

Building the Space Nation

By chance or design?

Leaving the growth opportunity to chance is not a strategy Australia's space ecosystem can afford.

[Page 12](#)

65,000 years of space

Australia's space story is a gift and a purpose that First Nations Australians have carried for 65,000 years.

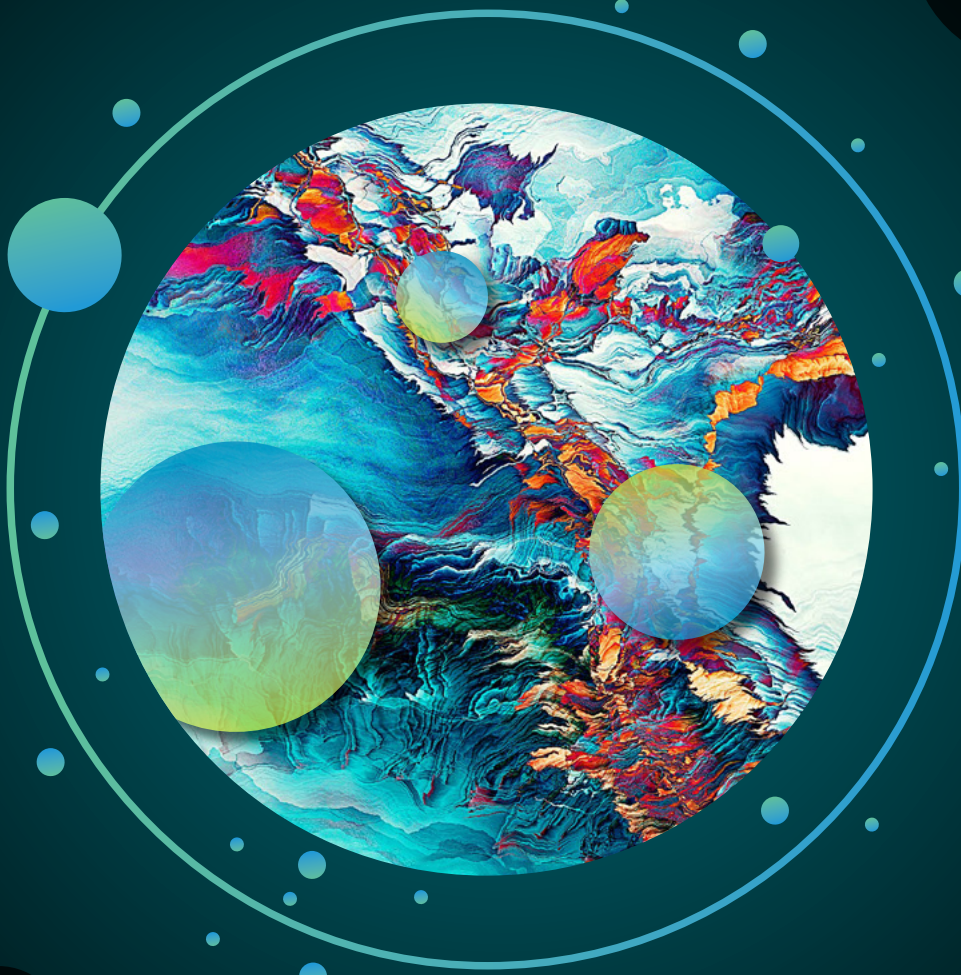
[Page 16](#)

The space ecosystem

Our space ecosystem is a complex network of connections that are continuously evolving.

[Page 18](#)

Issue 1 · December 2021



This report – *Building the Space Nation: Issue 1* – is the first contribution of Deloitte Space to strategically develop Australia’s space ecosystem. In this issue, we hold a mirror to the space ecosystem and consider the role of connections in building our space nation.

Acknowledgement of Sky camp and Earth camp

We are all of us, every human, drawn to the stars. They are a shared human experience and all of our cultures have stories about them.

My old people have told stories about those stars and the space between those stars longer than any other civilisation in the world. The secret to our culture though is that these are not just stories of myth and legend and something to share around a campfire. They are exercises in science, in mapping and astronomy, seasonal management and ceremonial cycles.

To us, the sky above us is not empty. It is not Space Nullius. It is a mirror of our life here (sky camp to this earth camp). They are inextricably linked and we occupy the 'space' in between these relational worlds. The connecting space in between the shiny objects is what draws our eyes. Just like the "Dark Emu" in the Milky Way, it is the dark between the light that tells the story. It is the space in between the bright lights that matters because that space is alive.

Prof. Deen Sanders OAM
Worimi man

I pay my respect to the elders (past and present) of the land on which this report was conceived and wherever you find yourself reading it. I honour their stories about the sky above us and the land beneath us and acknowledge that we are only here today because of the sacrifice and curatorial responsibility they carried and continue to carry for these places.

I also want to acknowledge any Aboriginal brothers and sisters and elders who pick this up because we share our stories and responsibility across the entire nation. Wherever you travel in the stars above us, that place is held in Aboriginal responsibility and these spaces (above and below) were never ceded.

Acknowledgements

AgriFutures Australia

Pip Grant
Senior Manager, evoke^{AG}

Airbus in Australia Pacific

Scott White
Industry and Innovation Manager within Strategy & BD team

Martin Rowse
Strategic Campaign Lead and KAM for Space, Australia

Amazon Web Services (AWS)

Mani Thiru
Space Industry Development Asia Pacific

Tony Sewell
Senior Manager, Aerospace and Satellite Partners

Andy Thomas Space Foundation

Nicola Sasanelli
CEO

Michael Davis
Chair

Arlula

Sebastian Chaoui
CEO & Co-founder

Australian Space Agency

Enrico Palermo
Head of the Australian Space Agency

Australian Trade and Investment Commission (Austrade)

Rebecca Shrimpton
Head of Sector – Defence, Space and Infrastructure

Axiom Precision Manufacturing

Fred Hull
Aerospace and Space Manager

Blacktree Technology

Jiri Lipovsky
Program Manager

Darwin Innovation Hub

Emma Nesbitt
COO

Defence SA

Richard Price
Chief Executive

Reg Carruthers
Executive Director

Darin Lovett
Director, Space

Defence Science & Technology Group

Rod Smith
STaR Shot Leader – Resilient Multi-Mission Space

ElectraNet

Simon Emms
Group Executive – Network Services

Esri Australia and Esri South Asia

Brett Bundock
Group Managing Director

Fleet Space Technologies

Flavia Tata Nardini
CEO & Co-founder

Flinders University

Prof. Melissa de Swart
Professor (Digital Technology, Security & Governance)

