LOOKING UP FROM DOWN UNDER: AUSTRALIAN ATTITUDES ON SPACE BY GENDER

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Introduction

In 2023, The Australian Centre for Space Governance (ACSG) undertook the first-ever comprehensive survey of Australian public attitudes on the nation's space role and activities. The study was motivated by the need to understand how Australians perceive and value space initiatives and investment. In the subsequent report entitled 'Looking up from Down Under: Australian Attitudes to National Space Activities', we presented our findings that the Australian public as a whole:

- Is interested in space, but feels it lacks knowledge about space activities;
- Views space development and research favourably, but does not necessarily support all space activities or initiatives;
- Strongly associates space with national security;
- Is most concerned about space debris and planetary impacts; and
- In terms of Australian investment, prioritises communications and Earth observation.[1]

This report, 'Looking Up from Down Under: Australian Attitudes on Space by Gender', serves as an addition to ACSG's ongoing series of shorter reports based on data from the survey. It aims to present and dissect the findings from the national survey in more detail, specifically focusing on how responses to our survey questions on Australian space activity varied based on respondents' gender. In doing so, we offer a more nuanced assessment that complements the findings in the full report.

Assessing gender representation and differences in views

It is in the interests of the space sector to consider the views and experiences of all genders in order to remain competitive and to drive innovation that is applicable to all. As Steer et al. (2024) note, a space sector that is not gender diverse risks:

> losing the advantage of women's equal contribution […], as evidenced in the wealth of research on the 'business case' and benefits of gender diversity to organisations. Moreover, a lack of representation often leads to a lack of sufficient critical, gender-responsive decision-making. (p. 2-3).

Preliminary data from a current global study undertaken by the Global Institute for Women's Leadership suggests that diversity is lacking in space careers.[2] Around the world, women are underrepresented in the sector, with only 20% of space employees being women.[3] This figure has remained unchanged for 30 years.[4] While no longitudinal study has been undertaken to understand why, this static figure indicates that women are leaving the space sector at the same rate they are entering it.

From research on disproportionate gender representation in STEM sectors—including the federal government's recent review into diversity in these sectors[5]—we know that there is a 'leaky pipeline'. Despite growing numbers of girls and women graduating from universities with STEM degrees, STEM careers remain male-dominated. Our survey presents a unique opportunity to identify whether there are differences in how men and women understand and view space-based technologies, which is of great value considering the gender disparity in the sector.

At the same time, there are many debates around public investment in space-based technologies in Australia. Because public opinion can shape government decision-making, pursuit and investment in Australia's space initiatives can be influenced or even determined by the extent to which Australian women support and advocate for them as a salient policy issue.[6]

In consideration of the above, this paper focuses on the gender breakdown from our Australian survey on public attitudes towards space. In analysing the results of this survey by gender, we found that:

> (1) Overall, both men and women had a high rate of neutral responses relative to other responses, but men were more likely to provide a positive rather than negative opinion on space activities.
>
> (2) Men in Australia were more likely than women to 'agree' or 'strongly agree' to all questions on the survey, while Australian women were more likely to answer that they 'disagree' or 'strongly disagree'. Even so, they were overwhelmingly more likely than men to answer 'neutral' or 'don't know' to the survey questions.[7]
>
> (3). Relatively, women valued space situational awareness, planetary defence, and space-enabled data more. In comparison, men placed more value than women on the launch sector, national security, and robotics. Men were far more concerned than women about Australia falling behind in the space sector relative to other countries and were likelier to feel Australia spent too little on space.

Interest and knowledge of space activities

As outlined in the full report on our survey findings, the authors employed iLink Research Services to develop a firmer foundation for discussing Australian public opinion on space. iLink conducted a nationally representative survey of 1,579 adult Australian residents. The survey was fielded over 16 days during September and October 2023, utilising iLink's online panel comprising a nationally representative sample of adults aged 18+ in Australia. Table 1 details the gender representation among respondents.

