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TOWARDS A UNIFIED SKY

Crafting a Diverse and Inclusive Workforce for Australia's Space Future

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Abstract

Diversity is complex and multifaceted, holding immense potential for transformative change. However, diversity initiatives risk negative consequences without careful implementation, as the outcomes are easily skewed.

This paper outlines strategies for successfully implementing diversity initiatives to enhance the Australian space sector. It identifies the acute talent shortage and underrepresentation of minority groups within the sector's workforce as critical barriers to innovation and growth. It consolidates recommendations across educational reform, workforce diversification, equity, inclusion, and international collaboration to leverage diversity as a strategic asset for enhancing Australia's global economic competitiveness in space. To meet this aim, responsible stakeholders should consider revising the national curriculum to incorporate space sciences with diverse perspectives, incentivise non-university tertiary institutions to offer space-focused qualifications, and launch a unified public awareness campaign.

This paper recommends the development of Indigenous space-themed cultural centres, establishing a cadetship program, implementing flexible work policies and Employee Resource Groups, and introducing neurodivergent scholarship programs to promote diversity and inclusion in Australia's space industry workforce. An Inclusion, Diversity, Equity, and Access (IDEA) strategy with specific recruitment and retention targets is also recommended, alongside the promotion of international collaboration and regular monitoring of workforce participation through snapshots to measure diversity metrics. These efforts aim to position the Australian space industry as a global leader in inclusivity and innovation, enabling a dynamic, diverse, and competitive workforce.

Acknowledgement of Country

The Australian Youth Aerospace Association, the Astra Program, and Team Acacia acknowledge the Traditional Custodians of Country throughout Australia. The participants, committee, and supporters of the Astra Program come from a variety of lands across Australia, including the lands of the Ngunnawal, Ngambri, Gadigal, Kaurna, Wurundjeri, Turrbal, and Jagera Peoples.

We pay our respects to Elders past and present, and extend that respect to all Aboriginal and Torres Strait Islander peoples. We honour Aboriginal and Torres Strait Islander peoples' continued connection to Country, waters, skies and communities.

We recognise the First Nations Peoples of Australia as the world's first astronomers, and celebrate their cultures and customs which continue to care for Country and nurture astronomical knowledge.

Introduction

Over the past decade, Australia's space sector has seen remarkable growth, emerging as a key pillar of the national economy. The imperative for diversity extends beyond social and ethical considerations, as it serves as a fundamental driver for innovation and excellence in Australia's space workforce [1].

Australia, a nation woven from a tapestry of diversity, does not see this rich fabric reflected in its space sector[2]. This is evident in the inadequate representation of marginalised groups, including women, individuals from rural or remote areas, Indigenous peoples, and neurodivergent individuals. To address these challenges, Australia must adopt a sustained, strategic approach to inclusivity, requiring collaboration across government, educational institutions, and industry stakeholders to break down systemic barriers to diversity.

This white paper sets forth a framework aimed at enhancing the inclusivity of Australia's space workforce, proposing strategies to bridge educational divides, increase access to space science education, and promote diversity through scholarships, cadetships, Indigenous cultural centres, and international collaboration.

Methodology and Limitations

This paper is the culmination of efforts by Team Acacia, as part of the Astra Program, who come from diverse educational and professional backgrounds. Over the past three months, the team engaged with Subject Matter Experts (SMEs) and conducted comprehensive research and analysis, culminating in ten recommendations.

In addressing Recommendation 1, we acknowledge its potential limitations. The ongoing transition to curriculum version 9.0 restricts data collection to official state curriculum websites. While space science is crucial, it is just one part of the broader educational framework. Focusing solely on the K-10 science curriculum overlooks integration possibilities with historical topics such as Australia's Cold War contributions. Future revisions should adopt a holistic approach, encompassing diverse materials and extending beyond science to incorporate historical perspectives on space exploration. Teachers face challenges in delivering quality education due to limited resources. This broader issue requires enhanced support in terms of technology access, resources, and professional development, as highlighted by the Australian Government's Pathway to Diversity in STEM Review (2024)[3].