FrontierSI

Graeme Kernich
CEO

Geoscience Australia

Maree Wilson
Branch Head, National Earth and Marine Observations

Geospatial Intelligence Pty Ltd

Naomi Mathers
General Manager

Rob Coorey

Founder & Managing Director

Gilmore Space Technologies

Adam Gilmour
CEO and Founder

HEO Robotics

William Crowe
CEO

Inovor Technologies

Matthew Tetlow
CEO

Lockheed Martin Australia Pty Ltd

David Ball
Regional Director Australia and New Zealand, Lockheed Martin Space

Main Sequence

Bill Bartee
General Partner

Microsoft

Lynn McDonald
Azure Space Lead, Australia

Northrop Grumman

Chris Deeble
Executive Director Strategy

NSW Government

Mike Gallagher
Director, Defence and Aerospace

NT Health

Wendy Pech
Health Innovation Project Lead

Optus

Nick Leake
Head of Satellite and Space Systems

Paspalis Innovation Investment Fund

Harley Paroulakis
CEO - Darwin Innovation Hub and Paspalis Innovation Investment Fund

Dr Paul Scully-Powers AM DSM

Australia's First Astronaut

SA Power Networks

Paul Topping
Strategic Initiatives Manager

Saber Astronautics

Jason Held
CEO

Shoal Group

Shaun Wilson
Founder & Head of Business Development

Shena Howell

Program Lead – Space Systems Engineering

SKA Observatory

Sarah Pearce
SKA Low Telescope Director

SmartSat CRC

Prof. Andy Koronios
CEO & Managing Director

South Australian Government

Tiffany Katchmar
Director – Space – Department of Trade and Investment

Southern Launch

Lloyd Damp
CEO

Space Industry Association of Australia (SIAA)

James Brown
CEO

Space Machines

Rajat Kulshrestha
CEO & Co-founder

George Freney

Co-Founder & Executive Director

Spiral Blue

Taofiq Huq
Founder & CEO

Stone & Chalk

Christopher Kirk
General Manager

Surrey Satellite Technology Ltd (SSTL)

Prof. Sir Martin Sweeting
Executive Chairman

Swinburne University

Kim Ellis Hayes
Space Technology Program Director and Major Discipline Co-coordinator

Thales

Matt Dawson
Director of Space Business

University of Adelaide

Volker Hessel
Professor & Deputy Dean (Research) & Research Director Andy Thomas Centre for Space Resources

University of Tasmania

Prof. Simon Ellingsen
Dean of Natural Sciences

University of Technology Sydney

Dr Joshua Chou
Senior Lecturer

UNSW Canberra Space

Russell Boyce
Director

UNSW Sydney

Prof. Andrew Dempster
Director of Australian Centre for Space Engineering Research (ACSER)

Victorian Government

Dr Amanda Caples
Lead Scientist – Department of Jobs, Precincts and Regions

Western Australia Government

James Yuen
Director, Space – Department of Jobs, Tourism, Science and Innovation

Western Parkland City Authority Sydney

James Passmore
Executive Director Commercial and Economic

Ben Kitcher

Executive Director Research and Technology

Introduction

In the development of this report, we spoke with space leaders from across the entire ecosystem. These conversations make it abundantly clear Australia has some of the most talented, passionate and driven people working in the space industry. This initial report delivers a consolidated voice of the ecosystem. While we provide a rallying call on key questions to be addressed to accelerate the development of Australia's space ecosystem, we will release further analysis and perspectives on each theme in the coming months, including Deloitte's own point of view.

The space industry has us excited and concerned in equal measure. We are excited by the size of the opportunity but concerned we will not take full advantage of what is in front of us.

Australia has many advantages: its geography, its capability in mining and agriculture (among many others) and a heritage of innovation and high-quality education. What we see when looking at the space industry is a collection of very talented and enterprising people and organisations. But the question is whether we are acting as individuals or as an ecosystem, working together with the common goal of making Australia a successful spacefaring nation.

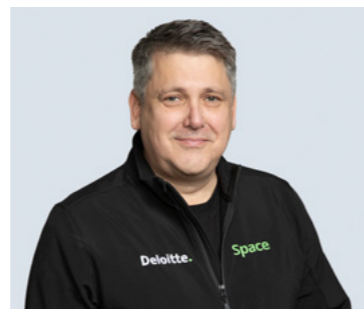
We have made fantastic progress in a very short period, but could we go further, faster with more collective focus? Rather than simply following and replicating what others have done, Australia has an opportunity to find niches and focus on those in order to create a competitive position, leapfrogging other countries while offering complementary capabilities and skills to the global space ecosystem. It's a fine balance, but we must get it right.

Deloitte is committed to taking an active role, alongside each of you, to build the space nation of Australia. We have invested in space for the last three years with the Gravity Challenge and have built a strong space practice that is committed to working with the ecosystem – and we absolutely believe that we must build in the right way, respectfully following guidance from the First Peoples of this wonderful country.

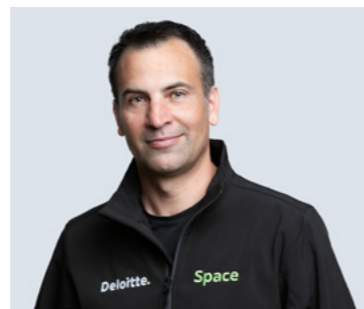
It's clear from our discussions with the space industry that not everyone agrees on what the future of space should or could be, or where and how Australia could or should participate. We think that is healthy. An ecosystem is not about a regimented structure, but rather a group of complex interconnected relationships that help to drive innovation and new ideas.

This is our call to action, but getting space right in Australia will not be a quick solution. We need to build it together. We need to go fast, but with a common purpose. Space is not a problem for others to solve – we all have a collective responsibility, and we should look to the future with great optimism.

Let's take the steps together, towards building our space nation.



Steve Rayment
Partner, Deloitte Space and Consulting



Jason Bender
Partner, Deloitte Space and Head of Innovation



For the Australian space sector to realise its full potential, we need a concerted national effort that sees industry, government and academia pulling in the same direction.

By working together as one ecosystem with a shared ambition we can take our place as a global space leader.

As those at the forefront of an industry that presents boundless opportunities, we have a collective responsibility to ensure we deliver for all Australians – both now and for generations to come.



Enrico Palermo
Head of the Australian Space Agency

Contents

12

By chance or design?

Leaving the growth opportunity to chance is not a strategy Australia's space ecosystem can afford.

65,000 years of space

Australia's space story is a gift and a purpose that First Nations Australians have carried for 65,000 years.

16

18

The space ecosystem

Our space ecosystem is a complex network of connections that are continuously evolving.

Collecting the voices of our ecosystem

We hold a mirror to the space ecosystem and consider the role of connections in building our space nation.

22



Talent

24



Building our value proposition

26



Commercialisation

28



Cohesion



Building the Space Nation By chance or design?

“Three... two... one... lift-off!”

Picture this: we’ve just witnessed the launch of the fifth Australian spacecraft this month, from Australian soil, carrying Australian technology to expand an Australian mega-constellation in support of an Australian mission. The spacecraft travels 300 kilometres to reach a low Earth orbit, where it uses new sensors developed by Australian industry to accelerate the world’s response to climate change and environmental management. The impact of this mission fuels a crescendo of innovation resonating beyond our shores, and we embed ourselves as a vital part of the interconnected global community of business minded problem solvers who shape the future of our planet and its relationship to space. Watched by the world, Australia becomes a leader – a true space nation.

