Australia, we need to be providing a space industry ecosystem which will inspire people to pursue a career and contribute," Bennett says.

"Fortunately, the situation is different to when I began my career, and we do have an invigorated industry which has grown over the last five years.

"Years ago, young people interested in space would be walking around wearing NASA t-shirts. We want them to be wearing Australian Space Agency t-shirts, but while we have come a long way, we are not quite there yet." ●



UNSW

Defence Research Institute

Your innovation partner for space research

UNSW harnesses its education and research capabilities, to upskill and enhance Australia's Defence, National Security, and associated industries.

Drawing on the experience of designing, building, and operating 5 satellites across 4 missions, UNSW Canberra Space is focussed on making real-world impacts that improve the safety, security, and sustainability of the space domain. Our multidisciplinary research programs combine space domain awareness, "Ai on the edge", and cyber resiliency research onboard our innovative space-based platforms to advance the state of the art for small satellite research and capability demonstration.

UNSW defence research strengths include:

- Space engineering and missions
- Mission and digital engineering
- Nuclear science and engineering
- Quantum technologies
- Cyber security and operations
- Advanced materials and manufacturing
- AI, ML, and trusted autonomous systems
- Global strategic trends, law, and ethics
- Decision superiority and human performance
- Future workforce planning and capability
- Medicine and health
- Information and influence
- Hypersonics and other disruptive technologies

DRI.UNSW.EDU.AU



US Secretary of State, Antony J. Blinken (far right) and Australian Prime Minister, Anthony Albanese (far left) watch as Australian Ambassador to the US, Kevin Rudd (seated left) and US Assistant Secretary for the Bureau of International Security and Nonproliferation, C.S. Eliot Kang (seated, right) sign the US-Australia Technology Safeguards Agreement in the Treaty Room at the Department of State, 26 October 2023.

Technology Safeguards Agreement opens the door for growth

By Lachlan Colquhoun

Australia's collaboration with the US space industry can move to new levels after the signing of the Technology Safeguards Agreement (TSA) between the two countries in October 2023.

Prime Minister, Anthony Albanese and US Secretary of State, Antony Blinken were in Washington for the signing of the agreement by Australia's Ambassador to the US, Kevin Rudd and US State Department Assistant Secretary for International Security and Nonproliferation, C.S. Eliot Kang.

The agreement was tabled in the Australian Parliament in February 2024

and is expected to come into force later in the year.

In a joint leader's statement, Prime Minister Albanese and US President Joe Biden said, "Our focus on innovation also extends to space ... signing of a space Technology Safeguards Agreement will create the potential for new space-related commercial opportunities."

INDIAN OCEAN DEFENCE & SECURITY CONFERENCE

WHERE AUKUS MEETS THE QUAD

24-26 JULY 2024
PERTH CONVENTION & EXHIBITION CENTRE

The expanded fourth Indian Ocean Defence and Security Conference 2024 will see key Australian and international government, defence and industry leaders explore the theme: **Where AUKUS meets the QUAD.**

It will highlight challenges and opportunities for international engagement and how industry may support diplomacy, defence and security policy in the region.

-  Expanded industry exhibition
-  Conference program
-  Delegation and VIP engagement programs
-  Networking and engagement events

WWW.IODSC.COM.AU



The TSA establishes a binding legal and technical framework for the protection of US space launch technology in Australia to prevent unauthorised use and access, allowing for the transfer of US space technology, including rockets and satellites, between the two countries.

The agreement covers any US space technology launched from or returning to Australia, such as US launch vehicles, which includes spacecraft and satellites, and any equipment and data associated with space launches.

It gives legal and regulatory confidence to US companies interested in working in Australia that their intellectual property is protected by a compliance regime.

The TSA is expected to be a major catalyst for further US involvement in the Australian space sector, predominantly through using Australian launch facilities.

It should expand the market to Australian companies and give a boost to the entire local space industry, with a multiplier effect through other areas of the economy.

US Secretary of State Antony Blinken said the agreement would help US companies to access launch sites that are closer to the Equator.

"In Australia, American companies will have access to more high-quality launch sites so that they can increase the frequency of their operations," he said, adding that "they'll be closer to the Equator, where the Earth spins the fastest, so their rockets get an extra boost and use less fuel."

"By opening new doors for the private sector, we'll grow investment between our countries and help create good paying jobs in both countries."

"It will help provide more opportunities for American and Australian firms to continue innovating and innovating together, whether they're using satellites to make GPS navigation more accurate or developing spacecrafts to study the universe."

The negotiations were led by the Australian Space Agency, and the agency's head Enrico Palermo said the TSA is a "signal of the ongoing momentum within the Australian space industry."

"This is a treaty level agreement which is required by the US for another nation to enable the launch and return of US space technology," Palermo said.