We must also acknowledge that whilst significant progress has been made, bias and discrimination remain deeply ingrained within the fabric of our society. Achieving genuine diversity and inclusion in the sector necessitates a profound societal transformation, which is outside of this report's scope.

Topic One: Bridging the Educational Divide

To create a diverse and inclusive Australian space sector, equity in access to education, knowledge and representation is vital in empowering marginalised and disadvantaged communities.

Recommendation 1: The Department of Education (DoE) should collaborate with space advocacy organisations to revise the Australian Curriculum, incorporating a broader range of space science content reflecting diverse contributions.

The Australian Curriculum versions 8.4 and 9.0, covering Kindergarten to Year 10, lack specificity in space science, resulting in nationwide teaching disparities and knowledge gaps. This deficiency exacerbates education inequalities, including funding disparities and underrepresentation within the curriculum. Notably, the representation of gender and culture in space science education is skewed, showing a lack of diversity in the curriculum. Among 145 scientists mentioned in the Year 11 and 12 curriculum, only one female scientist, Rosalind Franklin, is mentioned[4]. Research by B. Jensen et al. (2023) emphasises substantial deficits compared to international standards, particularly in relation to Earth and space science[5], hindering students' integration of space science with other disciplines such as politics, law and economics. Addressing these issues is crucial for a more inclusive and robust space science education, empowering students to explore diverse perspectives and strengthen Australia's educational foundation.

Effective change requires collaboration among stakeholders. National advocacy groups like the Australian Youth Aerospace Association (AYAA) or the Andy Thomas Space Foundation should partner with government bodies such as DOE and the Australian Space Agency (ASA). Through this collaboration, a benchmark standard for space science knowledge can be established, fostering a comprehensive curriculum. Additionally, space science education must be integrated across all year levels to promote inclusivity and dispel misconceptions.

The representation of diverse backgrounds should be prioritised, and educators should be equipped for culturally sensitive instruction. Collaboration between secondary statewide organisations and state education bodies like the NSW Space Research Network (SRN) and the New South Wales Education Standards Authority (NESA) ensures the reforms' effective implementation. These efforts align with the "Inspire" Strategic Space Pillar of the Australian Civil Space Strategy 2019/28[6], which aims for a diverse and inclusive workforce with a focus on Indigenous engagement and internships.

Recommendation 2: The Department of Education and the Australian Space Agency should incentivise non-university institutions to develop space-focused qualifications, fostering broader educational and career pathways from secondary school to the space sector.

Access to space science education varies across communities and states, particularly outside universities, with limited opportunities for individuals living in rural and low-income areas[7]. Data from the Office of the Chief Scientist highlights a gap in STEM professionals between economically diverse regions, emphasising the prevalence of non-university VET qualifications in less affluent areas[8]. Additionally, Aboriginal and Torres Strait Islander students represent only 0.7-0.8% of STEM enrollments, underscoring the need for inclusive outreach efforts in the space sector[9]. Public consensus exists on the importance of diversity in space sector activities[10].

Creating 20,000 new space sector jobs by 2030[11], as targeted by the ASA, faces challenges due to a mismatch between educational pathways and industry needs. This is evidenced by shortages across 319 Tier Three space-related skills[12], and limited early career opportunities for diverse talents[11]. High youth unemployment and scarce STEM internships contribute to this situation[13]. To address these gaps, a reconceptualisation of vocational education and training (VET) as a viable space sector pathway is needed. This is essential for marginalised groups and in challenging the notion that formal university education is the sole route into sector [14].

To tackle these challenges, NSW SRN must collaborate with the DOE and ASA in promoting non-university VET options and trade pathways in the space sector by:

No.	Recommendation*	Description
2.1	*Creating an online Careers Pathway Board (CPB) – listing industry opportunities, TAFE education pathways, and outlining space career options.*	This will provide a clear starting platform for students to explore their educational and career options.
		The CPB will outline available space-related qualifications, concentrated upon VET pathways, and internship/job opportunities.
		This resource will be freely accessible for graduating high school students and career advisors.
		This must be coordinated in-line with the ASA's existing job roles and study pathways portal.
2.2	*Advocating for increased government funding for tertiary institutions that invest in the development of space-related VET pathways.*	Lobbying the Education Minister and government stakeholders, to highlight the benefits of space to national prosperity.
		Inclusion of a rating system on the CPB will discourage tertiary institutions from creating VET pathways for monetary purposes.
2.3	*Cultivating increased engagement with industry stakeholders, to improve analysis of their human capital requirements and workforce needs.*	Seminars and Q&A's hosted by the SRN to help students and career advisors understand the different tertiary education opportunities.
		Hosting iterative Track 1.5 round-tables with industry and government on the topic of VET education and the space sector.
2.4	*Reviewing the Australian Qualifications Framework, exploring options to shift institutional and public attitudes to non-university qualifications.*	Conduct round-table dialogues with the DoE, education providers, and students regarding perceptions of university versus non-university pathways.
		Emphasise the utility of VET pathways and non-university tertiary education in creating a more holistic and diverse space industry.
		Shift public perceptions of the space industry as an elitist and exclusive sector.

*These recommendations align with the "Inspire" Strategic Space Pillar listed under Australian Civil Space Strategy 2019/28[16] – to showcase Australia's achievements in space activities to inspire young people to take up STEM careers, and support the growth of the future workforce.

Recommendation 3: National stakeholders in the Australian Space Industry should collaborate on a unified public awareness campaign to bolster support and attract diverse talent.

Key industry stakeholders such as ASA, Space Industry Association of Australia (SIAA), educational institutions, and government departments are encouraged to coordinate the launch of a comprehensive public awareness campaign. The campaign should educate Australians on their country's significant role in space exploration and correct any misconceptions about the space industry, highlighting how it can contribute to solving challenges on Earth[15]. To captivate and educate the Australian public, the campaign should leverage innovative experiential marketing techniques, extending its reach beyond the limitations of social media and conventional advertising. These experiential initiatives could include immersive space exhibits in major cities, hands-on space technology demonstrations, and interactive augmented reality experiences

that bring the cosmos closer to the public. Such strategies, aligned with the "Inspire" strategic space pillar of the Australian Civil Space Strategy 2019/28[16], aim to ignite interest in STEM education and skill development through the engaging lens of space exploration.

To bolster community engagement and foster a deeper connection with space, the campaign could facilitate collaborative public art projects, celebrate National Space Day with wide-ranging activities, and offer interactive educational exhibits across urban centres. Moreover, by coordinating a unified campaign across popular digital platforms, including Instagram, TikTok, and YouTube, and creating content such as podcasts, e-newsletters, and interactive Q&A sessions with space professionals, the initiative can appeal to and resonate with a broad and diverse audience. This comprehensive approach aims to advance Australia's global space standing by increasing public awareness and enthusiasm for the space sector. Increasing public awareness and support creates a compelling case for additional government funding, which is crucial for fostering a national culture deeply committed to space exploration and its vast possibilities. Importantly, this strategy aligns with efforts to attract diverse talent into the space industry, ensuring that the future of space exploration and innovation benefits from a broad spectrum of perspectives and skills.

Recommendation 4: The National Indigenous Australians Agency (NIAA) should collaborate with the ASA and DOE to develop Indigenous space-themed cultural centres, integrating Indigenous culture with the space sector.

Indigenous Australian culture's profound connection to the cosmos is reflected in ancient traditions and spiritual beliefs, spanning countless communities over millennia. Across the continent, Indigenous societies have revered the celestial realm, embedding stories of stars, planets, and constellations into their cultural tapestry through oral traditions, art, and ceremony[17].

The NIAA should fund or otherwise develop cultural centres that blend traditional Indigenous knowledge with modern space science to foster greater Indigenous participation in the space sector and promote improved educational outcomes, as well as the exchange of ideas and experiences. These facilities would support learning for all ages and backgrounds, focusing on space science, technology, and Indigenous space history. These cultural centres would also facilitate exhibitions that normally require travel to more remote locations.

A collaborative effort with the ASA and the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) is essential, as is incorporating existing strategies from initiatives like the Indigenous Art Centre Framework[18].