Achieving such a goal requires each part and subsystem of the spacecraft to be engineered to world-class quality. But, critically, it requires everyone to work together, build shared capability and respond to feedback from each other to be successful. No one can get to space by themselves – this mission requires teamwork.

This is good news for Australia. New Space calls for us to be agile and dynamic compared to legacy spacefaring nations. As an emerging player, we have a time-limited opportunity to position ourselves as leaders in the next generation of space.

To get there, industry development in the New Space paradigm must be different, and it requires an ecosystem mindset.

The space ecosystem

Characterised by multiple interdependent systems, organisations operating in the space environment resemble a complex and evolving ecosystem. There is no leader in an ecosystem, like government, dictating the actions of others. Rather, each member of the ecosystem is in charge of its own actions and future.

This may seem like there is an absence of responsibility or direction. However, it’s not command and control – an old space mindset – that results in a highly successful, innovative industry.

Instead, the ecosystem is organised around a shared vision for the future, acting as a magnet to draw in organisations and present opportunities for cooperation and collaboration across seemingly unconnected networks. The level of sophistication of the ecosystem that forms around successful enterprise will fundamentally rely on the quality of these complex networks.

This approach is different, even contrary to what has been done before. NASA, ESA, UKSA and others have an established reputation as having led and fed their industries to success. While we have much to learn from these agencies, looking at them too closely and seeking to directly replicate their operating models in the Australian context will not serve us in the long run.

So, let’s do this our way – together.

If we don’t want to inherit certain aspects of the old space ecosystem, such as slow and laborious innovation processes, we need to **invest in our connections with each other.**

Success will be driven by looking outside our narrow focus areas and connecting with others, both within the global space ecosystem and across the economy more broadly.

Our consultations with stakeholders across the Australian space ecosystem identified common strengths, opportunities and challenges across four recurring themes – **talent, building our value proposition, commercialisation and cohesion** – which we highlight in this report.

While these insights reflect common themes, this shared understanding has not led to a shared strategy. We need clarity on what we are collectively trying to achieve and a strategy to make it happen.

We are a team with bold individual ambition, but we’re not clear on how we will work together to get where we need to go.

An ecosystem strategy is the responsibility of everyone. Each ecosystem player has a unique role and should be able to answer:

- What is my role in this ecosystem and the role of the ecosystem I have created?
- How will I engage with the ecosystem?
- How can I support others to create value?

Using our connections to overcome investment challenges

Across the Australian space ecosystem, there are countless examples of budding start-ups with exciting ideas. Cutting their teeth on grant funding, these organisations are rapidly seeking investors to support their next phase of growth. However, in Australia, finding venture capitalists prepared to take on these emerging space innovators is a significant hurdle. Armed with proof of concept, but no clear proof of revenue, start-ups struggle to overcome the risk perception barrier.

We know that outside of defence and civil government space agendas, most activity is driven by the demands of the end users of space data. These end users are often far removed from the space industry itself – how many people with a smartphone know that GPS is a US-owned utility that provides positioning, navigation and timing services?

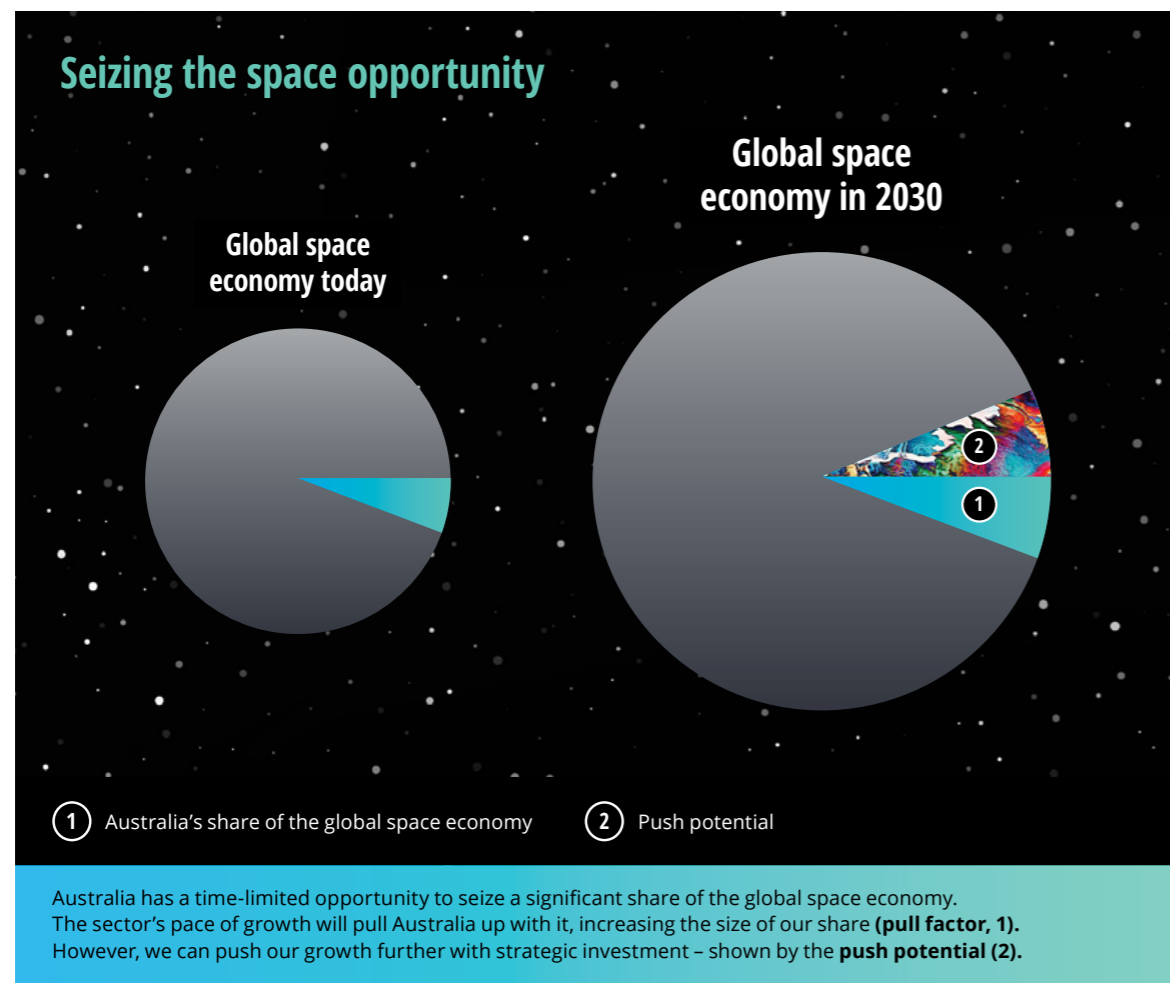
We need to work together, connect end users with the space industry and link space investments to revenue opportunities to battle the risk perception of space for the betterment of the ecosystem as a whole.

Seize the opportunity of space together or risk being left behind.