"So, without a TSA in place the launch and return of US space technology cannot happen, but with the TSA it opens up that trade opportunity."

"This is something we've worked very hard on negotiating over the last couple of years but I'm confident we've got a good deal for Australia which strikes the balance between protecting US technology but does not restrict our own industry growth."

The agreement with the US will be the most comprehensive and detailed TSA of its kind for any nation and there has been a lot of effort by key Australian space industry parties and government entities behind the scenes to ensure we get it right.

Equatorial Launch Australia (ELA), operator of the Arnhem Space Centre in the Northern Territory, welcomed the agreement and a spokesperson said it would "make Australia more attractive as a global launch hub" and support growth across the entire supply chain.

"The agreement will allow US space technology to be launched from Australian soil, positioning Australia and the Arnhem Space Centre as a premier launch hub for the global space industry," an ELA spokesperson said.

"This will not only create new opportunities and partnerships but also encourage significant growth across the entire Australian space supply chain. We are confident that this agreement will pave the way for a new era of collaboration and innovation, ultimately benefiting the entire space ecosystem."

ELA chairman and group Chief Executive, Michael Jones, said his company had been engaged with and negotiating with US rocket manufacturers for several years in anticipation of the TSA.

"We have all been awaiting the TSA completion. This is great news for us and clears the way for us to finalise our contracts with US launchers," he said.

"The agreement with the US will be the most comprehensive and detailed TSA of its kind for any nation and there has been a lot of effort by key Australian space industry parties and government entities behind the scenes to ensure we get it right."

The TSA will enable ELA to move ahead and finalise multiple joint draft contacts with US launchers and give the "green light" to finalise contracts with US rocket manufacturers.

Southern Launch, which operates two launch sites in South Australia—the Whalers Way Orbital Launch Complex and the Koonibba Test Range—also welcomed the agreement.

Southern Launch Chief Executive, Lloyd Damp, said it was a "game changer" for the company.

"The US space industry has been leading the space race for generations and this agreement will allow us to work closely with US space companies to facilitate launches or returns from our Australian sites," Damp said.

"The TSA makes this process easier and opens the door for us to relaunch these capsules into orbit from our Whalers Way Orbital Launch Facility on a rocket manufactured by a US company."

In a sign of things to come, Southern Launch recently announced a partnership with US company Varda Space Industries to facilitate the return of their in-space manufacturing capsule to the Koonibba Range later in 2024.

The TSA is similar to agreements the US has in place with the UK and New Zealand, and also serves to meet the nation's international non-proliferation obligations.

Australia and the US are also reportedly continuing negotiations on a bilateral space framework. ●

Aerospace Camp



54

One Giant Leap for Australian youth

By Michael Davoren,
One Giant Leap Foundation

The development of a future space workforce is crucial to advancing Australian sovereign capability. STEM [science, technology, engineering, and mathematics] and space education organisation, One Giant Leap Australia (OGLA)

Foundation is meeting industry needs, delivering grassroots programs that engage young people with the concepts of STEM and space, as well as facilitating deep emotional transformations. OGLA has made a huge impact over the last 12 months delivering programs such as Aerospace Camp, Aerospace Academy, the Global Space Challenge and much more.

"We are creating a pipeline of workforce talent that is required for Australia now and in the future. It is a big

picture, long-term goal and our strategy reflects this," says Jackie Carpenter, Director of OGLA.

At OGLA's Aerospace Camp, students experienced several enriching four-day experiences throughout 2023 and into 2024. The camp offers a comprehensive program tailored to the needs of professional and personal development. This dynamic program is filled to the brim with valuable content and participants find themselves leaving with a new found focus on their future.

Aerospace Camp



The camps represent a cherished dream of Jackie Carpenter and her late husband Robert Carpenter, who sadly passed away early in 2023.

"Bob would be so proud of the programs we are delivering", says Carpenter. "His passion for advanced technology and inspiring young people is reflected in these programs."

Aerospace Camp has already visited Lightning Ridge, Scone, Coonamble, Mudgee, Moree and Broken Hill is in the works (at the time of writing). Students living outside major metropolitan areas have a unique set of challenges and participants have been able to gain exposure to concepts, skills and industry professionals that they might not otherwise have. Despite the abundant online resources available to young people, geography can still impede their ability to fully engage in education, employment and community opportunities. Moreover, the COVID years have exacerbated isolation in regional areas. "We aim to bring industry networks and systems to them," says Carpenter.

The program spans across four days and three nights. Students engage with virtual reality, rockets, drones and so much more. The camp is also dedicated to nurturing transferable skills, such as team building, critical thinking, creativity and problem-solving. Aerospace Camp places particular emphasis on the key goals of "Work Ready, Wellbeing, Connectivity and Community". The strategy is to empower and guide

young people so they can discover their limitless potential and realise their aspirations. The fusion of practical workshops and presentations from space industry experts is also intended to increase students' self-assurance.