Table 1: Distribution of respondents by gender

Male	Female	Prefer not to say	Other
50.1%	49.3%	0.4%	0.3%

50.1 per cent of participants identified as male, 49.3 per cent as female, 0.4 per cent preferred not to say, and 0.3 per cent as another gender—which was not defined in the survey but may include trans, non-binary, gender-queer or other gender identities. Most of the analysis below focuses on men and women due to the small sample size of other genders in this study (n=9). However, the authors wish to express the importance of continuing to collect non-binary data and seeking further understanding of minoritised genders' perspectives on space and a range of other critical policy areas.

For Tables 2-9, the numbers represent the per cent of how each gender responded to the question. Table 2 shows that men felt more confident about their knowledge levels on space activity (37.9% strongly agree/agree versus 25.4% disagree/strongly disagree) than women (17.2% strongly agree/agree versus 50.9% disagree/strongly disagree). More women were also unaware of the Australian Space Agency, with 28.5% of women answering that they did not know of the agency's existence versus only 12.9% of men.

However, responses to other questions in our survey suggest that men and women have relatively equal levels of knowledge or interest in certain aspects of space. For example, this is detected in answers to our question on Earth observation functions, which show near-equal levels of awareness across all genders (Table 3), despite men claiming that they felt they knew the meaning of Earth observation at a rate higher than women (39.3% of men strongly agreed/agreed versus 23.6% of women). Women may feel less confident about their knowledge of general space activity but more confident about it when those activities are specified in the question, or they make a greater distinction than men between 'knowledge' and 'awareness'.

Table 2: Overall, I am knowledgeable about space activities occurring around the world.

	Male	Female	Prefer not to say	Other
Strongly agree	7.3%	2.7%	0.0%	0.0%
Agree	30.6%	14.5%	0.0%	0.0%
Neutral	36.7%	31.9%	50.0%	50.0%
Disagree	19.1%	31.6%	0.0%	50.0%
Strongly disagree	6.3%	19.3%	50.0%	0.0%

Table 3: Which Earth Observation satellite functions were you aware of prior to taking this survey (check all that apply)?

	Male	Female	Prefer not to say	Other
Weather forecasting	16.9%	20.9%	15.0%	28.6%
Disaster monitoring and response (bushfires, droughts, typhoons)	10.5%	10.5%	10.0%	0.0%
Agricultural management (e.g., crop management and health)	7.2%	5.1%	15.0%	0.0%
Monitoring climate change (e.g., sea levels, polar ice caps, vegetation, global temperatures)	11.6%	12.8%	5.0%	28.6%
Monitoring ecosystems (e.g., marine and coral reef health, forest and vegetation recovery after bushfires, animal populations and biodiversity)	9.6%	9.5%	10.0%	14.3%
Maritime surveillance (e.g., tracking and observation of ships, illegal fishing activities)	9.6%	9.2%	10.0%	0.0%
Evidence in court cases (e.g., determining water theft, unlawful deforestation, or native title)	4.7%	3.7%	5.0%	14.3%
Mapping and surveying	13.3%	14.3%	15.0%	0.0%
Assessing flooding or bushfire hazards for property insurance	6.6%	5.3%	5.0%	14.3%
Resource identification and use (e.g., for the mining and energy sector, water allocation)	6.4%	4.7%	5.0%	0.0%
Identification of cultural heritage sites	3.7%	4.1%	5.0%	0.0%

Historical knowledge of Australia's space activity was low across the board, and at similar levels between respondents. The greatest historical awareness across all genders was due to the 2001 film *The Dish*.

This was also the response with the largest disparity between genders, with Australian women having slightly more awareness of the film than Australian men.