Irrespective of the choices we make today, the Australian space ecosystem will grow, and grow quickly. Simply put, the size of the commercial opportunity is so significant that it will organically pull much of the promised growth (the 'pull factor'). For example, local ecosystem leaders like Gilmour Space Technologies, Fleet Space Technologies, Southern Launch and Saber Astronautics will continue to act as magnets, drawing in activity at a rate that matches their growth aspirations.

However, sitting back and letting industry players evolve independently, with each organisation, researcher and government agency walking to the beat of their own drum, will not build an ecosystem that is globally competitive and well known on the world stage.

Strategically building our connections across the space ecosystem – working together, seizing joint commercial and research opportunities, shaping national priorities, demanding an Australian seat at the global table – means we will get more than our fair share of the global space opportunity (the 'push potential').



Australia's space ecosystem: where to next?

Looking ahead and outside of our own ecosystem, space has a significant role to play in Australia's future as both a security and an economic priority. This responsibility bears weight and means the way we build this ecosystem today will have long-term impacts that extend well beyond the confines of our industry.

Further, space is going to play a leading role in solving big, complex and global problems like climate change. For the Australian space ecosystem to meaningfully contribute solutions, we need to be competitive in the global market. This demands deep connection, as well as competition, in the local ecosystem.

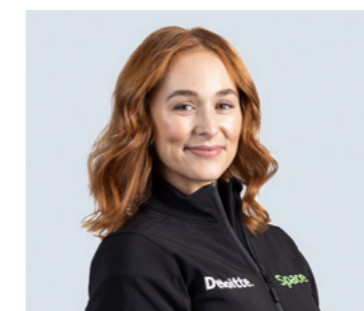
Building a cohesive ecosystem united by clarity and connection will support Australia's push to become a competitive global player. Each stakeholder group has a responsibility to build connections that will strengthen the ecosystem, whether it be across state borders, within the ecosystem itself or to the overarching vision of where we want to go and how we will get there.

So, for an ecosystem like ours, we implore you to think laterally: how are you going to leverage others in the ecosystem that are on the same journey as you? And because this is a two-way street, how can you also help others on their journey?

This is how we will build the space nation – together.



Kelly Heaton
Director, Deloitte Space and Deloitte Access Economics



Liesda Marsdon
Manager, Deloitte Space and Deloitte Access Economics





65,000 years of space

The stars have always been part of our human story, and Australia, unique in the world, can boast the longest continuous thread in that story through the ancient culture that thrums through this continent.

For 65,000 years, the First Nations people of this country have wondered, told stories and mapped the living landscape of the Universe. We have embraced the shining stars and the space between them as a source of lore, as calendar, map, repository of knowledge and more. By engaging space in a relationship to life on this planet we have incorporated space into the intricate systems of connection and responsibility that we hold for all life. The stars are not 'up there' in a distant, cold and disconnected way. They, just like us, are a part of our living Universe and there is a direct relationship between our earth and space.

This connection is not esoteric. It is supported by recent scientific constructs such as systems thinking, complexity theory and quantum constructs of relationality that remind us we are connected in consequence to each other, and to all things.

In economic terms we frame this as economic complexity or economic sophistication, and that work reminds us of the economic dividend of investing in the connections, infrastructure and value between things.

In ecological constructs that translates to building ecosystems that generate relational benefit, rather than over-investing in unrelated elements. In a space economy that translates to building business synergies, relationships and the right regulatory settings for business to flourish.

In a First Nations perspective it translates to understanding our agency and custodial responsibility for the prosperity of the whole system, and bringing all of the elements into a proper relationship with the system. This is not just ecosystem building but whole system building, where the space in between the stars is even more important than the stars themselves.

For Australia to be a space nation, we have to ask ourselves what agency we have as individuals, as businesses, as governments and as a collective. The unique opportunity for Australia will not lie in the conquest of space, monetising space or competing for the same space economy as others. It more authentically emerges from accepting our responsibility as custodians of the healthy and successful ecosystem for space and how taking a whole view, informed by ancient science and wisdom, can give rise to extraordinary innovation and opportunity.

Whether you prefer concepts of economic and regulatory structuring or quantum entanglement – or indeed Indigenous spirituality and complexity theory – we are connected to the elements in the sky, just as we are connected to the mechanisms of business, of government, of the academy, of rocket builders, of environments and of people. These connections are not just one way but fractal with multiple, sometimes unknowable consequences. The answer isn't in controlling, capturing or designing for those variables but in understanding their relational consequence.

The stars are not distant and space is not empty. It's livingness directly impacts our environment and the fragile safety of our planetary system, which still maintains all our lives. We should revere it. We should understand our responsibility to it because only then can we enter it in the right way and form a prosperous relationship with our future.



The risk

This is not just a cultural contribution. It is an economic, human and ethical role that is necessary to be played, lest the same mindset that let Australia be 'discovered' as a land without people or culture determine the fate for our stars.

No one wants to repeat the errors of the past, but we only need to look to the language of our engagement with space to see the thread of that DNA. Exploration, economies, markets, governments, scientific, military, mining; these are words that populate enterprise, military and government approaches to space. In and of themselves they are not wrong words, but if they are brought together in the wrong way they foretell a future that is merely an extension of our present deadly path, rather than the frontier of something shared and new.



The opportunity

Australia's space story has always been about Australia as a custodial nation. That is a gift and a purpose that First Nations Australians have carried for 65,000 years and from well before there were Western (Latin) words for Australia, Aboriginal or space. It was our human purpose. When you look at the stars through the heart of humanity, and not just the human head, it is an invitation for all Australia to share.

There is unique strength in our cultural depth, our ancient authority and Australia's unique capability to be a space nation.

There is global legitimacy and sovereign differentiation in building a space nation this way.

There is extraordinary economic and relational opportunity in building a space nation this way.