The plan aims for economic viability and increased visibility by incorporating these cultural centres in existing high-traffic venues such as libraries, museums, and galleries. These centres

are poised to provide educational and innovative opportunities for previously underrepresented communities, enhancing the space sector's diversity and inclusivity, while promoting the exchange of ideas and experiences.

Topic Two: Cultivating a Diverse and Inclusive Space Workforce

To uphold Australia's global standing, the space industry must diversify its workforce, with the inclusion of culturally and linguistically diverse individuals being crucial.

Initiatives like neurodivergent scholarships, flexible work policies, and university student cadetship programs offer avenues to address this gap.

Recommendation 5: The Department of Industry and Science (DISR), in collaboration with universities and Space Primes, should establish a cadetship program to attract and train the next generation of Space Workforce.

The Department of Defence has successfully implemented a cadetship program aimed at STEM undergraduate students, allowing them to kick start their careers while pursuing their studies[19]. Drawing inspiration from this model, it is proposed that DISR develop and launch a similar cadetship program, with the SRN joining as a participant or partner. Such a program would enable university students to work part-time in space-related roles, providing invaluable real-world experience alongside their academic pursuits. Connecting cadets with mentors throughout the program would facilitate learning from leading experts in the Australian space industry, enabling accelerated professional growth[20].

DISR should consider subsidising this program, encouraging a broader range of companies to offer work placements, including SMEs and startups. The initiative should be open to all disciplines, focusing on those interested in the space industry, as addressing Australian space challenges requires a multidisciplinary approach. By implementing this cadetship program, DISR can bridge existing skills gaps, encourage a more diverse workforce and nurture the next generation of space professionals.

Recommendation 6: The NSW Space Research Network should consider adopting flexible work policies and establishing Employee Resource Groups, thereby setting industry-wide guidelines for the sector.

Developing expertise goes beyond merely providing resources; it involves creating opportunities to utilise those skills whilst ensuring a safe atmosphere and promoting the success of the workforce. Implementing flexible work policies, including remote work options, flexible hours, and part-time positions, is crucial to achieving these objectives. Studies have shown that companies embracing flexible work practices, primarily by increasing part-time managerial roles, achieve improved gender balance at the executive level[21]. Moreover, a recent poll by the International Workplace Group indicates that 84% of Australian firms utilise flexible working arrangements to enhance talent retention[22], resulting in higher productivity and a more inclusive environment in which employees feel valued and recognised. Embracing flexibility widens the talent pool and fosters a more inclusive atmosphere within the Australian space industry.

Additionally, strategic collaboration with Employee Resource Groups (ERGs) is a powerful strategy for promoting diversity. By establishing ERGs tailored to various diversity dimensions such as gender, ethnicity, or generational differences, organisations can create dedicated forums for employees to share experiences and insights and address challenges related to workplace inclusion. A recent McKinsey report found that 66% of employees believe ERGs foster a sense of community[23], shaping a workplace culture that genuinely values diversity and inclusion. However, ensuring executive sponsorship for these ERGs to promote inclusion and diversity is essential. When high-ranking executives serve as sponsors, they can advocate for ERG recommendations at the leadership level, influencing decision-making processes and reinforcing the organisation's commitment to fostering an inclusive workplace.

Recommendation 7: The Australian Government, in collaboration with the Australian Space Agency, should establish and support a neurodivergent scholarship program to diversify the space talent pipeline.

The ASA, in partnership with the Australian Government, should consider introducing a neurodivergent scholarship program to enhance the inclusivity and diversity of the talent pool within the space industry. This initiative aims to provide equitable career advancement opportunities for neurodivergent individuals, encompassing conditions such as autism spectrum disorder (ASD), mood disorders, ADHD, and dyslexia. By doing so, it actively celebrates the unique strengths and perspectives that neurodivergent individuals contribute, thereby fostering a workforce that is both evolving and inclusive.

As many as 11-20% of Australians identify as neurodivergent, also known as cognitive divergence[24]. Cognitive diversity is defined by A. Reynolds and D. Lewis (2017) as "variations in how people think and process information unrelated to gender, ethnicity, or age"[25].