Table 4: I was aware of the following past Australian space activities prior to this survey (check all that apply):

	Male	Female	Prefer not to say	Other
Australia's first satellite WRESAT	6.2%	4.5%	0.0%	0.0%
2001 film The Dish	16.6%	22.9%	60.0%	33.3%
Australia's support for the Apollo moon landings	15.3%	17.2%	0.0%	16.7%
The rocket range at Woomera	14.4%	12.5%	20.0%	16.7%
The European Launch Development Organization rocket launches from Woomera	7.2%	5.0%	0.0%	0.0%
Tracking stations	14.6%	14.2%	0.0%	16.7%
The USA space station Skylab breaking up over Western Australia	13.5%	12.1%	0.0%	16.7%
Australian-born NASA astronauts Andy Thomas and Paul Scully-Power	12.3%	11.6%	20.0%	0.0%

Interest levels and increased exposure to information on space activity could help explain confidence levels in knowledge and why women were overall less likely to demonstrate an opinion about Australian space activity and participation. As seen in Tables 5 and 6, male respondents were far more likely to answer affirmatively that they were interested in international and domestic space activity and were far more likely to receive or seek information about space (Table 7). Among the Australian public who do seek or receive information, Australian men were slightly more inclined than women to get their information from domestic and international news outlets (36.8% of men versus 31.8% of women), though these figures are consistent with gender gaps in Australian news consumption.[8]

Table 5: Overall, I am interested in space activities around the world, such as satellites providing navigation or communication services, human spaceflight, exploration of the solar system, rocket launches, and ground facilities such as tracking stations.

	Male	Female	Prefer not to say	Other
Strongly agree	18.5%	9.1%	0.0%	0.0%
Agree	44.5%	29.2%	0.0%	25.0%
Neutral	24.7%	32.8%	50.0%	75.0%
Disagree	9.0%	18.6%	0.0%	0.0%
Strongly disagree	3.4%	10.3%	50.0%	0.0%

Table 6: Overall, I am interested in Australian space activities.

	Male	Female	Prefer not to say	Other
Strongly agree	14.7%	8.7%	0.0%	0.0%
Agree	44.4%	30.7%	16.7%	25.0%
Neutral	27.1%	31.9%	33.3%	75.0%
Disagree	9.5%	18.0%	0.0%	0.0%
Strongly disagree	4.4%	10.7%	50.0%	0.0%

Table 7: Most of my knowledge about space comes from (check all that apply):

	Male	Female	Prefer not to say	Other
Australian news outlets	22.3%	20.3%	11.1%	0.0%
International news outlets	14.5%	11.6%	0.0%	0.0%
Social media	10.6%	10.8%	11.1%	0.0%
Work	3.5%	2%	0.0%	0.0%
Friends and family	9.1%	10.3%	22.2%	0.0%
Fictional mediums (e.g. Movies, television, and/or fiction books)	9.8%	9.9%	22.2%	0.0%
Non-fiction mediums (e.g. Documentaries and/or non-fiction books)	12.8%	11.3%	22.2%	16.7%
Local museum	4.6%	3.6%	0.0%	0.0%
Space site or cultural institution	6.6%	3.6%	0.0%	0.0%
I do not receive or seek out information about space	6.1%	16.5%	11.1%	83.3%

Men were more likely to agree that space was important as part of their everyday lives (42.5% of men versus 29.5% of women), Australia's national infrastructure (71.0% of men versus 53.2% of women), the Australian economy (61.5% of men versus 40.1% of women), and national security (60.0% of men versus 40.0% of women). More Australian men were *opinionated* about the cancellation of the $1.2 billion National Space Mission for Earth Observation (NSMEO) program than all other respondents: 37.3% of men were neutral on this subject compared to 52.8% of women, with 33.7% of men agreeing or strongly agreeing with the cancellation compared to 29.6% of women (Table 8). The rest disagreed or strongly disagreed with the cancellation.

More men than women view Australian investment in space as 'about the right amount' or 'too little' (Table 9). In these instances, greater reported interest levels and greater exposure to space matters in the media could inform Australian men's view of space activities. Men were also more likely to respond in agreement that space research is important for advancing scientific knowledge (62.9% in agreement vs 46.9% of women), and that it is a useful way to encourage Australians to undertake STEM studies and jobs (65.5% in agreement vs. 52.1% of women). Notably, while most respondents agreed that it is important for space activity to represent a diversity of Australians, more men answered affirmatively (62.4% of men compared to 55.5% of women).

Overall, both men and women had a much higher rate of 'agree' versus 'disagree' responses across these questions, though women were far more likely to answer 'neutral' and slightly more likely to disagree than men.