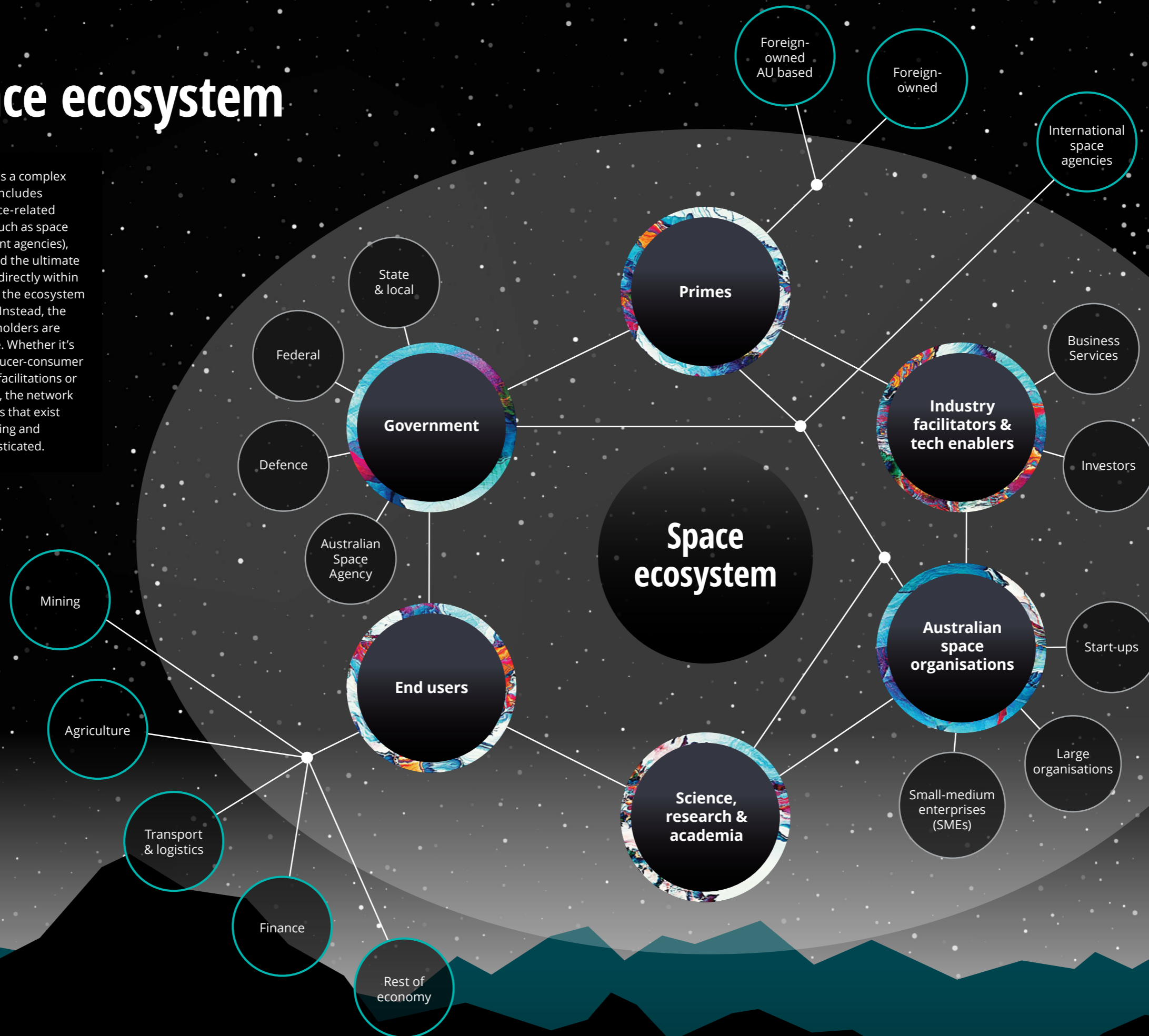


Prof. Deen Sanders OAM
Partner, Deloitte Space
and Deloitte Integrity



The space ecosystem

Australia's space ecosystem is a complex network of connections. It includes stakeholders central to space-related activity and value creation (such as space organisations and government agencies), facilitators of this activity and the ultimate beneficiaries that do not sit directly within the ecosystem. Importantly, the ecosystem does not have a focal point. Instead, the connections between stakeholders are what drive activity and value. Whether it's activity based on direct producer-consumer relationships, contracts and facilitations or co-investment opportunities, the network and the types of relationships that exist within it are constantly evolving and becoming increasingly sophisticated.





Collecting the voices of our ecosystem

In Australia, Deloitte Space regularly engages with stakeholders across the breadth of the space ecosystem. This uniquely positions us to observe the specific experiences of different stakeholders, including barriers and drivers to growth and reflections on how we can build the space nation.

Over the course of two months, we gathered a collection of perspectives from these ecosystem players on where we've been, what we're doing, where we're going and how we should get there.

These perspectives are inevitably diverse, but they share common undertones. Here, we present the voices of the ecosystem across four recurring themes: **talent, building our value proposition, commercialisation and cohesion.** Acting as a mirror, we provide an overview of what the ecosystem is thinking and experiencing today, and how this might inform the ecosystem of tomorrow.

The stars of the show

Who makes up Australia's space ecosystem and how can they shape the industry's future?

Australian space organisations

Small, medium and large Australian organisations specialising in the delivery of space-related services and/or products across the value chain. The number of these space organisations is growing swiftly in fields such as bespoke satellite and rocket subsystem fabrication, propulsion system development and launch, on-orbit spacecraft diagnostics, satellite data aggregation and analysis, and satellite communications and services. They will be key to growing our presence in the global space economy.

End users

The end users of Australia's space ecosystem reflect the sectors of the economy that benefit from space technology or data as part of their operations. As space technology spillovers and research endeavours continue to broaden in scope, and become richer in their application, we anticipate the number of end users to increase sharply in coming years.

Government

The role of government in New Space is ever changing and encompasses local, state and federal agencies across Australia. Government has a varied and evolving part to play in the development of the Australian space ecosystem through policy direction, regulation and facilitation, and as a provider of funding for industry development.

Industry facilitators & technology enablers

These organisations aren't typically considered to be direct players in the space ecosystem, but they will begin to play a vital role in supporting the industry's push for sophistication. Whether it be increasing the pool of potential investors; offering space-specific legal advice, education or training; supplying the digital and cloud-based tools to support system development; or providing access to traditional engineering capabilities in adjacent industries, the number of these organisations will increase rapidly. Ensuring they are well-versed in the specifics of the space industry will be an important factor in ecosystem development.

Primes

Primes are traditionally considered the biggest players in the space, defence, aviation and maritime industries, and are often found leading large space programs for defence and governments across the world. These organisations have the space heritage and business acumen required to not only deliver technical capabilities for enterprise and government, but also support the growth of the ecosystem by collaborating with smaller, local space organisations and SMEs.

Science, research & academia

Australia's science, research and academic excellence is internationally recognised across multiple industries – and space is no different. Universities and research institutions across the nation have been involved in early-stage scientific discoveries and innovations, and have demonstrated advanced capabilities in quantum technologies, nanotechnology, advanced materials, highly specialised sensor fabrication, microgravity applications for space medicine, robotics, autonomous systems and more. Continuing these activities will be critical to establishing Australia as an undisputed leader in space research.



Talent

Talent, and the availability of the right skills and capabilities, is a priority area for all ecosystem stakeholders. Building a sustainable ecosystem requires a continuous pipeline of talent that matches the needs of industry. Across the ecosystem, we heard of the importance of long-term planning for education and training, as well as the need to identify where the space ecosystem can educate others.

This isn't news – not by a long stretch. But it's front of mind for all participants in the Australian space ecosystem and is warranted as the first theme we discuss. Without talent we cannot deliver on our commitments today, nor realise our ambitions tomorrow. So, beyond a need for more skilled workers, what exactly does the ecosystem want when it comes to talent?

Building a talent lifecycle

- **Developing talent at every opportunity** with a strategic approach incorporating inspiration, education, training and opportunity.
- Missions to **inspire the next generation of students**, such as the moon rover in collaboration with NASA.
- Delivery of STEM programs from as early as primary school, including curriculum changes and educational sessions with parents, to **raise awareness of space** as a prospective career path.
- **Space-specific training**, industry placements and internship programs for tertiary and university undergraduate programs.
- Ensure there is sufficient demand in the ecosystem to **provide sustainable career opportunities** that attract and retain talent. Stakeholders cited a lack of jobs in the industry as one of the most challenging barriers to talent attraction and retention.

