

**A REPORT ON THE 2023  
UN OFFICE OF OUTER SPACE AFFAIRS/  
CANADIAN SPACE AGENCY  
SPACE4WOMEN EXPERT MEETING**

MONTREAL 30<sup>TH</sup> OCTOBER – 3<sup>RD</sup> NOVEMBER 2023

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February 2024

**'Women need to use their power'**

**Otsi'tsakèn:ra (Charles Patton)**

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## Disclaimer

This report is an account of the UNOOSA Space4Women Expert meeting from the perspective of the authors and does not represent the views of UNOOSA, CSA or the authors' affiliated institutions.

## Acronyms and Abbreviations

Acronym/Abbreviation	Meaning
CSA	Canadian Space Agency
ANU	Australian National University
ASA	Australian Space Agency
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DDAP	Disaggregated Data Action Plan
EU	European Union
GIWL	Global Institute for Women's Leadership
ICAO	International Civil Aviation Authority
IDEA	Inclusion, Diversity, Equity and Accessibility
KARI	Korea Aerospace Research Institute
SASIC	South Australian Space Industry Centre
SIAA	Space Industry Association of Australia
SGAC	Space Generation Advisory Council
STEM	Science, Technology, Engineering, and Mathematics
UAE	United Arab Emirates
UNOOSA	United Nations Office of Outer Space Affairs
UN COPUOS	United Nations Committee on the Peaceful Uses of Outer Space

# 1.0 Introduction

The 2023 Space4Women Expert Meeting was jointly hosted by the United Nations Office for Outer Space Affairs (UNOOSA) and the Canadian Space Agency (CSA). This was the fourth in a series of expert meetings which began in 2017. The venue was the International Civil Aviation Organization (ICAO) Headquarters in Montréal, Canada. The theme for 2023 was "Building capacity to promote and advance gender equality in the space sector".

[Space4Women](#) is a UNOOSA project aimed at encouraging women and girls to pursue Science, Technology, Engineering, and Mathematics (STEM) education and careers. Space4Women raises awareness about the importance of gender equality and women's empowerment in the space sector, in order to redress the global gender imbalance in the space industry. Through annual expert meetings (hosted previously by the governments of Brazil/UAE 2021, South Korea 2022), UNOOSA and its partners facilitate multi-stakeholder dialogue about the role of women in space science, space technologies and their applications, and space exploration.

The 2023 Space4Women Expert Meeting consisted of themed plenary sessions, working group sessions, networking and other activities. A key outcome was contributing to the development of the first gender mainstreaming toolkit for the space sector. The aim of this toolkit is to support institutions and individuals to integrate gender and diversity considerations across different contexts and levels, to increase the meaningful participation of women and girls. Gender mainstreaming is [defined by the Council of Europe](#) as "The (re)organisation, improvement, development and evaluation of policy processes, so that a gender equality perspective is incorporated in all policies at all levels and at all stages, by the actors normally involved in policy-making". The gender mainstreaming toolkit is seen as a mechanism to address Sustainable Development Goals 4 (Quality Education) and 5 (Gender Equality).

The Expert Meeting was attended by 68 delegates from 35 countries, including five from Australia and two from Aotearoa New Zealand. UNOOSA Director Aarti Holla-Maini gave the opening address, with opening keynotes from CSA President Lisa Campbell, Her Excellency Sarah bint Yousef Al-Amiri, UAE Minister of State for Public Education and Advanced Technology and Chairwoman of the UAE Space Agency, and Canadian Astronaut Jennifer Gibbons.

First Nations Elder Otsi'tsakèn:ra (Charles Patton) of the Kanien'keha:ka community of Kahnawa:ke, on the south shore of Otsira:ke (Hochelaga/Montreal), provided a welcome to country. His speech emphasised themes of respect, gender equality, and care for the environment, and made links with our roles as interplanetary custodians.

In addition to the usual output reporting to the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS), UNOOSA and the host nations wish to ensure tangible outputs and tools that facilitate ongoing growth and participation of women in the space sector, nationally and globally. The hosts of the expert meetings have used the opportunity to elevate their government priorities on gender equality.

The purpose of this report is to bring the insights of the Expert Meeting to the broader Australian space community as the basis for reflection and action. It represents our personal views and experiences at the meeting and acts as a supplement to the official report.

## 2.0 Issues and themes

While the Expert Meeting covered a wide variety of issues and themes, a few stood out in terms of their broad applicability to Australian contexts.

### 2.1 Data collection and analysis

In 2021, the Canadian Government introduced a [Disaggregated Data Action Plan](#) (DDAP) as a whole-of-government approach. The DDAP requires the collection of data on specific population groups, with a focus on Indigenous peoples, racialized groups, women and persons with disabilities, to address inequalities and gaps.