Table 8: The $1.6 billion programme to develop a sovereign National Space Mission for Earth Observation was cut by Australian Government in mid-2023. To what extent do you agree with the cancellation of this programme?

	Male	Female	Prefer not to say	Other
Strongly agree	10.2%	8.0%	33.3%	0.0%
Agree	23.5%	21.6%	0.0%	0.0%
Neutral	37.3%	52.8%	66.7%	50.0%
Disagree	21.2%	12.1%	0.0%	25.0%
Strongly disagree	7.7%	5.5%	0.0%	25.0%

Table 9: In your opinion, are we spending too much, too little, or about the right amount on our space activities?

	Male	Female	Prefer not to say	Other
About the right amount	34.3%	28.9%	16.7%	0.0%
Don't know	27.6%	44.9%	83.3%	75.0%
Too little	26.5%	14.7%	0.0%	25.0%
Too much	11.6%	11.6%	0.0%	0.0%

When asked to rank space activity priorities and risks, there was more variety and fewer trends to be discerned amongst different genders. Men and women equally valued satellite technology and capability as an industry and for government, with only slight

degrees of difference. For instance, though it garnered slightly more support from men, both men and women ranked communications highly as a national priority for our space industry. Both also signalled Earth observation satellites as a high priority in their rankings, though women did so at a higher percentage than men (30.3% of women ranked it as the number one civil space priority for the Australian government compared to 22.8% of men). All genders reported equal awareness of the functions and applications of Earth observation and equally valued Earth observation as a priority, which suggests a correlation between space knowledge and the value placed on space technologies. This insight is important, as it suggests that increasing public awareness about the importance of space-based technologies for our daily lives and national needs might contribute to public support for investment in these priorities.

Ultimately, women were more likely than men to demonstrate higher support and concerns for space activity when these activities were connected to space-enabled data. Women ranked Earth observation data and satellite management more highly as areas of importance for industry and government. They also felt that space-enabled data being compromised and used for nefarious purposes was one of the top risks associated with space. Australian women ranked space debris and planetary defence more highly as priorities than men. Meanwhile, men were more inclined to agree with questions pertaining to national security and technologies in general. Groups who identified as 'other' and 'prefer not to state' were more likely to prioritise Earth observation highly and view technology malfunctions and data malfeasance as the biggest risks. However, as noted, our sample captured very few participants who identified within these groups.

Lastly, significantly more Australian men than women felt the possibility that "Australia falls behind in space technologies compared to other nations" was risky, and to a greater extent they felt "robotics and automation on Earth and in space" should be a government priority. The launch sector was also considered a higher priority by more men than women, though much less overall than other space activities by both genders.

Conclusion

Despite the greater tendency for Australian women to respond 'neutral' to many of the survey questions, there was still an overall higher rate of agree responses than disagree responses across most of the questions for all genders (Table 10), suggesting that the Australian public feels more positively than negatively about space activities. However, the survey shows that Australian women feel they possess less knowledge and interest in space technologies and activities and are especially less willing to express an opinion about Australian space matters, though it is unclear from just this survey what might be motivating these responses.

Existing research has identified several related possibilities for what might account for the gender disparity in the survey responses, including that:

(1) Reflective of STEM more generally, women are less represented, retained,

and advanced in space higher education and space workforces, which may impact interest in and support for space-based science and technology initiatives.[9]

(2) Girls and women are more likely than men to underestimate their knowledge of science and technology if they are in non-STEM fields and, relatedly, to express fewer opinions on these issues.[10]

(3) Despite more recent efforts, space activity is broadly personified and viewed as a masculine enterprise in English-speaking countries, especially in how the political discourse surrounding space can focus on control, conflict, expansion, conquest, and exploitation.[11] Furthermore, many high-profile participants and advocates for space initiatives globally and in Australia have been men.[12]

These possibilities are connected. For example, the lack of women promoted to management and leadership roles in the sector may help to contribute to the view that space is a masculine enterprise, and the lack of female leaders and role models in the sector may also influence the lower numbers of women who enter STEM degrees in university education. Women report not being made to feel welcome or equal participants in the space sector. This may contribute to women's confidence levels in their knowledge of space activities and technologies that are displayed across our survey responses.