The camp works in collaboration with local schools and community groups providing full accommodation and catering. Offered during school terms, Aerospace Camp follows a curriculum-based approach and the impact on students can be deeply felt, according to OGLA Education Outreach Manager, Jenna McCarthy.

"It has been obvious how much students are absorbing technical content," says McCarthy. "Students walk away reciting the CASA [Civil Aviation Safety Authority] drone flying regulations verbatim for example."

The emotional impact has proved to be equally powerful. By collaborating with others from diverse backgrounds, students have developed significant collegial connections and gained valuable collaborative skills. Numerous parents have commented on a noticeable transformation at the camp's conclusion, expressing their delight and even shedding tears of joy along with students and OGLA staff alike. McCarthy says it is hard not to be moved by the experience, "parents have seen their children displaying a higher level of engagement and enthusiasm compared to when they were initially dropped off at camp four days prior".

On the wider career front, many students are often astonished to discover that careers in space can encompass far more than just being an astronaut. The camp emphasises inclusivity in space, showcasing the sector as a domain that fosters collaboration and the need for diverse skills and disciplines.

On the wider career front, many students are often astonished to discover that careers in space can encompass far more than just being an astronaut. The camp emphasises inclusivity in space, showcasing the sector as a domain that fosters collaboration and the need for diverse skills and disciplines.

"As we strive to construct colonies on the Moon and Mars, all the professions and trades that currently exist on Earth will be just as crucial in these novel habitats," says Carpenter. "We need gardeners, for example."

Aerospace Academy, a condensed version of the camps, has been running concurrently throughout regional NSW, again supported by the NSW Government. These three-day workshops give participants the option of attending a space focused day (one of two) or an aviation day. Students gain practical experience in building, testing and launching rockets. They also learn about space agriculture and what humans need to live in space. So far OGLA has delivered workshops in Dubbo, Coonabarabran, Port Macquarie, Taree, Port Stephens, Queanbeyan, Bateman's Bay and Kiama with Albury, Griffith and Orange scheduled for 2024.

The OGLA team went to Melbourne in September to run Space Teams Academy, an exhilarating virtual space adventure based on real data, created by former NASA astronaut Dr Gregory Chamitoff. During the event, RMIT's Dr Graham

55

IMAGES: Supplied



Global Space Challenge



Global Space Challenge



Global Space Challenge



The Gadget Girlz

Dorrington spoke to the students about the lunar rover, the RMIT HIVE rocketry team showed students some of their launches, and they also got to experience virtual reality. The program was made available for free thanks to RMIT and OGLA to 32 Year 7 and 8 students. It was inspirational to see student enthusiasm and parental feedback was equally inspiring. “I hope it inspires my son to aim high with his ambitions for a career, whatever they end up being, as he has now seen and experienced firsthand what creativity and passion, combined with rigour and intellect, can achieve”, said one excited parent.

Meanwhile in Queensland, students were enthusiastically engaged in the Space Teams Academy event, the Global Space Challenge, last September. More than 30 scholarships were made available to students thanks to OGLA with the assistance of the Department of Science, Industry and Resources, University of Southern Queensland’s (USQ) iLAUNCH program, Geospatial Intelligence and the Queensland Government.

The competition was an immersive six-day international virtual event where students designed a mission to explore another planet through captivating online simulations. Each day’s session

consisted of a one-hour live tutorial, led by an industry expert as a part of daily mission training. The program guided students through planetary systems, spacecraft design, the intricacies of orbital mechanics and astrodynamics, mission planning, piloting skills, and detailed knowledge of atmospheric descent and landing. Students also learned about survival techniques in space, the design of habitable deep space environments and the exploration of planetary surfaces.

OGLA staff facilitated the program which was held at USQ’s Toowoomba campus and participants also received online guidance from Dr Chamitoff. The challenge was open to students aged 12 and older from Years 6, 7 and 8. Scholarships were granted to applicants who submitted videos demonstrating not just their expertise in STEM and space, but also their genuine interest and enthusiasm.

Teams of four or five, participated in competitive tasks against young space explorers from a wide range of countries, such as the USA, Canada, Egypt, India, Lebanon, Ukraine, Papua New Guinea, the Netherlands and Germany.

“We were delighted to be able to also offer some scholarships to students in Papua New Guinea for

this event which was fantastic”, says Carpenter. “This program is the STEM education version of professional mission software with teamwork, collaboration and communication once again being essential to the successful accomplishment of their missions.”