By promoting alternative pathways into the sector, the program is positioned as a step towards inclusivity, ensuring that contributions from neurodivergent individuals reshape the sector's future development and success. Evidence shows that teams, especially neurodivergent individuals, are particularly effective in addressing the complex and uncertain challenges faced in the space sector [26]. This approach not only addresses the pressing skills shortage by attracting a broader range of talent but also bolsters the sector's innovation and resilience. It positions the sector as a global leader in recognising the importance of neurodiversity, by developing a vibrant and inclusive community that reflects the diversity inherent to Australia.

Topic Three: Advancing Equity, Inclusion and International Collaboration

Fostering equity, inclusion, and global collaboration is crucial for the Australian space industry's sustainability and growth. Efforts to expand industry participation must prioritise inclusivity, driving innovation and success, while international partnerships strengthen Australia's global position and promote equity within the industry.

Recommendation 8: The NSW Space Research Network should lead by example by fostering diversity and innovation within the space community through International Researcher Exchanges

The SRN is encouraged to champion diversity and innovation within the space community by leading international researcher exchanges akin to secondments through international universities and stakeholders. Building upon the success of the Research Pilot Project [27] funding scheme and the Australian Civil Space Strategy's third phase, Delivering Success (2021-2028)[28] the SRN stands poised to drive enhanced global collaboration in line with national priorities. To realise this vision, the SRN could develop a comprehensive international outreach and partnership strategy, articulating specific objectives, collaboration targets, and measures to mitigate risks. Emphasising the protection of intellectual property rights during cross-border collaborations is paramount to ensuring accountability and transparency.

By actively facilitating the exchange of researchers between international universities and stakeholders, the SRN can serve as a driving force behind the cultivation of a diverse and innovative space community. These exchanges not only enrich the pool of talent and perspectives within the Australian space sector but also contribute to broader cultural understanding and cooperation. Drawing on successful university-led international collaborations, the SRN can highlight the manifold benefits of such partnerships, nurturing a

culture of innovation and intercultural exchange. Through strategic communication and knowledge sharing, the SRN can cultivate a dynamic network of global collaborators, driving progress and excellence in space research while promoting diversity and inclusion as core values.

This strategy could exert positive influence and aims to secure Australia's interests and promote a diverse, multicultural and innovative Australian space community through strategic communication and knowledge exchange with international universities and stakeholders.

Recommendation 9: The NSW Space Research Network should consider developing an IDEA strategy with targeted goals for diverse staff recruitment and retention, serving as a benchmark for industry-wide diversity efforts.

Many small and medium-sized enterprises (SMEs) in the space sector lack a formal Inclusion, Diversity, Equity, and Access (IDEA) policy with clear objectives. Developing, communicating, and implementing an inclusive plan fosters organisational commitment and accountability towards diversity and inclusion goals. A detailed IDEA strategy statement should set specific recruitment and retention targets for individuals from diverse backgrounds, offering a robust framework to guide efforts in enhancing diversity and inclusion while aligning with broader societal values of fairness and social justice.

Extensive research underscores the benefits of diverse and inclusive workplaces, including increased innovation, productivity, and resilience. Studies by McKinsey & Company and the Boston Consulting Group show that companies with higher gender and ethnic diversity outperform industry medians by 15% and 35%, respectively[22]. An IDEA policy provides a systematic approach to promoting diversity and equity, ensuring equal opportunities for all, and reflects the values of fairness and social justice, symbolic of a forward-thinking organisation committed to excellence. A well-crafted IDEA policy should encompass several key components:

Component	Description
Clear Objectives and Targets	Articulate clear objectives and measurable targets for increasing workforce diversity, including specific representation percentages for various underrepresented groups such as CALD, individuals with disabilities, First Nations people, LGBTQIA+ individuals, and individuals from minority religious backgrounds.
Recruitment and Retention Strategies	Outline strategies for attracting and retaining diverse talent, including targeted recruitment initiatives, diversity training programs, mentorship opportunities, and inclusive workplace policies.
Monitoring and Reporting Mechanisms	Establish mechanisms for monitoring progress towards diversity goals and reporting on outcomes, including tracking staff and applicant diversity and their representation at different organisational levels.
Cultural Competency Training	Provide training for all staff to foster an inclusive environment where diversity is celebrated and valued.