Building hard and soft skills for the sector

- A technically robust and commercially viable ecosystem needs **sophistication across facilitating industries**. To support this development, the ecosystem must identify capabilities not only in STEM but also in the 'soft skills' humanities (e.g., business, finance, law, government policy and marketing). Space is a necessarily complex industry that requires facilitating industries to have a sophisticated understanding of the ecosystem.
- This could be facilitated through **entry-level courses as electives** across a range of adjacent disciplines (e.g., business, marketing, law, commerce, mining and agriculture).

Building a workforce that can compete on the global stage

- The Australian space industry is relatively new and our workforce has not had the opportunity to upskill itself and acquire relevant experience, which makes qualified engineers and technicians from overseas attractive to Australian space companies. These companies must **hire and upskill Australian talent** to support the growth of the local ecosystem.
- At the same time, we must create attractive propositions to **bring back Australian talent from overseas** (e.g., providing competitive salaries in the global space market).



Don't overcomplicate the jobs and university courses available. Space is not just satellite manufacturing and rocket engineers. There is a need for an organisational workforce, similar to the aviation sector – it does not just focus on pilots, but a supply chain of different skill sets.

David Ball

Lockheed Martin Australia Pty Ltd

Primes

We need to educate parents of the future workforce on the benefits and pathways of the space sector, and ensure that the curriculum includes content which highlights space as an industry.

Prof. Simon Ellingsen

University of Tasmania

Science, research & academia

We need to develop Australia's space workforce through knowledge transfer, inspire young people and take a coordinated approach to workforce development and employment.

Dr Andy Koronios

SmartSat CRC

Science, research & academia

We have a lack of educational pathways that focus on space – bringing people from overseas is only a short-term solution.

Nick Leake

Optus

Australian space organisations

We have a lot of talent in Australia that can solve global problems, including the challenges faced by other space agencies.

Dr. Amanda Caples

Victorian Government

Government

We need to develop apprenticeships that include both software and hardware, bringing the theory into practice. We have to be bold, look long term, be target driven and play the long game. This is the way it's sustainable. We need to establish our position as a spacefaring country.

Rajat Kulshrestha

Space Machines

Australian space organisations

Technology enablers have a role to play in developing the talent pipeline. We have focused on developing talent and supporting skills development and Indigenous community projects.

Lynn McDonald

Microsoft

Industry facilitators & tech enablers

We need a more diverse space sector to promote uptake of space tertiary programs. Academia can also offer exchange programs to build capability faster.

Kim Ellis Hayes

Swinburne University

Science, research & academia

We need to grow and build with the right expertise if we are to achieve an ecosystem of companies that are viable and sustainable.

Martin Rowse

Airbus

Primes



Building our value proposition

What do we want to be known for? Why Australian space? It's clear there's still more work to be done on our united value proposition. We each have our own drivers that get us out of bed in the morning – business success, research breakthroughs, working with like-minded people – and our own space focus areas. But we need a common driver, a common north star for Team Space Australia. What better ecosystem to unite around a mission than space, and what are the building blocks of our value proposition for the Australian space ecosystem?

Building on our current capability

- **Leverage expertise in adjacent industries** where we are established global leaders. Missions like the Australian-made 'foundation services rover' have invigorated and inspired industry to re-invest in existing capabilities with new applications. Identifying how Australia can best stage investments over the medium-long term will position the ecosystem to capitalise on commercial opportunities that could arise (e.g., space resource utilisation).
- **Build on our geographic advantage and explore Australia's spectrum abilities** to support global missions and local demand. Leverage years of experience supporting global missions with satellite communications coverage and explore Australia's radiocommunications spectrum capabilities, minimising interference between frequency bands and services and improving efficiency.
- **The global launch market presents an exciting opportunity for Australia**, which can have a catalytic impact on the rest of the space value chain. The global market for launch is complex and competitive and, as a result, the broader ecosystem is interested in what the Australian opportunity – and Australian advantage – looks like. To take advantage of this opportunity to the fullest, the broader ecosystem needs to work with launch specialists to understand the opportunity presented by Australian launch and define our end-to-end Australian space supply chain.
- The ecosystem needs to continue innovating in sensor research, commercial edge computing capabilities and artificial intelligence and machine learning systems to **meet commercial downstream demand**.
- **Leverage leading research in GNSS** – especially in advanced GNSS receivers – and integrate capability with digital platforms to meet downstream demand.

Building capability for the future

- It's time for us to **scale our capability to support small to medium-sized satellites**, a necessity driven by a desire for sovereign capability to support defence programs and a need to deliver services to the global space market. We must start investing in manufacture, assembly, integration and test (MAIT) capabilities to support large satellites of 250 to 500 kilograms.
- Explore and invest in new niches to **take a leading role in the global space market of the future**. As sustainability becomes essential for space operations, **Space Domain Awareness (SDA)** will become critical to industry development and we should play a leading role. We should also ensure we **align capability development with global problems** such as meeting the needs of end users in climate and the environment.
- Invest today in the foundations for space biology research and quantum technologies for communications and sensing to **meet future commercial demands** in space exploration, medicine and tourism. Advanced satellite platforms could also be an area of future competitive advantage for Australia.
- **Invest in on-orbit manufacturing and software-defined spacecraft** to support commercial satellite maintenance, developing this niche capability and placing Australia at the forefront of manufacturing. Commercial satellite communication operators seek innovation that enables in-space hardware upgrades to replace aging satcom fleets that provide government, enterprise and consumers with state-of-the-art services.



The ambition is to build a sovereign space capability – the ecosystem will follow. We have the geography, the R&D and the technology.

Mike Gallagher
NSW Government

Government

If you help local capability develop organically, then this is where the IP is born, this is where its background will be, this is where its supply chain will grow and it will benefit the entire space ecosystem in Australia.

Matthew Tetlow
Inovor

Industry facilitators & tech enablers

Getting a photo taken next to a server rack is not as attractive as getting it taken next to a launch or satellite, but the capabilities enabled by that server rack for space and the sovereignty and resilience of ground and space control segments is a fundamental issue. The proportion of organisations in Australia that are focused on this is very limited, yet it is one of the most critical elements from a national (defence and civil) perspective.

Chris Deeble
Northrop Grumman

Primes

Space is the linchpin for technology that enables connectivity, positioning and remote sensing at scale.

Pip Grant
AgriFutures Australia

End users

A robust, enduring Australian space industry needs to contain all facets of space from launch technologies through to end user application development and support. Launch is the foundational capability that anchors downstream space industries to Australia and attracts international investment to our nascent ecosystem.

Lloyd Damp
Southern Launch

Australian space organisations

Australia can be a strategic service provider in the southern hemisphere for the global coverage of space assets, activities and missions.

James Yuen
WA Government

Government

I would love to see Australia as the global leader in downstream applications including remote sensing of the land and positioning, navigation and timing with enhanced GNSS platforms. Australia should aspire to be a world-leading centre for calibration and validation of any satellite data and derived products.