McCarthy was on the ground in Toowoomba and was delighted by the tremendous interest generated by the challenge. “The level of enthusiasm demonstrated by the students was truly remarkable and heartening to witness. There was immense creativity displayed in the initial entry videos too,” McCarthy says. “The program has managed to reach a vast number of regions in Australia and has also successfully connected these regions to the rest of the world.”

The efforts of the Queensland school students undeniably left a lasting impression on the community. Featured in local media, a local team from Toowoomba, known as “MOD-N Inc” (a name created by the students themselves), showcased their remarkable skills. They emerged victorious in the Middle School section and secured a commendable second place in the overall global event. Meanwhile, an inspiring all-girls team, named “Scooters”, displayed their talent and determination achieving a commendable

second place in the High School division and an impressive fifth place overall, despite tough global competition. There were even more accomplishments to celebrate as a student from Concordia Lutheran College in Toowoomba snagged an award for their “Amazing Surface Habitat”.

“I spent 200 days on the International Space Station,” stated Dr Chamitoff, the mastermind behind this program. “During that time, I realised how truly remarkable it would be if every individual could have the same opportunity to explore and marvel at our planet.”

Dr Chamitoff acknowledged that as he teaches the content at university level, the subject matter is complex. However, this program makes it visually engaging and interactive for students.

McCarthy says that the program’s success and appeal to young people can be attributed, in part, to its “gamification”.

The feedback from both parents and students about the program was overwhelmingly positive. Once again, parents recognised the transformative impact the program had on students with a genuine interest in space. They believed it offered a unique learning experience that went beyond the usual school curriculum. The Global Space Challenge is predicted to have an even wider reach

across Australia with the next challenge scheduled for Space Week 2024.

Elsewhere, OGLA partnered with the Australian Space Agency and the Japan Aerospace Exploration Agency (JAXA) to deliver both the KIBO Robot Programming Challenge and the Asian Try Zero-G program. The former, now entering its fifth year, enables teams to program “Astro Bee” and “Int-Ball” robots on the International Space Station (ISS). Working from Earth alongside Japanese astronauts in orbit, Australian team, “Dreamrover”, performed to a very high standard once again.

The Asian Try Zero-G program gave students the opportunity to design an experiment to be conducted on the space station. The program aims to push the boundaries of scientific exploration while promoting crewed space experiment aerospace engineering activities on board the Kibo module on the ISS. An Australian student from Australian National University, Shingo Nishimoto, has been chosen to have his experiment carried out in orbit by JAXA astronauts inside the Kibo module in 2024.

Shingo said, “Words can’t describe how excited I am! I am looking forward to observing the rotating motion of chopsticks for a long duration under the zero gravity environment. The experiment

will help us to understand whether the theoretical expectation is correct, and I believe that the theory can apply to the space robots that manage the angular momentum vector to the robot’s body frame using shape deformation.”

Germinating in the background of all these programs, 4,000 wattle seeds that spent time in orbit on the ISS continue to grow in Australian schools. Students are monitoring the growth of “Space Seeds” alongside “Earth Seeds” in this unique national experiment which will soon expand to the USA and India.

“What better way to inspire students to take up a career in space or agriculture than asking them to help solve the problems of sustainability of the planet?” asks Carpenter.

Finally, in November, as part of the ELO2 Consortium, OGLA helped deliver the “Little Dipper Challenge”. This online activity focuses on lunar rovers and what they are used for in anticipation of Australia’s first lunar rover—part of the Australian Space Agency’s Moon to Mars Trailblazer Initiative.

OGLA maintains contact and continuity with student alumni and offers leadership programs such as the Student Ambassador Program and the “Gadget Girlz”—a STEM group run by girls for girls. Nicola Baker is one such OGLA student helping younger students explore a career path in the Australian space industry. “I grew up in a small town in NSW where there weren’t many STEM things going on, especially for girls,” Nicola said. “My journey with One Giant Leap Australia has been amazing ... seeing the younger girls’ faces light up watching another girl teach them is proof that there is a place for them in space. It’s made me feel more passionate about getting girls into this.”

Everyone at OGLA knows that the key to developing a future space workforce is continuity of engagement.

“Presenting students with real world problems, working with the community and collaborating with industry are key factors in our programs”, says Carpenter. “Linking everyone together is the only long-term solution ... to broaden the STEM workforce base and lead to a prosperous economy for our country and the world.”

Here’s to the next generation of home grown space explorers. ●



From classroom to cosmos: Space training in Australia



Rick Doblancovic

By Rick Doblancovic

Only about one in five Australians are aware of the benefits of space technology in their everyday lives¹, although space is a common topic in mainstream media. Those in the space industry are able to recognise that the global space market is growing rapidly. Likewise in Australia, the Australian Space Agency was given an ambitious goal following its formation in 2018—adding 20,000 jobs to the Australian space workforce by 2030².