Leadership Commitment and Accountability	Emphasise leadership commitment to diversity and inclusion, holding leaders accountable for achieving diversity targets.

By taking proactive steps to develop and implement an IDEA strategy, the NSW SRN can set a precedent for other space companies in Australia, demonstrating its commitment to fostering a diverse and inclusive workforce. This not only enhances the organisation's reputation but also contributes to the overall success and sustainability of the Australian space industry.

Recommendation 10: The Australian Space Agency, in collaboration with industry partners across the Australian space sector, should take the lead in coordinating regular assessments of workforce participation and diversity metrics through a comprehensive 'workplace participation snapshot'.

The Australian space industry faces persistent challenges in ensuring equity and inclusion for its diverse workforce, with underrepresented individuals encountering systemic barriers to career advancement despite diversity promotion efforts[28]. To address this, the ASA and industry partners should conduct regular assessments of internal career movements, collecting data on turnover rates, promotions, and demographic attributes like race, gender, ethnicity, and disability. Meticulous analysis of this data will enable the sector to identify disparities and implement targeted strategies, enhancing accountability and transparency in decision-making processes. Such an approach aligns with recommendations outlined in the Australian Human Rights Commission's report, "Leading for Change: A Blueprint for Cultural Diversity and Inclusive Leadership Revisited" (Australian Human Rights Commission, 2020)[29].

Implementing a 'workforce participation snapshot' led by ASA, akin to an economic snapshot, would be instrumental in monitoring industry demographics, participation rates, and career progression trends[30]. This initiative will offer a comprehensive overview of diversity and inclusion metrics, facilitating informed decision-making and tracking progress toward diversity goals. By prioritising regular assessments and data-driven strategies, the Australian space industry can foster an equitable and inclusive environment for all employees, driving innovation and success[31].

Recommendations

Topic One: Bridging the Educational Divide

- **Recommendation 1:** The Department of Education (DoE) should collaborate with space advocacy organisations to revise the Australian Curriculum, incorporating a broader range of space science content reflecting diverse contributions.

- **Recommendation 2:** The Department of Education and the Australian Space Agency should incentivise non-university institutions to develop space-focused qualifications, fostering broader educational and career pathways from secondary school to the space sector.

- **Recommendation 3:** National stakeholders in the Australian Space Industry should collaborate on a unified public awareness campaign to bolster support and attract diverse talent.

- **Recommendation 4**: The National Indigenous Australians Agency (NIAA) should collaborate with the ASA and DOE to develop Indigenous space-themed cultural centres, integrating Indigenous culture with the space sector.

Topic Two: Cultivating a Diverse and Inclusive Space Workforce

- **Recommendation 5:** The Department of Industry and Science (DISR), in collaboration with universities and Space Primes, should establish a cadetship program to attract and train the next generation Space Workforce.

- **Recommendation 6:** The NSW Space Research Network should consider adopting flexible work policies and establishing Employee Resource Groups, thereby setting industry-wide guidelines for the sector.

- **Recommendation 7:** The Australian Government, in collaboration with the Australian Space Agency, should establish and support a neurodivergent scholarship program to diversify the space talent pipeline.

Topic Three: Advancing Equity, Inclusion and International Collaboration

- **Recommendation 8:** The NSW Space Research Network should lead by example by fostering diversity and innovation within the space community through International Researcher Exchanges.

- **Recommendation 9:** The NSW Space Research Network should consider developing an IDEA strategy with targeted goals for diverse staff recruitment and retention, serving as a benchmark for industry-wide diversity efforts.

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The Astra Program is a great introduction and opportunity for Australian youth to collaborate in understanding the key challenges in the Australian Space industry. It has also been an exceptional forum for learning from Australia's leading space authorities.

Endnotes

[1] E. Palermo. 2022. 'Australia's Space Sector: We Have Lift-Off.' Business Envoy, Department of Foreign Affairs and Trade. Accessed March 5, 2024. https://www.dfat.gov.au/about-us/publications/trade-investment/business-envoy/business-envoy-february-2022/australias-space-sector-we-have-lift.

