Astra AYAA

ASTRA PROGRAM 2025

WHITE PAPER SERIES

Produced by the Astra Program

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Published by the Australian Youth Aerospace Association
www.ayaa.com.au

Executive Summary

Australia and Pacific Island Nations share geographic, security and environmental challenges that space technology can help address. This white paper analysed the problem statement: How can Australia and its regional neighbours enhance space sector cooperation to address shared challenges and promote sustainable development and stability? These problems are important as enhancing cooperation in the space sector would enable Australia and the Pacific Islands Nations (PINs) to jointly address critical shared challenges including climate change vulnerability, maritime security, and development needs that individual nations cannot solve effectively on their own. Moreover, discovering solutions to this problem will present opportunities for development with PINs that will further grow the global space sector.

The paper analysed case studies within PINs such as Tonga and New Zealand, as well as case studies of collaboration within the space sector such as the Australian Space Agency's efforts to spark interest in STEM and the SMARTSAT initiative that partners universities, research organisations, and industry together. The paper also investigated international collaborations such as Australia's collaborative space program with New Zealand that can be expanded into an Oceanian Space program.

Based on these case studies, This paper proposes the following recommendations:

Development recommendations:

- Australian and New Zealander governments should continue to cultivate a network of space organisations that partners universities, research organisations, and industry together.
- Guarantee access to space for Australia and PINs through the continued development of domestic launch sites and Australian sovereign launch capability.
- Create value propositions for PINs that help frame space technology and capabilities as affordable, viable, and valuable for PINs, that help build frameworks for PINs to create their own revenue streams through space industries.
- Form an Oceania space collaborative program for sustainable space development by reducing skill gaps, developing regional launching sites, and creating structures for financial investment in PIN space industries that will allow PIN's own space industries to sustain themselves in the long run.
- Establish a regional education initiative which engages children 3-18 years in the space industry by creating a STEM-focused award scheme that provides scholarships and accelerated study pathways.

Climate change and ecology recommendations:

- Establish track 1.5 sessions for collaboration to regularly address the effects of climate change using space technologies in an agreed timeline.

Security recommendations:

- Expand satellite infrastructure, coverage and initiatives with the use of space assets to tackle maritime security threats like illegal (IUU) fishing in the region.

TEAM CASUARINA

How can Australia and its regional neighbours enhance space sector cooperation to address shared challenges and promote sustainable development and stability?

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Acknowledgement of Country

Team Casuarina, alongside the Astra Program and the Australian Youth Aerospace Association, would like to acknowledge the Traditional Custodians of Country throughout Australia. The Casuarina Team is based across Australia; Gadigal, Dharug, Ngunnawal, Ngambri, Wallumettagal, Bidjigal, Wurundjeri and Kaurna Land.

We pay our respects to Elders, past, present and emerging, and extend our respects to all Aboriginal and Torres Strait Islander peoples. We recognise the First Nations Peoples of Australia as the world's first astronomers, and their enduring knowledge in cultures and customs, which have nurtured and continue to nurture terrestrial, and astronomical knowledge.

Introduction

International cooperation is a key principle in achieving peaceful ventures in the space sector.[1] Unprecedented levels of space sector development necessitate inputs in the way of specialist resourcing, human and capital investment from developed and developing countries. Not altogether surprisingly thus, space has traditionally been the preserve of wealthier nations who have the economic scale and technological capacity to bear such costs. Smaller nations by contrast, have often been relegated to the margins.

This dynamic is especially clear in view of the evolving relationship between Australia and its regional neighbours in Southeast Asia and Oceania. The region - historically overlooked in

discussions regarding the development of a collaborative space industry - is notable particularly for its unrealised potential in space sector cooperation.

This white paper shall examine this issue with reference to three shared challenges of especial interest to Australia and its regional neighbours: the question of climate change and ecology, human and social development, as well as regional security. Its geographical focus, whilst incorporating broader findings relevant to the Southeast Asian region, is primarily on smaller Pacific Island Nations (PINs).

Background

While the issue of collaboration in the space sector has long been an object of discussion, much of the tenor has tended to overlook its application to smaller regional nations. While initiatives like the Asia-Pacific Regional Space Agency Forum have aimed to foster regional cooperation, larger states, like Australia and India, have nonetheless tended to dominate keynote speaker positions.[2] Smaller nations who lack institutional influence often struggle to relay their perspectives in the current diplomatic structure.[3] This reflects a broader issue in Asia-Pacific space development that smaller nations, like PINs, have not been appropriately consulted.