But with changes in government, these ambitious goals are considered by most as historical. We have seen the axing of the \$1.2 billion National Space Mission for Earth Observation program, the axing of the \$32.3 million pledge to support Australia's spaceports, and the scaling back of the Australian Space Park in Adelaide. Currently Australia is, and will seemingly remain, a consumer when it comes to space-related products and services. Government agencies continue to pay tens of millions each year for space-derived data about our own country. We know that real-time satellite information could save lives in times of bushfires

Australia provides significant opportunities for supporting this growing global demand for space-related services. We have strong international partnerships and agreements, unique geographic advantages, and a civil space industry that is actively developing products and services.

and floods, but our own needs appear to be deprioritised when we continue to source data from the satellite schedules of other countries.

Space is one of the few industries where launching a product means immediately entering into a global market. Based on recent projections, the 2023 global space market was worth \$547 billion and will reach more than US\$1 trillion by 2030³. Australia provides significant opportunities for supporting this growing global demand for space-related services. We have strong international partnerships and agreements, unique geographic advantages, and a civil space industry that is actively developing products and services. But how can Australia build revenue and not incur ongoing expense?

With government disinterest, our enterprising space companies are turning to private investors and targeting their products to the international marketplace. Challenges abound as small to medium enterprises work to bring their product to a maturity level that is globally competitive. This is a steep hill to climb and while successes are rightly celebrated, they are difficult to achieve and far between. Typical of many other STEM [science, technology, engineering and mathematics] industries, Australia is battling a shortage in the skills and numbers of people needed to support space-related programs.

A 2021 SmartSAT study found widespread shortage and future demands across the vast majority of space-related skills⁴. These skills are vital for industry

growth, but the difficulty in addressing the skills gap is a significant issue and of national importance. Recent figures from the C4 Space/APAC South Australian Space Industry Skills Demand Study⁵ showed that space organisations were currently unable to fill 28% of their workforce needs, let alone have enough people to cover future demand as the industry doubles in size. The end result is that organisations will be forced to broaden their search for staff to areas outside of adjacent industries and into totally unrelated areas, such as bicycle repair shops as a recent example where the skills available aligned to space industry needs.

The flow on effect is that organisations will need to support significantly more learning on the job. An individual can start work and take 6-12 months to become productive, which is a significant portion of the average job tenure in Australia of 3.3 years⁶. And while on-the-job learning does work, it is a quick fix that places financial burden on space organisations that may already be financially challenged by investors expecting rapid time to market and high rates of return. Moving across multiple investment sources to try and expand the





Unlike the tertiary sector training, vocational training offers people the opportunity to develop hands-on skills that will be essential for the space industry to move into production and address global market needs.

find people overseas with broad skills. The upcoming formalisation of the Technology Safeguards Agreement will make sourcing expertise from the United States a likely opportunity; however, this should not be the only consideration. Europe, Japan and, in particular, India are having great success in space-related projects without the massive US costs.

A recent space policy advice paper released by Engineers Australia articulates the need for “a structured plan to build the necessary human and physical resources that form the capability and capacity supply pyramid”. This “supply pyramid” places training as an essential part of the foundations required to create and grow a globally competitive space industry. The paper also proposes the development of a national training institute for space to ensure that the necessary hands-on skills are developed to take products out of the lab and into production at scale.

Unlike the tertiary sector training, vocational training offers people the opportunity to develop hands-on skills that will be essential for the space industry to move into production and address global market needs. Academic space research and laboratory work remains an essential component of the overall sector, but it will not provide the essential hands-on skills required to build the products and deliver the services needed.

Work is currently underway to integrate space-related skills into vocational training courses across multiple states and bring space-focused training to vocational organisations nationally. Micro-credentials or bespoke industry courses are also options being explored in a manner similar to those developed for the shipbuilding industry, but these options will require sufficient industry demand to create the momentum needed to make them

viable. These enterprising activities offer a glimpse of a future where both tertiary and vocational training organisations can work together to create a clear pathway for students to graduate high school and become effective contributors to the Australian space industry.

We can never lose sight of the fact that our standing in the global space environment will be reflected in our commitment to responsible practices, international collaborations and the pursuit of knowledge. A well-educated, well-trained workforce will be the foundation of Australia’s competitive advantage that will help the nation move forward into new opportunities in space. Our rise as a nation in the global space community requires robust educational foundations that cultivate the skills of aspiring space professionals. The classrooms of today will be the launching pads of tomorrow, and the cosmos beckons those who dare to dream, learn, and reach for the stars. ●

About the Author

Emilio Riccardo (Rick) Doblanovic, Training Chair of the National Committee for Space Engineering and Managing Director of C4 Space (www.c4space.com.au), a business supporting the development, success, and sovereignty of the Australian space sector.