[2] S. J. Pell, 2021. "What are the growth areas in domestic STEM skills to support jobs in the space industry, and how can these be addressed by the tertiary (university and relevant VET) sector?" Rapid Response Information Report 1 July 2021. Office of Australia's Chief Scientist, Executive Officer of the National Science and Technology Council. Accessed March 4, 2024.

[3] Australian Government. 2024. Pathway to Diversity in STEM Review final recommendations report. Accessed February 15, 2024. https://www.industry.gov.au/sites/default/files/2024-02/pathway-to-diversity-in-stem-review-final-report.pdf

[4] K. Ross, S. Galaudage, T. Clark, N. Lowson, A. Battisti, H. Adam, A. Ross, and N. Sweaney, "Invisible Women: Gender Representation in High School Science Courses Across Australia," 2023, https://journals.sagepub.com/doi/10.1177/00049441231197245. Accessed February 27th, 2024

[5] B. Jensen, M. Ross, M. Collett, N. Murane, and E. Pearson, "Fixing the Hole in Australian Education | The Australian Curriculum Benchmarked Against the Best," 2023, https://apo.org.au/sites/default/files/resource-files/2023-11/apo-nid325172.pdf. Accessed March 1st, 2024

[6] Australian Space Agency, Australian Civil Space Strategy 2019-2028, Canberra: Australian Government, 2019, https://www.industry.gov.au/publications/australian-civil-space-strategy-2019-2028. Accessed 25th January 2024

[7] Department of Education. "Why is STEM Important." Last modified October 26, 2023. Accessed March 1, 2024. https://www.education.gov.au/australian-curriculum/national-stem-education-resources-toolkit/introductory-material-what-stem/why-stem-important.

[8] Office of the Chief Scientist. Australia's STEM Workforce. Canberra: Australian Government, 2020. https://www.chiefscientist.gov.au/sites/default/files/2020-07/australias_stem_workforce_-_final.pdf.

[9] Department of Education. "Aboriginal and Torres Strait Islander students." Last modified May 2, 2022. Accessed March 1, 2024. https://www.education.gov.au/australian-curriculum/national-stem-education-resources-toolkit/i-want-know-about-stem-education/which-school-students-need-stem-education/aboriginal-and-torres-strait-islander-students.

[10] T. Moss, K. R.Hasani, and A.Deejay. Looking Up from Down Under: Australian attitudes to national space activities. Australia: Australian Centre for Space Governance, 2023. https://www.spacegovcentre.org/post/space-in-the-australian-public-eye-in-depth-survey-reveals-national-opinions.

[11] M. Price. "Fast-tracking jobs and technologies for space." Last modified February 25, 2022. Accessed March 1, 2024. https://www.minister.industry.gov.au/ministers/price/media-releases/fast-tracking-jobs-and-technologies-space.

[12] SmartSat. Space Industry Skills Gap Analysis. SmartSat Technical Report no. 5. Adelaide: SmartSat, 2021. https://smartsatcrc.lbcdn.io/uploads/Space-Industry-Skills-Gap-Analysis-Final-Report.pdf.

[13] S.J. Baker, D. Lovett, and D. D. Curtis. "Secondary school students exploring careers in the space industry: A South Australian work experience program." Issues in Educational Research 31, no.2 (2021): 348-369. https://www.iier.org.au/iier31/baker.pdf.

[14] G. Siekman, and P. Korbel. Defining 'STEM' Skills: review and synthesis of the literature. Adelaide: NCVER, 2016. https://www.ncver.edu.au/__data/assets/pdf_file/0022/61339/Support-doc-1-Defining-STEM-skills-review-and-synthesis-of-the-literature.pdf.

[15] G. Autry, "Space Research Can Save the Planet—Again," Foreign Policy, July 20, 2019, https://foreignpolicy.com/2019/07/20/space-research-can-save-the-planet-again-climate-change-environment/.

[16] Department of Industry, Science, Energy and Resources. Australian Civil Space Strategy 2019/28. Canberra: Australian Government, 2019. https://www.industry.gov.au/sites/default/files/2024-02/advancing-space-australian-civil-space-strategy-2019-2028.pdf.