Maree Wilson
Geoscience Australia

Government

Australia's opportunity in space lies in the overlap with adjacent disruptive technologies that our nation excels at. The majority of activity should and will be where the need and the money is: downstream analytics, the application of artificial intelligence (including in-orbit AI), turning space-derived data into decision-ready information for the many sectors and users on the ground.

Russel Boyce
UNSW Canberra Space

Science, research & academia

We have the opportunity to leapfrog older and more established industries with digitally led space solutions and establish our niche that builds lasting value. Australia can participate on a global scale using our competitive advantages: our unique location in the southern hemisphere for sub-orbital, orbital, polar-orbital launch; our capacity to develop new technology unhindered by scale, like quantum computing for satellites; and our use of AI to make organisations more intelligent and improve efficiencies through cutting-edge machine learning techniques.

Shaun Wilson & Shena Howell
Shoal

Australian space organisations



Commercialisation

Australian space is commercial space. Building a sustainable space ecosystem requires more than just good products and people; it requires commercial, outcome-based investments and impact. But it wouldn't surprise anyone to know that, across the ecosystem, challenges with commercialisation are inhibiting growth. We get it – as organisations mature and ecosystems grow, the commercial 'growing pains' often stifle great ideas and prevent them from becoming profitable products. Add the perceived (and real) riskiness of space, the 'final frontier' vibe from the non-space community and the need to demonstrate flight heritage, and commercialisation becomes harder and more delayed than in your average sector. Where do we start?

Building a commercially competent ecosystem

- Australian space organisations must **find a niche and show return on investment** to build commercial credibility.
- Organisations must **have a clear value proposition** and recognise the importance of business development, investing not only in technology but also in commercialisation strategies and other key areas.
- The ecosystem's **upstream and downstream activities need to be connected** to ensure products are fit for purpose. The commercialisation of Australian upstream space technologies will only be realised with a clear relationship to downstream demand. For example, end users in agriculture, financial services, insurance and mining must drive technical sensor requirements for Earth observation applications.
- Commerciality requires credibility, and this can be supported by **government taking on a customer role**. This approach could also improve collaboration, such as through the development of national missions requiring whole-of-ecosystem cooperation. This will support a shift away from government acting solely as a source of grants towards long-term procurement of space capability. Taking on this role will provide stability, a pathway to flight heritage and opportunities to move into the export market.

Building commercial opportunities together

- Despite state-of-the-art technologies and capabilities, adoption of space technologies in adjacent industries in Australia remains low compared to other countries. Instead, companies prefer to invest in imagery providers and data aggregators rather than satellite developers. Fostering demand across these industries will be central to the sustainable development of the ecosystem, so we need to **explore opportunities to connect with others outside of our ecosystem**. For example, future space events must support downstream panels and extend invites to end users to raise awareness.
- Explore the investment required for long-term industry development. Defence and civil space grant programs provide a pathway to develop foundational capabilities and build space heritage, but to support organic and sustainable growth, the industry must explore private funding. Proactively creating awareness of Australian space capabilities in venture capital circles and the private sector is needed to **de-risk the ecosystem and increase investment appetite**.
- Australian space organisations must continue to **engage with the international market** and export technologies (e.g., deliver specialised subsystems and componentry to established commercial markets in the US and Europe, participate in global missions and leverage existing connections and demand in the APAC region). There is an opportunity for Australian organisations to build strong supply chain relationships with countries of similar space growth in the APAC region; this means identifying what Australian technologies are driving demand across APAC today, such as specialised electronics, CubeSat platforms and communication systems.



Australian start-ups are innovative and work very hard. When we go to international investors, they're very impressed and happy to give capital – but it's not the same with Australian investors.

William Crowe
HEO Robotics

Australian space organisations

Space companies are not often commercially minded and rarely led by businesspeople. We need more commercially minded people in the space industry.

Flavia Tata Nardini
Fleet Space Technologies

Australian space organisations

We're not quite getting commercial business models right. We require skill sets from other industries, and the people mix needs to be experimented with to get the right model.

Sebastian Chaoui
Arlula

Australian space organisations

Every industry, not just space, sees a high level of start-up failure. Space companies need to assess commercial viability early on to de-risk. We need commercial acumen to do this on a capital pathway.

Chris Kirk
Stone & Chalk

Industry facilitators & tech enablers

Our space initiatives need to consider the impact and economic value that they will deliver. We need to become more commercially minded.

Dr Andy Koronios
SmartSat CRC

Science, research & academia

From an investor perspective, the key aspects we consider are around companies that offer a sound business case and a commercialised and competitive solution to prevalent, global problems.

Bill Bartee
Main Sequence

Industry facilitators & tech enablers

We are recognised for research but not commercialisation in space. Commercialisation – that's the part that's not happening. We must move the needle to get to the end state of commercialisation.

Mike Gallagher
NSW Government

Government

The space industry needs revenue that is repeatable. It's imperative to sustain the industry – the industry cannot live on grants alone. Start-ups find it challenging to sustain revenue over longer periods and need more certainty.

David Ball
Lockheed Martin Australia Pty Ltd

Primes

The growth of Asian nations' space capabilities continues at an astonishing pace - Japan, India, and South Korea are all expanding their space programmes. While the participation of the private sector in national space missions is still largely a US phenomenon, many Asian private space firms and startups have commenced embedding their technologies and capabilities into ISRO, JAXA, KARI - making access to space a lot cheaper and more competitive. There's a real commercial opportunity here for Australia to participate in the space missions' supply chain of the East. Accessing the venture capital flows, immense talent, market and mission needs for innovative new space products and applications would further Australia's commercial space trajectory.

Mani Thiru
AWS

Australian space organisations

Government is a great catalyst and stimulus to the private sector. As a long-term procurer, it will provide the necessary short-term stability and opportunities to move into the export market.

Prof. Sir Martin Sweeting
Surrey Satellite Technology Ltd (SSTL)

Science, research & academia



Cohesion

The value of an ecosystem is more than the sum of its parts. Yet, for this to be realised, we need to function as an ecosystem. We need to look beyond our siloed, transactional relationships – what we need to do to keep the lights on and bills paid each day – and collaborate with the broader space ecosystem. Doing so requires a common purpose, a cohesive strategy, around which we can all rally. No one gets to space alone, and not a single stakeholder in the Australian space ecosystem thinks we’re getting this one right. From financial analysts poring over insurance data in Sydney offices to ground station mechanics in remote Northern Territory, how do we create a sense of cohesion in such a diverse ecosystem?