Laurie St-Onge (Senior Economist) and Lauren Gravis (Gender Based Analysis Plus focal point), both from CSA, discussed quantitative data about gender representation in the Canadian space sector. Some takeaways included:

- A [2020 report](#) on the Canadian space sector (Canadian Space Agency 2020) noted that those identifying as female constituted 28% of the space workforce. This figure had increased to 30% in 2023. However, only around 20% were in science or technical roles, with the remainder in administrative roles. There was still a documented pay gap.
- The same goes for women within Canadian Space Agency careers (small 1% increase).
- There are fewer women-owned/lead space businesses than women-owned/lead STEM and technology businesses more broadly in Canada.
- There is a need for further qualitative research to complement the quantitative data.
- Future data could be improved by measuring gender representation versus sex representation, inclusive of non-binary gender data.
- There are critical privacy issues with data collection that remain under-addressed, particularly with reference to intersectional data collection (gender, sexuality, ethnicity, disability, etc.).

The importance of adequate fine-grained data was emphasised in a presentation by [Soyoung Chung](#) (KARI): 'If you can't measure it, you can't improve it'. Chung's survey shows that women's participation in the Korean space sector is around 10% or under. She also observed that Korean men in space feel discriminated against if women are seen to be supported, demonstrating the adage 'when you're accustomed to privilege, equality feels like oppression'. One key framing approach that she presented was: "don't fix numbers, don't fix women, fix the system".

KARI is working with UNOOSA on a global study of women employed in space industry. A key component of this study is focusing on the perceptions of gender equality, not just the numbers. Merely measuring numbers and aiming for higher percentages of women in STEM/space careers is not enough. The structures within organisations must come under scrutiny and "perceptions" must also be measured.

These discussions highlighted the gaps in Australian data. Industry surveys, produced every few years, have shown that Australia is in step with the global figures, at around 16 - 20 % women. However, there is little further detail to draw upon beyond this figure.

## 2.2 Empowering and inspiring girls

Different approaches and solutions are needed in different political and cultural contexts; there is no single set of solutions. For example, in some countries the language of "empowering" and "inspiring" girls to work in STEM and space careers can be misappropriated by institutions whose structures and practices are discriminatory, to place the emphasis on what girls or women need to do better, instead of how to introduce inclusive educational and workplaces. Girls are already interested in STEM and women already want to work in these sectors, but they are made to feel unwelcome, or denied opportunities. The barriers are structural and organisational.

Her Excellency Minister [Sarah bint Yousif Al-Amiri](#), Chairwoman of the UAE Space Agency, stated that the problem of gender inequality in the space sector (and STEM) cannot be "fixed" by empowerment and inspiration programmes aimed at girls. Rather, there is a need to understand what the problem really is: the fabric of organisations first and foremost.

When asked what the UAE Space Agency's secret to success is, she replied that the establishment of the agency was entrusted to people under the age of 30. They were able to throw out old rule books and set up new policies, priorities and actions, with full backing of the Prime Minister. The Australian Space Agency (ASA) has recognised that its recent establishment offers similar opportunities to start afresh and get things right.

However, in some other countries, there is a great need for parental empowerment and support of girls, explicit programmes providing pathways for girls, and access to examples of women who have broken with traditional expectations as inspiration. [Olayinka Fagbemi](#) (Nigerian Space Agency) noted that many girls in regional areas are betrothed at an early age, and have no expectations of any other life. The impact on parents of hearing her talk about space and STEM careers was immense because it was a visible and living demonstration of possibilities. She related that winning the parents over was crucial to allowing girls to have access to education.

[Primerose Bomokayi](#), Junior Scientist at the [Zimbabwe National Geospatial and Space Agency](#), explained that empowerment works when there is more agency, when women are the ones inspiring girls and other women, and when "empowerment" is about structural, family and organisational support. She talked to the necessity of empowering women through empowering the family matriarch. Shifting cultural expectations for girls requires inspiration from women who have broken down barriers, and empowerment through education and narratives.

[Gulchehra Kokhirova](#), Director of the Institute of Astrophysics, National Academy of Sciences of Tajikistan, spoke about initiatives to support girls and women become astronomers in Tajikistan: it is believed by some Tajik people that girls should not be out at night, which forms a major barrier to night-time observations. Gulchehra had to create and deliver programmes to inform parents, and practices so she could ensure the safety of girls and women working with her.

[Omowumi Alabil](#), Head of Academic Programs, African Regional Centre for Space Science and Technology Education, Nigeria, spoke about the [#SheSpace](#) Nigeria programme that she established. Nigerian girls aged 8-12 were selected from five geopolitical regions in Nigeria, and taught how to create maps, adapt existing code, and trace Earth observation data, to draw conclusions about the causes of extraordinary floods in Nigeria. Their conclusions contributed to an evidence-based understanding that departed from the accepted narrative about the cause of the floods. Parental support was also critical and was nurtured, especially from the fathers. As part of the programme, the girls received a laptop, mentoring, and training. The catchphrase was "Catch them young".

[Anita Antwiwaa](#), Head of Department, All Nations Space Systems Technology Laboratory in Ghana, explained there were only eight women enrolled in her department at All Nations University. These women needed to feel empowered to continue their studies in this male-dominated field.