[17] Indigenous Knowledge Institute, "Indigenous Astronomy and the Solar System," last modified 2022, https://indigenousknowledge.unimelb.edu.au/curriculum/resources/indigenous-astronomy-and-the-solar-system.

[18] Department of Infrastructure, Transport, Regional Development and Communications (DITRDCA), Office of the Arts, "Indigenous Art Centre Framework," accessed March 2, 2024, https://www.arts.gov.au/sites/default/files/documents/indigenous-art-centre-framework.pdf.

[19] Australian Government, Defence. STEM Cadetship. n.d. https://www.defence.gov.au/jobs-careers/student-pathways/stem-cadetship

[20] JP Morgan Chase & Co., "The Importance of Mentors and Sponsors in Career Development," last modified 2023, https://www.jpmorganchase.com/news-stories/the-importance-of-mentors-and-sponsors-in-career-development.

[21] J. Cermak, R. Howard, J. Jeeves and N. Ubaldi "Women in Leadership: Lessons from Australian Companies Leading the Way" 2018. https://www.mckinsey.com/featured-insights/gender-equality/women-in-leadership-lessons-from-australian-companies-leading-the-way

[22] D. Sundiatu, K. Dolan, V. Hunt, and S. Prince. "Diversity Wins: How Inclusion Matters." McKinsey & Company. 2020.

https://www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-wins-how-inclusion-matters.

[23] N. Catalino, N. Gardner, D. Goldstein, and J. Wong. "Effective Employee Resource Groups are Key to Inclusion at Work. Here's How to Get Them Right" McKinsey & Company. 2022. https://www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-wins-how-inclusion-matters.

[24] Life Without Barriers, "It's time to shake off stereotypes and reject harmful representations of neurodivergent people," last modified 2022, https://www.lwb.org.au/news/did-you-know-these-famous-aussies-are-neurodivergent/.

[25] A.Reynolds and D.Lewis, "Teams Solve Problems Faster When They're More Cognitively Diverse," Harvard Business Review, March 2017, https://hbr.org/2017/03/teams-solve-problems-faster-when-theyre-more-cognitively-diverse.

[26] R.D. Austin and G. P. Pisano, "Neurodiversity as a Competitive Advantage," Harvard Business Review, May 2017, https://hbr.org/2017/05/neurodiversity-as-a-competitive-advantage.

[27] NSW Space Research Network. Research Pilot Program. n.d. https://www.spaceresearchnetwork.org.au/networkactivities/research-pilot-program/. Accessed March 14, 2024.

[28] Australian Space Agency. Australian Civil Space Strategy 2019-2028. Canberra: Australian Government, 2019. https://www.industry.gov.au/publications/australian-civil-space-strategy-2019-2028. Accessed January 25, 2024.

[29] Australian Human Rights Commission. 2020. Leading for Change: A Blueprint for Cultural Diversity and Inclusive Leadership Revisited. https://humanrights.gov.au/our-work/race-discrimination/publications/leading-change-blueprint-cultural-diversity-and-0 Accessed January 29, 2024.

[30] Diversity Council Australia. 2020. "State of Inclusion: Australian Business Progress Report 2020." https://www.dca.org.au/wp-content/uploads/2023/07/dca_annual_report_2021_final30may_1.pdf. Accessed February 8, 2024.

[31] Hunt, Vivian, Dennis Layton, and Sara Prince. 2015. "Why Diversity Matters." Harvard Business Review. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/why-diversity-matters. Accessed January 21, 2024.

Appendix

	Size of adult population	Percentage with a VET STEM qualification	Percentage with a university STEM qualification	Percentage with a VET non-STEM qualification	Percentage with a university non-STEM qualification
NSW	6 093 897	8	5	18	18
Vic.	4 845 709	8	6	18	18
Qld	3 790 497	9	4	20	14
SA	1 383 652	9	4	19	14
WA	1 997 728	10	5	18	15
Tas.	419 757	9	3	19	13
NT	179 363	9	3	17	13
ACT	322 917	6	9	16	27
Other Territories	3 773	10	3	17	9
Total Australia	19 037 278	8	5	19	17

The distribution of STEM qualified people in Australia, by state or territory of usual residence (Office of the Chief Scientist, 2020, 19)[8]