Build a coordinated approach

- Sustainable growth requires a long-term strategy that considers the entire ecosystem. We need **tighter integration across government, defence and civil space strategies**, along with better coordination between these sectors to avoid duplication of capabilities and facilitate sustainable infrastructure investment.
- Policymakers and ecosystem players seem to have different, often conflicting views on **what sovereign capability truly means**. Sovereign capability must be informed by a strong understanding of MAIT capabilities for subsystems and specialised componentry; there is no need to reinvent the wheel and build components from scratch when similar solutions exist internationally.
- Australia's space ecosystem needs to be geography-agnostic, **breaking down barriers between states and territories** and taking a national approach to growth. Geographies must start seeing themselves as part of the Australian space economy, not as individual players operating in isolation. This creates efficiency in investment, avoids duplication of infrastructure, enables better coordination across the space value chain, cultivates complementary capabilities across the nation and reduces competition between states. The space ecosystem needs to identify how it can connect to create competition that is not counterproductive.
- Current funding schemes and policies such as defence's Australian Industry Capability Program promote collaboration across the ecosystem. However, to support organic growth, the ecosystem must **collaborate organically across the supply chain** by procuring technologies from other Australian suppliers and integrating them into their systems for performance enhancement, regardless of government grants.

Build shared opportunities

- **Identifying opportunities to collaborate and invest across the value chain** will be crucial. To grow sustainably, organisations need to identify and build cross-value chain relationships with a view to pursuing co-investment opportunities. Investing in business-to-business relationships will build capabilities, share risk, create pathways to space heritage and increase individual technical-readiness levels (TRLs) and commercialisation opportunities.
- **The defence industry and its ecosystem** will play a key role in the development of the space industry, both as a customer and partner. This includes continuing to build relationships with established industry players to identify areas of investment that support the development of sovereign capability. However, due to long program timelines and complexities in defence procurement, the ecosystem cannot depend solely on defence programs to provide a pathway to flight heritage.



Collaboration – it’s important in the Australian space industry, especially across SMEs. Space programs require a depth of capability and disciplines that no single company will be able to offer, so you will need to partner with others.

Fred Hull
Axiom Precision Manufacturing

Australian space organisations

We need policy and commitment to a connected, ongoing roadmap and program of work – without it, there’s no demand, no investment and no sustainability of the space industry.

Matt Dawson
Thales

Australian space organisations

It’s important that across the industry we break down silos and continue to push ahead with a cohesive strategy that shows the government’s true ambition to grow the Australian space industry. Otherwise, we run the risk of reinventing the wheel and duplicating financial investments, which is not in the interest of the industry as a whole.

Nick Leake
Optus

Australian space organisations

Space activities don’t happen in a cycle of three to four years. It’s critical to have a sustainable plan addressing both research and private sector needs, based around a long-term vision from the ASA and government agencies and the ability to invest and nurture capabilities over a decade or more.

Sarah Pearce
SKAO

Science, research & academia

Each state has its competitive advantages and this can be difficult for space companies to navigate. There is still a lot of opportunities to work more collaboratively between states and companies.

Dr Joshua Chou
University of Technology Sydney

Science, research & academia

Government needs to help build the ecosystem by attracting SMEs and primes. We need to attract complementary skills and relationships from global organisations to promote collaboration and deliver mutual benefit.

Tiffany Katchmar
SA Government

Government

We should invest in partnerships with India and Japan. When collaborating with others, you work out what the real opportunities are.

James Brown
Space Industry Association of Australia (SIAA)

Industry facilitators & tech enablers

Current funding schemes almost disincentivise companies by creating ‘grantpreneurship’, which is useful but not part of a broader supply chain. Funding should drive collaboration and create capability in the right areas, driving the right behaviours.

Rajat Kulshrestha
Space Machines

Australian space organisations

An integrated approach is not just about efficiency, economics and national security. It’s about climate, predicting and managing bush fires, monitoring heat in cities, developing regional Australia, tourism, national smart manufacturing and driving STEM education. It’s medicine, exploration and deep space communications – what does space not do?

Rebecca Shrimpton
Australian Trade and Investment Commission (Austrade)

Government

Government as a customer is the missing ingredient. When government is the customer, we have to work together as an Australian space ecosystem.

Adam Gilmour
Gilmour Space Technologies

Australian space organisations



Authors and contributors



Jason Bender
Partner, Deloitte Space
and Head of Innovation
jabender@deloitte.com.au



Andrea Culligan
Partner, Deloitte Space
and Deloitte Monitor –
Innovation and Ventures
aculligan@deloitte.com.au



Caru Froneman
Graduate, Deloitte Space
and Marketing
cfroneman@deloitte.com.au



Kelly Heaton
Director, Deloitte Space
and Deloitte Access Economics
kheaton@deloitte.com.au



Rosie Jonas
Senior Manager, Deloitte Space
rjonas@deloitte.com.au



Stuart Kerr
Marketing Director, Deloitte Space
stkerr@deloitte.com.au



Liesda Marsdon
Manager, Deloitte Space
and Deloitte Access Economics
lmarsdon@deloitte.com.au



Dr Pradeep Philip
Partner, Deloitte Space and
Head of Deloitte Access Economics
pphilip@deloitte.com.au



Steve Rayment
Partner, Deloitte Space
and Consulting
srayment@deloitte.com.au



Byron Riessen
Principal, Deloitte Space
briessen@deloitte.com.au



Prof. Deen Sanders OAM
Partner, Deloitte Space
and Deloitte Integrity
deensanders@deloitte.com.au



Dr Geraldine Baca Triveno
Specialist Senior Manager,
Deloitte Space
gbacatriveno@deloitte.com.au



Deloitte.

This publication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collectively the “Deloitte Network”) is, by means of this publication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this publication.

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited (“DTTL”), its global network of member firms, and their related entities. DTTL (also referred to as “Deloitte Global”) and each of its member firms and their affiliated entities are legally separate and independent entities. DTTL does not provide services to clients. Please see www.deloitte.com/about to learn more.

About Deloitte

Deloitte is a leading global provider of audit and assurance, consulting, financial advisory, risk advisory, tax and related services. Our network of member firms in more than 150 countries and territories serves four out of five Fortune Global 500® companies. Learn how Deloitte’s approximately 286,000 people make an impact that matters at www.deloitte.com.

About Deloitte Asia Pacific

Deloitte Asia Pacific Limited is a company limited by guarantee and a member firm of DTTL. Members of Deloitte Asia Pacific Limited and their related entities, each of which are separate and independent legal entities, provide services from more than 100 cities across the region, including Auckland, Bangkok, Beijing, Hanoi, Hong Kong, Jakarta, Kuala Lumpur, Manila, Melbourne, Osaka, Shanghai, Singapore, Sydney, Taipei and Tokyo.

About Deloitte Australia

In Australia, the Deloitte Network member is the Australian partnership of Deloitte Touche Tohmatsu. As one of Australia’s leading professional services firms, Deloitte Touche Tohmatsu and its affiliates provide audit, tax, consulting, and financial advisory services through approximately 10,000 people across the country. Focused on the creation of value and growth, and known as an employer of choice for innovative human resources programs, we are dedicated to helping our clients and our people excel. For more information, please visit our web site at www2.deloitte.com/au/en.html

Liability limited by a scheme approved under Professional Standards Legislation.

Member of Deloitte Asia Pacific Limited and the Deloitte Network.

© 2021 Deloitte Touche Tohmatsu

MCBD_Syd_12/21_758185198