Furthermore, in line with studies done in the US connecting women's views on science and technology with support for investment in these fields, the ways in which women are exposed to information about Australian space activities and how the sector engages with women may impact how much support space investment in Australia receives from women. [13] In other words, when the Australian space sector engages with women and girls as outsiders they are less likely to support investment in space activities and technologies.

As observed in 'Looking up from Down Under: Australian Attitudes to National Space Activities', Australians were just as likely to answer 'neutral' to our survey questions as they were to agree or disagree with them, suggesting possible ambivalence regarding matters of space. When breaking responses down by gender, we see that Australian women make up the majority of these 'neutral' responses. Our survey findings thus serve as another data point suggesting space is not unique when it comes to the gender gap within STEM more generally. While Australia has endeavoured to address this gender gap—such as through the STEM Equity Monitor[14] and the newly launched Australian Space Diversity Alliance [15] —more work must be done to involve and retain women in these fields.[16]

Future studies are also necessary to empirically determine what is behind the high rate of 'neutral' responses from Australian women regarding space and to connect this to improved outcomes for women and the space sector. Future surveys would also benefit from a larger sample of respondents who do not identify as either male or female, and an analysis of additional factors such as age, ethnicity, income, and educational level.

Table 10: Distribution of opinion by gender for all answers given to all ordinal questions.

	Male	Female	Prefer not to say	Other
Strongly agree	13.1%	7.6%	4.2%	6.3%
Agree	38.4%	27.8%	18.8%	29.7%
Neutral	31.4%	39.3%	38.5%	35.9%
Disagree	12.0%	15.8%	2.1%	20.3%
Strongly disagree	4.2%	7.7%	32.3%	6.3%

Notes

[1] Tristan Moss, Kathryn Robison Hasani and Aleks Deejay, 'Looking up from Down Under: Australian Attitudes to National Space Activities', Australian Centre for Space Governance, 2023.
[2] Alice Gorman et al., 'How Can We Build Capacity to Advance Gender Equality in the Space Sector?' (The Australian National University, 14 February 2024), https://giwl.anu.edu.au/news/how-can-we-build-capacity-advance-gender-equality-space-sector; Elise Stephenson, 'Making Space for Women: Gender, Diversity and Outer Space', UN Women – Asia-Pacific, 14 March 2023, https://asiapacific.unwomen.org/en/stories/feature-story/2023/03/making-space-for-women-gender-diversity-and-outer-space.
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[6] Cobb, Wendy N. Whitman. "Who's supporting space activities? An 'issue public' for US space policy." *Space Policy* 27, no. 4 (2011): 234-239.
[7] The one exception was question 13 on the cancellation of the National Space Mission for Earth Observation program, where a 'disagree' or 'strongly disagree' response can be read as 'positive' response.
[8] For example, see: P., Chatskin, M., & McCallum, K. (2023). *Women and news special report: Gender gaps in news consumption and engagement*. Canberra: News and Media Research Centre, University of Canberra.
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[11] Litfin, Karen T. "The gendered eye in the sky: a feminist perspective on earth observation satellites." *Frontiers: A Journal of Women Studies* 18, no. 2 (1997): 26-47.; Griffin, Penny. "The spaces between us: The gendered politics of outer space." In *Securing outer space*, pp. 67-83. Routledge, 2009.; Cobb, Wendy N. Whitman. "For All (Wo) mankind: Advancing a Feminist Critique of US Space Policy." *Space Policy* 67 (2024): 1-9.
[12] Alice Gorman, "Almost 90% of Astronauts Have Been Men—but the Future of Space May Be Female," *The Conversation*, June 16, 2020, https://theconversation.com/almost-90-of-astronauts-have-been-men-but-the-future-of-space-may-be-female-125644; and Elise Stephenson, "Making Space for Women: Gender, Diversity and Outer Space," *UN Women – Asia-Pacific*, March 14, 2023, https://asiapacific.unwomen.org/en/stories/feature-story/2023/03/making-space-for-women-gender-diversity-and-outer-space.

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