Views on Climate Change/ Ecology

According to data by the World Meteorological Organisation, climate change is a growing threat to both the socioeconomic development and the very existence of the PINs.[4] While there are some existing projects initiated by Australia to help the PINs, most of them focus on funding the broader climate change issue and fail to take into consideration the other operational issues that may occur during implementation. For instance, while Australia has contributed $9 million to support its Pacific neighbours in meeting their greenhouse emission reduction targets, this effort - welcome though it may have been - failed to adequately account for the unique challenges particular to the region. This failure is at once due to a fundamental limitation in analytical capacity as well as the absence of more targeted regional level coordination. These deficits in Australia-Pacific collaboration are the object of analysis in this white paper.[5]

Views on Development

While Australia and New Zealand (NZ) have established active space sectors, PINs are currently navigating development challenges due to limited infrastructure, human capital and industrial resources.[6] Australia's space strategy has a primary focus on agriculture, disaster response and Earth Observation (EO).[7] While PINs face much the same in the way of shared challenges and are projected to be disproportionately affected by threats like rising sea levels, their efforts have been hamstrung by limitations in capital and human resources and infrastructure.[8] Their concerns are more immediate and the development of a vibrant space industry a lower priority. This is clearly a problem insofar as space technology can have a transformative effect in aiding disaster relief and climate change mitigation efforts in the region. By leveraging Australia's space industry expertise and forging a more involved and expansive partnership, renewed collaborative efforts can improve social and economic stability and development outcomes in the region.

While Australia and New Zealand (NZ) have established active space sectors, PINs are currently navigating development challenges due to limited infrastructure, human capital and industrial resources. Australia's space strategy has a primary focus on agriculture, disaster response and EO. While PINs face similar challenges and are disproportionately affected by threats like rising sea levels, their efforts have been hamstrung by limitations in capital, human resources and infrastructure. Their concerns are more immediate and the development of a vibrant space industry a lower priority. This is clearly a problem insofar as space technology can have a transformative effect in aiding disaster relief and climate resilience efforts in the region. By leveraging Australia's space industry expertise and forging a more involved and expansive partnership, renewed collaborative efforts can improve social and economic stability and development outcomes in the region.

Views on Security

Australia's defence strategy has renewed prioritisation toward space sector with funding from $7 billion in 2020 to $9-12 billion in 2024, highlighted in the 2024 Integrated Investment Program (IIP), primarily for projects like geostationary orbit-based satellite communications and the Deep-space Advanced Radar Capability to enhance space domain awareness (SDA) and strategic communications.[9] In contrast, $510 million was allocated under the maritime domain for Australia's Pacific Maritime Security Program (PMSP) to support partners' maritime security.[10] While space investments contribute to broader strategic security, it is not directly tailored to the immediate needs of the PINs. Strengthening space collaboration with PINs requires prioritising their concerns.

Methodology

Assumptions and Process

This white paper has studiously ensured that all sources cited herein adhere to accepted standards of empirical research. This policy has been maintained across the three topics of analysis; development, security & ecology and climate change.

This paper has adopted a similar approach to that set out by Maximilien Berthet and Riccardo Corrado in their paper 'ASEAN Regional Collaboration'.[11] It incorporates similar expert insights, case studies & secondary sources. The research process began with a qualitative assessment of existing regional nation-specific space capabilities in order to form a conceptual foundation for

analysis. This was followed by an open community engagement through a topic snapshot and consultations with appropriate subject matter experts. The paper analyses three key themes, consistent across the region: development, climate change & ecology and security. This thematic approach streamlines analysis by highlighting continuities across the region.

Limitations and Suggestions

The conceptual focus on PINs presented challenges given the limited availability of systematic information on space capabilities across small island nations. Thus, the case studies identified within this white paper do not and cannot necessarily capture all PINs. Further elaboration and research would be required to more accurately make additional targeted recommendations.

Topic Assessment

Topic 1: Development (Human Capital, Industrial Growth, and Stability)

Australia and New Zealand (NZ) have strong existing cooperative linkages in their respective space sectors.[12] While many other nations in Oceania lack comparable space industries, there is, nonetheless, a growing regional demand for space services such as Earth Observation (EO) & satellite communication.However, significant challenges remain in developing space capabilities among Oceania region nations. In particular, space organisations and startups in PINs suffer from the lack of availability of capital, human resources, and local industry.[13]

Unlike Australia, which generated $3 to 4 billion AUD annually from its space industry as of 2017, Tonga, for instance, has seen no comparable commercial benefit in its telecommunications satellite network 'Tongasat'. This disparity can be credited to a general risk aversion from prospective commercial and industrial partners internationally as well as prohibitively high upfront startup costs.[14] To address these challenges, Australia and NZ can use their established capabilities in education, industry, research, and human capital development to help grow, support and develop Tonga's - and comparable regional - space industries in a way that is equitable and suitably respectful of regional sovereignty.