- <https://www.spacegovcentre.org/post/space-in-the-australian-public-eye-in-depth-survey-reveals-national-opinions>
- <https://www.minister.industry.gov.au/ministers/price/media-releases/fast-tracking-jobs-and-technologies-space>
- <https://www.mckinsey.com/featured-insights/sustainable-inclusive-growth/chart-of-the-day/gigant-leap-for-the-space-industry>
- <https://smartsatcra.com/app/uploads/Space-Industry-Skills-Gap-Analysis-Final-Report.pdf>
- <https://www.c4space.com.au/wp-content/uploads/SA-Space-Industry-Skills-Demand-Study-April-2023.pdf>
- <https://mccrindle.com.au/article/job-mobility-in-australia/>
- <https://www.engineersaustralia.org.au/sites/default/files/2024-02/Space-Policy-Advice-Paper.pdf>

available time becomes more and more challenging as the equity dilutes with each investment round.

Upskilling people sufficiently to be effective contributors to the space industry requires a balance between training organisations instilling the industry essentials and companies delivering training specific to their business. Unfortunately, the extent of space-related training offered by Australian training organisations is limited and certainly not mainstream within either the tertiary or vocational sectors. Niche training options do

exist in the tertiary sector; however, substantiating tertiary training for space is highly challenging due to low student numbers. A few forward-looking tertiary organisations are rising to this challenge. One such approach involves developing training in space-related skills by adapting existing courses to industry needs while complying with the regulatory framework. This adaptive solution enables rapid bridging of industry skillsets. In contrast, developing courses from scratch could take years to be approved, let alone integrated into accredited training organisations.

When speaking about space-related training, one line of thinking is to “bring in experts from overseas” to train the Australian community. While appearing straightforward, this approach fails to recognise that the space industry overseas is different from space in Australia. Where a NASA rocket launch program may have hundreds of people involved in a project, an Australian program will be limited to dozens, simply because of our reduced population, number of clients and available budget. This means that Australians in the space industry must be multi-skilled and

able to cover significantly more scope than would be expected of experts overseas. Consequently, Australian space training needs to be both broad and comprehensive, developing a wider range of skills so that people become highly employable across multiple Australian space companies.

Training must also be industry relevant, timely, and delivered by professionals with credible expertise in a broad range of areas. Thankfully Australia is already blessed with a number of these people. Unfortunately, we need more. It will be necessary to try to



Unlocking the stars: How streamlining regulations can propel the space sector to new heights



By Kelly Yeoh

We, humanity, have long looked to the stars, dreaming of possibility. Some of us are driven by boundless ambition, beyond dreaming, into doing. We have seen spectacular results that create a clearer understanding of now, and hope for futures to come.

In the shadows of this boundless ambition lies a complex labyrinth of regulatory frameworks, designed to protect not only us, but everything we touch. These regulations, intended to safeguard our future in space

exploration, often become barriers to the very innovation they aim to foster.

This paradox presents a crucial challenge—finding the equilibrium between our aspirations and the imperative to protect. The task before us is not to dismantle the framework that underpins our stewardship of our cosmic and terrestrial environments, but to refine it, redefine it, and reframe it. Regulations are enablers, not impediments.

Hear me out on this ...

The essential role of regulations

In our quest to boldly go where no one has gone before, we, collectively,

need to be reminded of our duty to proceed with caution and respect. Given our history, humanity does not always get this right, and so we come to agreements, accords, treatise at an international level, and enshrine these agreements into local laws, generating regulatory requirements.

Central to the regulatory challenge is the imperative of risk mitigation. A significant portion of the regulatory effort is devoted to preventing harm, or having a means of dealing with any harm that is done. Mostly preventing it.

Regulations in the space sector, often viewed through a lens of constraint, are actually the custodians of our collective aspirations and responsibilities. They ensure that our endeavours do not infringe on the rights and safety of others, that we tread lightly on both terrestrial and extraterrestrial realms, and that the sanctity of space remains unviolated by human recklessness (well, intention does not always equate to reality, but we try). These rules are borne from an understanding that the cosmos is a shared resource, rich with scientific knowledge, cultural significance and potential.

And stuff just works better when we do not break it.

An example of the critical nature of regulations is the fragile environment in low Earth orbit (LEO), now threatened by the proliferation of debris. Debris begets debris, we know this, and a potential cascade of collisions could render LEO unusable and impassable, locking humanity out of space for decades, or even generations. Regulations aimed at preventing this are not mere formalities, they are vital safeguards, underscoring the need for careful management of launches, orbital flight paths, end-of-life plans, debris mitigation and so much more.

They represent our commitment to a future where exploration and expansion are balanced with stewardship and sustainability. Without this, humanity has no future in space.

The weight of bureaucracy

Yet, the path paved by regulations is often winding and arduous, laden with bureaucratic hurdles that can dampen the spirit of the most fervent pioneers.

Regulations in the space sector, often viewed through a lens of constraint, are actually the custodians of our collective aspirations and responsibilities. They ensure that our endeavours do not infringe on the rights and safety of others, that we tread lightly on both terrestrial and extraterrestrial realms, and that the sanctity of space remains unviolated by human recklessness (well, intention does not always equate to reality, but we try).

The process of navigating these regulations is fraught with challenges including extensive documentation, rigorous approvals and frequent rework, turning the thrill of innovation into a test of endurance. This is not solely charted by space agencies. It unfolds across a vast and shifting hierarchy of responsibility and requirements across many organisations. These requirements, adapted to each mission, cover everything from land use permissions (including launch and landing locations, and what lies beneath flight paths and stage drops), protection of cultural heritage, protection of wild and marine life, air traffic, safe handling of dangerous materials, international trade and transfer, risk mitigation and insurance requirements, debris mitigation, access to radio spectrum and so much more. So, while it can be highly complex, it can also be enormous, and with many stakeholders.

This bureaucratic weight does not discriminate. From fledgling startups to seasoned enterprise, all who venture into space feel its pressure. The complexity of adhering to numerous national and international standards, each with its own set of requirements and interpretations, can add layers of difficulty to already massive and complex missions.

The high cost of complexity

This complexity exacts a cost far beyond financial; it drains invaluable time and opportunity. Resources that could otherwise be dedicated towards advancing the goals of the company in question. It involves a gamut of works

and costs, which include uncovering necessary processes, research and discovery, exhaustive document preparation (often involving the same information inserted across many locations), adhering to intricate technical specifications and standards, liaising with third-party suppliers and certifiers, and waiting for information or processes with timeframes that are beyond the control of the applicant. And on the subject of time, well ... time is money, and it can take an awful lot of time.

The cost and effort fluctuate dramatically with the mission's scope and parameters, adding to uncertainty.

While that uncertainty lessens over subsequent permits, any changes from earlier missions can have the effect of actioning alternative or additional works that may not be understood. Relatedly, any companies with little experience in these regulatory workflows will be at a distinct disadvantage to companies who are more familiar or working through these processes more frequently.

After engaging in detailed consultations across the space sector, and by no means exclusive to the Australian space sector, a recurring narrative has emerged, highlighting the substantial impact of regulatory constraints on innovation. Companies express frustration over the clarity of regulatory processes, which often seem to ensnare them in a cycle of confusion and inefficiency. They recount experiences of submitting information, only to find it falls short of the requirement, and often little assistance to indicate what would



64

satisfy that requirement. The rework (and sometimes re-rework) can take considerable time, causing costly delays. The lack of clear guidelines exacerbates this challenge, making it difficult to anticipate needs and comply effectively. This all amounts to significant frustration within the industry.

This feedback underscores an urgent call for reform within the regulatory framework governing the space sector to alleviate the burden on stakeholders and reduce costly errors and delays. Yet, amidst the voices calling for a relaxation of regulations to unleash innovation, a different chorus emerges. What if the answer lies not in diminishing the regulations, but in refining the process itself?

And ... How do we enable the rapid advancement of space technologies without compromising on these protections?

A glimmer of hope: Process automation

Space regulations, in their essence, are not an impediment to space, they are the key to sustainable and responsible space exploration, but they are really,

really inefficient, and heavily manual. The challenge, then, is to transform this bureaucratic process from a barrier into a conduit for innovation.

The obvious answer is process automation. Where manual processes hamper progress, automation is a powerful tool, capable of transforming the cumbersome into streamlined, accelerated and agile.

Through understanding and encoding of regulatory requirements called into action by varying mission parameters, space companies can instantaneously access precise requirements tailored to their missions, enabling compliance with international standards without sacrificing innovation or speed. A single point of data entry could prevent redundant data input. Smart algorithms can check any documents for completeness and quality, providing the opportunity to remedy before submission.

By automating the intricate and often redundant tasks involved in regulatory compliance, such as document submission, data insertion and verification, and compliance tracking, the space sector can significantly reduce the

time and resources devoted to navigating bureaucratic mazes, local, cross-jurisdictional and cross-organisational, to better enable collaborative projects while preserving accountability across all involved parties.

This proactive approach would drastically cut down on research and discovery, repetitive inputs, and the rework and delays that currently plague the industry, facilitating a smoother path to launch and beyond. This shift not only promises to enhance efficiency but also to improve security, accuracy and transparency, crucial elements in a field where precision and accountability are paramount.