Impact on the Australian Space Industry

The latest comprehensive review of Australia's space industry conducted in 2017 by Acil Allen Consulting, identified Australia's mature capabilities in various sectors such as satellite ground

stations, EO, education and training.[15] It also identified weaknesses in the financing and insurance of the Australian space industry. Furthermore, it highlighted numerous emerging capabilities, including small satellite instrumentation manufacturing and orbital launch services.

Since then, Australia's space industry has made significant progress. The Australian Space Agency (ASA) has created partnerships with SMARTSAT, a collaborative initiative across over 135 universities, research organisations and industry stakeholders. Through these partnerships, the Australian government has provided funding and scholarships to develop capabilities in telecommunications, Internet of Things connectivity and next-generation satellite systems.[16]

Advances have also been made in creating a sovereign launch capability for Australia through industry. Startups like Gilmour Space Technologies, Black Sky Aerospace and ATSpace are developing their own rockets capable of carrying small satellites to orbit. Notably, Gilmour Space is preparing to launch its Eris orbital class hybrid rocket in 2025. Spaceports have been established in Australia by numerous launch providers such as Equatorial Launch Australia, Southern Launch and Western Australia Spaceport.[17]

Further investment in Australia's space industry would contribute significantly to the local economy whilst ensuring robust sovereign control over space capabilities. At present, only NZ demonstrates an effective sovereign launch capability. With renewed focus however, Australia can position itself as a space capability provider for other regional states and organisations, especially those in the Oceania region where it may not be economical to build, maintain or operate autonomous space capabilities.[18]

Review of Current Approaches

Australia currently maintains strong ties with other national and international space organisations, such as NASA, the ESA and JAXA. Cross-Tasman cooperation, in particular, has been heavily stressed with an especial focus on improving environmental and agricultural management across the region. The ASA's SMARTSAT initiative may be taken as emblematic of this success in as much as it has contributed to the thorough integration of Māori knowledge with EO satellite data to monitor landscape flammability and help fire planning and management.[19]

Whilst Australian-NZ collaboration is well established, Tonga has primarily partnered with China to maintain their geostationary satellite slots and to launch satellites for their telecommunications network TongaSat. This initiative was impelled largely by Tonga's desire to

substantially increase government revenue on the order of 25 percent. Notwithstanding their plans, the result has been rather less positive. Tonga's nascent satellite telecommunications network has been beset by numerous foreign powers aiming to take over their satellite slots or seize their satellites before launch. The result has been fiscally disastrous resulting in a total financial windfall of T$45,708 (approximately $29,973 AUD as of 2025) being delivered from 1993-1994, a far estimate from the predicted T$11.4 million ($7.46 million AUD).[20]

New Zealand's space industry stands in contrast to Tonga's experience. With the advent of NZ's sovereign launch capability and the subsequent nurturing of its space industry by the NZ Space Agency (NZSA), its space industry is estimated to have a value of $1.69 billion and employs 0.2% of its total workforce.[21] A more considered review of these three nations' experiences would enable greater understanding as to how Australia can better collaborate with other nations and organisations across the region.

Topic 2: Climate Change/ Ecology

Climate is projected to pose a marked challenge to ecological stability in the Oceania region. PINs, for instance, are highly susceptible to sea-level rise due to their largely distinguishable low-lying landscapes.. Global Navigation Satellites Systems are presently being used to monitor such impacts of climate change, whilst also playing a role in early warning systems across the region. The South Pacific Commission, the region's leading technical organisation, offers scientific expertise in order to address rising sea levels and natural disasters in member countries.

Impact on the Australian Space Industry

Climate change is widely recognised to constitute a present and ongoing existential threat to the well-being, security, and livelihood of people across the broader Pacific. This stark reality set out acutely in the Boe Declaration on Regional Security is made more pressing by the fact that PINs lack the economic scale, technical expertise, and human capacity to adequately institute autonomous disaster resilience systems by themselves.[22] With this in mind, AusAid - the second largest regional donor - has closed the gap by funding six climate change projects worth US$38 million across the region.[23]

Review of Current Approaches

The Secretariat of the Pacific Regional Environment Programme (SPREP) is the administrative organ tasked with handling most regional financial contributions. The Secretariat, however, is beset by considerable administrative bloat, exacting considerable costs and diminishing the ultimate direct money transfers to SPREP. This has forced the SPREP to fall into a cycle where they are forced to be more accountable to the donors than the countries that they serve.[24] It has been argued that SPREP and other regional agencies have normalised external involvement, including their values and tools, in managing environmental issues in the Pacific, particularly in projects like the PICCAP, which was the first major GEF-funded climate change project in the region.[25]

Australia's former Seasonal Worker Programme was a great example of how circular international labour mobility could facilitate capacity building by equipping agricultural workers with skills to apply to crop production in climate change-impacted environments. This has shown that the incorporation of climate change adaptation in international labour mobility programs can yield great results in terms of developing capabilities and upskilling.[26] Such a program could, additionally, be easily replicated for aspiring space sector workers across the Oceania region.

Upon review, current approaches to combat the effects of climate change are likely to hinge most around the issue of migration. Studies have shown that current policy mechanisms can be adapted to facilitate the effective movement of people affected by climate change in the Pacific in an orderly and controlled manner. However, it has been reported that there has been little dialogue on how these existing policies can be amended to benefit both the parties, Australia and the Pacific. Without clear communication in the region, the success of migration policy will struggle to be implemented successfully.

Climate change is an interlinking factor for numerous sectors. Resolving climate policies by focusing on PIN needs would assist in capacity building and efficient resource sharing to combat climate change. Australia relies on international communities for EO data. Dedicated EO facilities in the region would optimise resource sharing, enhance capacity building, and provide Australia with satellite data for their required projects.

Topic 3: Security

PINs maritime security issues have broader regional ramifications. Fish stocks, transnational criminal activity, and maritime borders are all at risk from Illegal, Unreported, and Unregulated

(IUU). Activities engaged in trafficking, smuggling, environmental destruction, and grey zone tactics jeopardise Australia's vital exclusive economic zone (EEZ).[27] 'Dark vessels' intentionally disable their Automatic Identification System (AIS) transponders or Vessel Monitoring System (VMS), indicating the necessity for more advanced monitoring measures. Due to the region's vast geography and limited patrol and enforcement capabilities, challenges remain to reduce IUU activities.[28] Strengthening collaboration and addressing economic-related drivers of undesired seafaring activities remains critical to Australia's long-term investment in regional stability.

Impact on the Australian Space Industry

Maritime security challenges necessitate greater Maritime Domain Awareness (MDA) through space-based surveillance technologies like satellite imagery and radio frequency (RF) detection.[29] MDA helps detect IUU activities close in real-time and can measure ocean conditions (e.g. temperature, current), and marine life distribution, helping PINs anticipate unwanted activities.[30] This demand drives commercial opportunities for satellite services and data analytics providers, encouraging innovation to advance vessel detection, tracking, and identification thus boosting Australia's global competitiveness in the space sector.

Additionally, downstream activities such as space-based data processing and surveillance integration create employment opportunities in law enforcement and resource management. Ultimately, space technologies combat IUU-related crimes, strengthening Australia's border security, whilst supporting the naval sector through enhanced communications and surveillance.[31]

Review of Current Approaches

The Quad's Indo-Pacific Partnership for MDA (IPMDA) utilises satellite technologies to combat IUU fishing. Web-based SeaVision overlays AIS data with satellite imagery and RF data from providers (e.g. Hawkeye 360 and Skylight), for users to analyse and share maritime information in order to detect dark vessels.[32] The extent to which PINs can readily access such services is uncertain and partially dependent on the applicability of IPMDA laws.[33] Automating the analysis of data and AIS using AI algorithms reduces latency, however, the coverage of existing satellites over PINs raises questions of efficacy in the region.[34] Surface assets like Australia's patrol boats' effectiveness in the region may be constrained by limited satellite-based AIS coverage, underscoring the need for coordinated ground and space capabilities.

Case Studies

New Zealand's space industry

As of 2019, Deloitte has estimated the total economic contribution of the space sector to New Zealand to be $1.69 billion, supporting 5000 full-time Jobs.[35] New Zealand does not have large institutional space programs. Instead, its space sector relies on NewSpace organisations. This means that New Zealand is one of the few countries where its space industry is primarily driven by commercial demand rather than government interests.[40] The presence of New Zealander-founded company Rocket Lab has ignited interest in the space sector. As a response, the Ministry of Business, Innovation and Employment created the New Zealand Space Agency (NZSA) to implement policy, support space sector development, and engage with overseas partners.