Integrating process automation into the regulatory framework of the space sector is not just an upgrade. It is a significant shift towards making the industry more agile, innovative and collaborative in a way that aligns with our goals of responsibility and sustainability. Imagine a sector where regulations serve their purpose without stifling progress, where the spirit of exploration is matched by a commitment to preservation and respect.

Success stories and the path forward

Process automation has emerged as a pivotal force in enhancing efficiency, compliance and user satisfaction across many sectors. It has revolutionised the way we handle tasks, transforming cumbersome, error-prone activities into streamlined, user-friendly processes. For instance, the evolution of HICAPS [Health Industry Claims and Payments Service] payments for Medicare (local to Australia) is a testament to this transformation. What was once a lengthy process of submitting claims, waiting for cheques and banking delays has now been replaced by instant processing. This advancement allows healthcare providers to charge only the co-payment portion, significantly improving the experience for providers and patients. This has benefited patients through making healthcare more affordable due to the reduction of out-of-pocket expenses, and given them access to their money now, not when a refund finally clears.

Similarly, the automation of power grid management exemplifies how technology can optimise predictive maintenance, monitoring and capacity planning. These improvements not only enhance operational efficiency, but also ensure a more reliable energy supply.

Identity verification can now be checked in real-time against government sources for the purposes of opening bank accounts, applying for security clearances and many other functions, providing a deeper level of convenience, and additionally heightening user security as it eliminates the need for vendors to store personal data.

These real-world examples underscore the transformative potential of automating the navigation of regulatory requirements. By eliminating manual bottlenecks, reducing errors and enhancing transparency, automation serves as a bridge between regulatory compliance and operational efficiency. Compliance processes can be simplified for businesses and regulators alike, enhancing the experience for all parties involved, and ensuring that applications are fit for purpose and ready to be assessed on merit. Moreover, effective

This is not about making the process easier for the sake of convenience. It is about enabling space companies to do what they do best; creating awe-inspiring innovations that push the boundaries of possibility. It is about freeing up resources that are better spent on doing and being amazing, and about providing a safety net, or a security blanket, so that those amazing things will not be the cause of pain and penalty going forward due to something as avoidable as missed compliance and human error.

automation of processes can redefine the perception of regulators, not as barriers, but as facilitators providing frameworks within which safety and innovation coexist.

Done right, it builds trust between the stakeholders, bridging the gap between regulatory requirements and the dynamic needs of industry.

A new frontier awaits

This journey, vast and complex, is not one to be undertaken alone. It is a collaborative venture that will thrive on unity and concerted effort across sectors and disciplines. To do this properly, it is crucial that we forge robust alliances not just within the space sector, but also with the myriad of government and private bodies that play pivotal roles in the giant hierarchy of requirements.

This is not about making the process easier for the sake of convenience. It is about enabling space companies to do what they do best; creating awe-inspiring innovations that push the boundaries of possibility. It is about freeing up resources that are better spent on doing and being amazing, and about providing a safety net, or a security blanket, so that those amazing things will not be the cause of pain and penalty going forward due to something as avoidable as missed compliance and human error. And it is about the safety and protection of all.

By revolutionising the current workflows with systems designed to inform, educate and guide users, we can significantly demystify the regulatory landscape. Implementing smart

platforms that offer clear solutions, tailored precisely to specific mission parameters, directly addresses the unique challenge each mission faces, streamlining the flow of information and action required, and eliminating redundancy. Furthermore, enhancing these workflows with advanced scheduling and tracking capabilities provides an additional layer of simplification and transparency that alleviates uncertainty and delay.

The introduction of any such tool does not diminish the rigour, or dilute the importance, of the regulations themselves. Instead, it enables companies to meet these requirements without unnecessary hardship and frustration, helping to encourage lawful compliance. And it opens the door to greater innovation and exploration.

Space is hard. It just does not have to be quite so hard. ●

About the Author

Kelly Yeoh is the CEO and founder of Blue Dwarf Space, a company dedicated to streamlining regulatory compliance. With a rich background that spans technology, law, space regulations, and the simplification and psychology of user experience, our team have positioned Blue Dwarf Space at the forefront of addressing the complexities and challenges of accessing space. We do this by facilitating a smoother path for companies navigating the intricate landscape of space regulations. Blue Dwarf Space is not just a company, it is a mission to make space more accessible to anyone.

Inquiries or further discussions are welcome at info@bluedwarf.space

65

Advocating for
Australia's
interests in
space in the
21st century
and advancing
the agenda for
responsible
space
governance.



ACSG
AUSTRALIAN CENTRE FOR
SPACE GOVERNANCE



spacegovcentre.org



[linkedin.com/company/spacegovcentre](https://www.linkedin.com/company/spacegovcentre)



contact@spacegovcentre.org