One key way the NZSA supports its space industry is through its Outer Space and High-altitude Activities Act (OSHAA) enacted in 2017. The licensing requirements under OSHAA for each space activity (such as launching rockets or testing rocket motors) are "simple and identical to one another", where all activities require similar precautions or qualifications. This reduces the complexity and cost for each licence granted.[36] There is also flexibility in the system; if an operator already holds a licence from a particular jurisdiction such as NASA or the ESA, the NZSA will ensure that the requirements for OSHAA have been met and grant the licence. By doing so, compliance costs can be minimised. New Zealand also supports numerous financial grants and startup programs that support the space industry. For example in November 2019, the MBIE granted NZ$ 500,000 for six research projects to be done in partnerships with local universities as well as local aerospace companies. In addition, universities and research institutes often allow their facilities to be used by space startups to test their prototypes. This has successfully created at least 104 organisations within the space sector.[37]

Tongasat and interference from foreign actors

In 1990, the government of Tonga claimed 16 of the 180 geosynchronous orbit parking spaces to create a national telecommunications company.[38] The American telecommunications company INTELSAT viewed Tonga as a dangerous competitor and tried to convince the International Telecoms Union (ITU) to reject all of Tonga's claims. In the end, the ITU gave Tonga nine slots, paving the way for the first PIN-owned space industry, Tongasat. [39]

However, the Tongan slots were seized by many different actors.[40] Both the United Kingdom and Indonesia contest ownership of certain orbital slots, whilst the United States, Hong Kong-based AsiaSat, and the People's Republic of China (PRC) positioned their satellites in these slots without authorisation, with a further two slots seized by Russia following a payment dispute.

The PRC reconciled with Tonga through negotiations.[41] In exchange for switching diplomatic relations from Taiwan to the PRC, a Chinese satellite company became Tongasat's leading client, as well as a promise for Chinese help in developing income streams from Tonga's satellite slots. However, in 2006, China placed a satellite in Tongan space without coming to an agreement with Tongasat.[42] After negotiations, China agreed to pay $50 million USD as grant assistance to Tonga. However, the payment was made to Tongasat directly contrary to government expectations of a 50/50 split. After deliberations in the Supreme Court of Tonga, the court ruled that the payments were the property of the Tongan government and Tongasat was ordered to pay out $6000 USD as compensation.[43]

In the case of the Tongasat satellite, it is clear that any country with the political, technological, and financial resources to create their own satellite network may face difficulty in generating a sustainable and stable domestic industry due to political barriers. It also highlights how foreign influences hinder their development, pushing these PINs to seek stability and growth through larger partners, potentially geopolitical rivals to Australia.

The Australia-New Zealand Collaborative Space Program

A late 2024 SmartSat article highlighted the Australia-New Zealand Collaborative Space Program, – NZSA with Australia's space research organisation SmartSat CRC (agreed in January 2024)– aim to increase space capability while addressing common challenges for both nations.[44] The four newly introduced projects focus on enhancing environmental and agricultural management utilising shared expertise and resources. Given the catastrophic rise in bushfires over the past two decades, fire management has become increasingly important, especially to rural and at-risk communities.[45] Deploying EO technologies in this region will address common challenges, increasing long-term stability.

Australian Space Agency (ASA)

The ASA, as Australia's authorised governmental space program, aims to 'advance Australia's position in the global space economy'.[46] It offers a vast range of activities for school-age

children.[47] Two notable parts offered by the Agency are the Australian Space Discovery Centre (ASDC) and Learning Resources and Activities. The ASDC not only provides a place for children to learn about the space industry but also holds school programs and events.[48] The free-of-charge school programs target students from Years 5 to 12, aiming to engage students' interest in STEM and promote careers in space. For instance, Operation: Goldilocks is an online workshop for Years 5 to 8 themed around exploring the planets through the use of mathematical and scientific skills.[49] The Learning Resources and Activities offers online activities through the ASA website, making it broadly accessible.[50] These fun, engaging school programs and learning resources can engage children in STEM, increasing exposure and therefore increasing the likelihood of a strong future STEM workforce.

Hunga Tonga–Hunga Ha‘apai Volcano Eruption and Subsequent Tsunami

The 2022 Hunga Tonga-Hunga Ha’apai volcano eruption displays the significance of regional response and monitoring in natural disasters. The eruption resulted in damage to an important underwater telecommunication cable, temporarily cutting Tonga off from the outside world and possible assistance.[51] The underwater explosion also resulted in the expulsion of water vapour to the stratosphere, leading sulphur aerosol particles to form. This dense layer was later confirmed with the help of satellite imaging, a worrying development given the particles’ potential to alter the reflective load of the Earth’s solar radiation.[52] Sulphur dioxide can, in turn, affect human respiratory systems and cause acid rain.[53] These troubling developments were captured with the assistance of the Suomi National Polar-Orbiting Partnership satellite, specifically its onboard ozone mapping sensors and profiler with in-situ measurements.[54] The sudden rise of electron density and ionosphere height increase were discovered through the use of Japan’s Arase Satellite to detect equatorial plasma bubbles.[55]

These events amply demonstrate how space technologies can bolster disaster early warning systems. PINs, by virtue of their relative isolation, sparse populations and underdeveloped industrial and economic capacities, are especially susceptible to such ecological disasters.[56] It follows, thus, that an expansive early warning/monitoring satellite system like that of the USA and Japan would likely be of considerable utility.

Recommendations

Theme 1: Development

Recommendation 1: Government-Space sector community

Reflecting on the successes of the New Zealand Space Agency (NZSA) in developing the "NewSpace" community, Australia should provide funding and support for space organisations, streamline compliance costs by standardising regulatory requirements, and leverage existing international standards and licenses to expedite approvals for space activities. Space organisations developing advanced space capabilities such as launch capability would contribute significantly to economic growth and employment.[57]

Furthermore, the public should continue to recognise and embrace the shift from traditional government-driven space initiatives to the emerging "NewSpace" which is driven primarily through startups, universities, research organisations, and commercial industries. Space organisations that embrace this shift can utilise their space capabilities to establish financial robustness and self-reliance, leading to a space industry that is self-sustaining and does not rely on government demand.[58] Governments can support the NewSpace community by having an attentive and proactive approach to industry building, for example creating communal networks of facilities such as wind tunnels and laboratories, and supporting partnerships between universities, research organisations, and industry in the space industry ecosystem. There should be a focus on expanding the Australian and NZ space industry network to willing organisations in the Pacific region.[59]

Recommendation 2: Support for space initiatives in the Pacific

To guarantee access to space for both Australia and potential future partners in the Pacific, Australia should continue to support the development of domestic launch sites and sovereign launch capability.[60] This is especially for protecting space industry assets from initial production to orbital launch, particularly if those assets belong to nations or organisations vulnerable to foreign interventions. This would help protect Pacific Islanders' space assets from being seized or manipulated by malicious actors.[61]

Moreover, for nations with priorities outside of space, a re-evaluation of the value proposition space technology gives is recommended. Space technology such as EO can provide a solution for vital national priorities such as agricultural management, environmental resilience, and disaster early warning and prevention.[62] By reframing space technology as an affordable and viable solution to national issues, PINs can be encouraged to support space initiatives such as SMARTSAT which would increase collaboration in space across the Pacific region. Australia should especially be proactive in helping PINs create revenue streams through space industries, allowing them to gain their sovereign sources of income as well as international influence. [63]

Recommendation 3: An Oceania Space collaborative program

The new projects launched through the Australia-NZ Collaborative Space Program are a great demonstration of how space collaboration could be used to help PINs to cope with the effects of climate change. This reflects the significance of collaboration in general. A collaborative Oceanian space program launched to target and address specific shared challenges would do much to alleviate possible problems. Countries with more mature and advanced space capabilities like Australia and New Zealand can offer space expertise, resources and education to countries with fewer capabilities like PINs. This will help train PIN people to gain relevant skills to sustain their own countries' space industry in the long run. Masters and PhD scholarships and research funding can be provided to help grow experts in the region. PINs can help this region to develop launch sites for their proximity to the equator to improve the region's space sustainability. Oceania can also help promote PIN sustainable agriculture, fisheries and tourism. Since these are some key factors that are contributing to their economy, government and private companies can subsequently increase funding and expenditure on the space industry.[64] However, exploitation should be prevented by putting reasonable measures in place. This collaboration will benefit both parties, fostering relationships, reducing skill gaps and developing a sustainable space industry for the region.

Recommendation 4: An award scheme

A STEM-focused award scheme, modeled after The Duke of Edinburgh's International Award, can engage children in space and STEM fields. Initially available to PINs' children 3 to 18 years old, the program can later expand across Oceania and globally.[65] The scheme can have multiple levels to suit different abilities with each level requiring children to participate in sufficient hours in specific activities; certificates, awards or scholarships can be awarded based on the level

attained. This award scheme is an ideal choice because it also incorporates numerous organisations and governing bodies that offer these opportunities together. This will increase the chance of children getting exposed to the maximum available opportunities in STEM offered by different countries by completing the required activities. This will also encourage space centres or other space-related activities to be introduced to the region for the next generations.

Businesses can provide scholarships to participants; governments can provide funding to support the scheme; not-for-profit organisations can provide activities for this scheme; universities can provide accelerated study pathways for students who participate in this scheme. Through coordinated efforts, such as Track 1.5 Diplomacy, this initiative promotes collaboration and participation, ultimately supporting the development of a sustainable STEM education framework in the region.

Theme 2: Climate Change/ Ecology

Recommendation: Track 1.5

The establishment of 'track 1.5-like-session' can be encouraged for the discussion of climate change-related issues and the amendment of policies that benefit all the concerned parties, with priority given to the several PINs-specific issues that do not get discussed in existing conferences. Participation can involve key stakeholders – government and non-government experts, academia, scientists and private space companies from Australia and PINs include a formal framework for dialogue such as the Multi-Stakeholder Dialogue. The aim is to allow stakeholders to amend policies for mutual benefit. The objective for each session would be to create a list of actionable items assigned to concerned parties with a timeframe to implement the discussed criteria, which is to be reviewed during the start of the next session.[66]

Theme 3: Security

Recommendation: Satellites to enhance MDA

Australia and PINs should collaborate to expand satellite infrastructure, prioritising CubeSats equipped with S-AIS, SAR, RF sensing, and AI-driven analytics to improve dark vessel detection and IUU fish monitoring. As well as reviewing the satellite coverage in the PIN region (post-2020) to optimise deployment strategies.[67] Capacity-building initiatives, such as the Pacific Security College, should focus on upskilling CubeSat maintenance and AI-driven analytics. Furthermore,

focus should be placed on securing funding through public-private partnerships, the Quad's IPMDA and the Pacific Island Fishing Forum Agency (FFA) to reduce costs and ensure equitable data access.

Conclusion

With the further development of an integrated Oceanian space industry, regional collaboration will be crucial to overcome the regions' shared developmental, security, and ecological challenges. This effort is even more important in consideration of the historically underappreciated nature of the region in space affairs.

This white paper has endeavoured to offer up a number of recommendations organised with a view to catalysing regional space sector cooperation. These have included: increased regional collaboration in education, social and economic development, environmental management and monitoring, as well as shared space capacity initiatives, especially those concerned with establishing shared launch capabilities in the region.

In addition, to support the specific issues of PINs when it comes to climate change, track 1.5 sessions for collaboration should be established to regularly address the effects of climate change using space technologies in an agreed timeline. Finally, Oceanian security can be strengthened through expanding satellite infrastructure, coverage and initiatives with the use of space assets to tackle maritime security threats like illegal (IUU) fishing in the region.

To enhance space sector cooperation between Australia and PINs, this paper recommends growing the network of space organisations, extending the Australia-NZ collaborative to include all PINs and to undertake regional initiatives in education, business development, environmental management, and financial support. To guarantee access to space for Australia and PINs, the continued development of domestic launch sites and Australian sovereign launch capability should be supported. In addition, to support the specific issues of PINs when it comes to climate change, track 1.5 sessions for collaboration should be established to regularly address the effects of climate change using space technologies in an agreed timeline. Finally, Oceanian security can be strengthened through expanding satellite infrastructure, coverage and initiatives with the use of space assets to tackle maritime security threats like illegal (IUU) fishing in the region.

Australia has recently made substantial gains in the way of developing its own robust space industry and capabilities. Present trends - especially when compared to previous reviews of Australian space capability in 2017 and 2018 - point to a near future launch capability.[68]

Australia has continued to promote cooperation between its educational, research and industry organisations both within Australia and internationally, especially with New Zealand, and continues to support maritime security and monitor for disasters in the region using its space capabilities.

Expanding Australia's existing networks to include and sharing existing space capabilities with PINs would ensure mutual access and sustainable development of space technology. It could help in creating economic growth, improving educational access and developing local businesses in PINs. There is also immense potential for space in addressing challenges for PINs such as rising sea levels, climate change and having early warning systems for natural disasters, as well as land, sea and ecology management, illegal fishing, and many more. Increasing collaboration within the region and improving Australia's ties to these often neglected Pacific Island Nations.

Acknowledgements

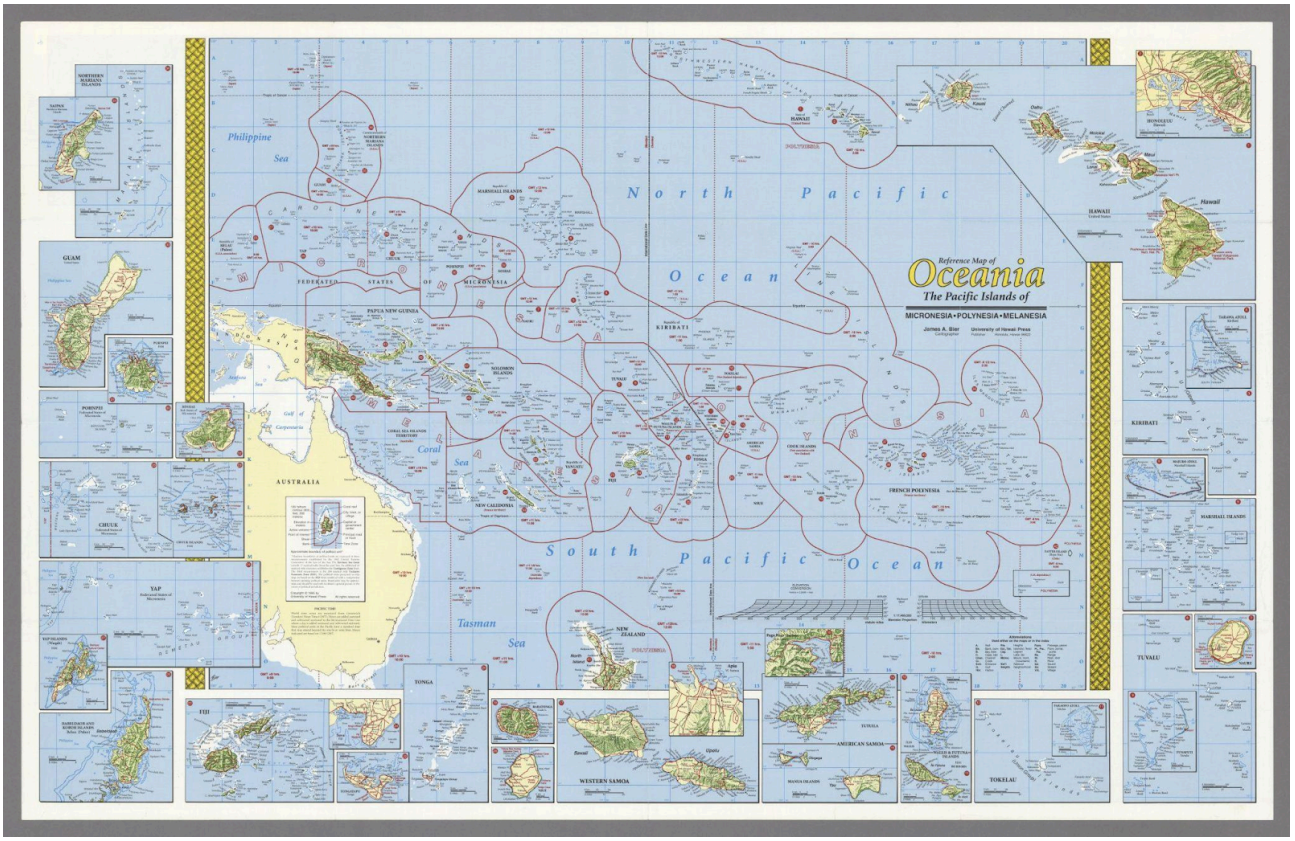
Team Casuarina would like to thank and acknowledge the crucial support that we have received throughout the preparation of this white paper.

We would like to in particular thank Christopher Kourloufas for his insight and guidance in the creation of this white paper. We would also like to thank the following subject matter experts for their time throughout the writing of this white paper, without whom it would not have been possible.

- Dr. Danielle Ireland-Piper
- Dr. George Carter
- Hoani Hakaraia
- Lois Anne Leal
- Maximilien Berthet
- Paolo Samoza
- Zandria Farrell

Finally, we would like to thank the Australian Youth Aerospace Association, the Astra committee, and our Team Coordinators (Amy Pang and Anel Kapur) for their organisation and guidance of the program.

Appendix A



Reference map of Oceania : the Pacific Islands of Micronesia, Polynesia, Melanesia[69]

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