It's clear that both initiatives and policies that focus on organisational change and pathways for empowering girls, women, and under-represented groups, are required to advance gender equality in the space sector.

## 2.3 Storytelling

While there was a dedicated session on storytelling, many stories were exchanged in conversations during breaks and networking events. It was astonishing to learn how many large space corporations and agencies did not have coherent policies on gender equality and had made little progress. Informal discussions highlighted factors such as lack of support from leadership, and the difference it made when men in high level management positions supported women. Many delegates at the meeting were taking personal leave, or self-financing because, despite lack of support from their employers or institutions, they knew it was important to attend.

Some topics that were raised in these informal discussions included:

- Women who call out discriminatory behaviour are often made to feel like they created the problem, and face backlash.
- Many countries are slow to prioritise gender equality in the space sector, resulting in difficulties getting problems addressed.
- The idea that progress on gender equality was inevitable was not well-evidenced, with many participants desiring further tangible action.
- Trans and gender diverse people felt even further marginalised by their space sector employees, and often did not have the international networks, protections, safety or voice to have their challenges considered.

Rahima Kandahari, Deputy Assistant Secretary for Science, Technology and Space Affairs at the US Department of State, shared stories of her experience as an Afghan woman who immigrated to the US in the 1980s, and then later worked as a policy officer for the US in Afghanistan. She was often the only woman in the room and had also been asked to leave the room so the men could negotiate. Her persistence in her work led her to become the lead of the Office for Global Women's Issues, where she advised US ambassadors posting overseas to include women at the table at every meeting. Now, working on Science, Technology and Space Affairs, she advocates for equity and inclusivity across the board.

## 2.4 Horizontal networks and webbed workplaces

Dr Sarah Gallagher, Director of the Institute for Earth & Space Exploration and Professor of Physics & Astronomy, Western University, spoke about "working around the system" when the system is creating barriers or is unsupportive for women or under-represented groups.



Most organisations have hierarchical, vertical organisational charts which create siloing, isolation, and allow one "bad link" person to hold individuals down. Working around this is possible through three major strategies:

- 1) Create horizontal informal networks
- 2) Create a liaison role, an individual who can be approached by anyone and support them, in a formal, independent capacity
- 3) Facilitate mentoring relationships - but do the work to make sure the mentoring works for both mentor and mentee

These strategies can create a more flexible, resilient, supportive networked work environment.

More than one speaker made the point that rather than looking lower in the hierarchy and waiting for junior staff to acquire the skills and support to be appointed to leadership roles, these could be filled by searching horizontally in related areas. A [recent Australian study](#) about the general workforce found that "it will take 70 years to reach equality on full-time employment and more than 200 years to reach equity on income". Being aware of horizontal connections rather than focusing on the vertical could speed up the process.

## 2.5 Intersectionality

A number of working group and plenary discussions raised the need for a broader, intersectional approach to diversity. In other words, focusing only on the need for gender diversity can mask the kinds of discriminations that LGBTIQ and non-binary gender identities, people of colour, and people with disabilities face in the same institutions, when it is the same structures which exclude or disadvantage women that exclude or disadvantage other underrepresented groups. Women who also belong to another underrepresented group can often experience biases and discrimination in compounded ways. It is the intersection of identities which requires a more holistic approach to understand how sexism, racism, ableism, homophobia and transphobia, and classism, for instance, interact to create lesser or greater challenges for individuals.

While there was broad agreement that an intersectional approach is needed, at the same time "Space4Women" is a UN-branded initiative, which has been established through multilateral consensus. As such, the name and the core agenda will not be adapted; however the discussions, themes and action items for future Expert Meetings can be more inclusive.

## 3.0 Australian Participation

The Australian delegates, who came from a range of industry, academic, and government backgrounds, participated in all group sessions, and some spoke on a number of panels.

### 3.1 Themed session #3 — Gender mainstreaming in space policy, strategy, technology and exploration: good practices and lessons learned

In this session, experts discussed strategies to implement effective gender mainstreaming practices at all levels through client-centred, intersectional, and equitable approaches, to ensure that the benefits of space reach everyone. The speakers were Vera Pinto Gomes (Policy and Equality Coordinator, European Commission), Jennifer Breslin (Director at Futuristas, USA), Rynee Fandora (Space Edu Company, Thailand) and Dr Elise Stephenson (Deputy Director, [Global Institute for Women's Leadership](#) (GIWL), ANU, Australia).

[Dr Elise Stephenson](#) from GIWL sought to go beyond the existing statistics on gender representation in the space sector, to look at experiences. Drawing on almost 400 responses to a survey on gender, sexuality, disability, and ethnic diversity in the global space sector, she identified high rates of discrimination, harassment, and unequal practices like pay and leadership gaps. She found that top concerns included: pay inequality; covert/hidden forms of discrimination; “token” gestures; under-representation in leadership (vertical segregation); harassment, bullying and abuse; inadequate policies (parental leave, gender affirmation, etc.); under-representation in different fields (horizontal segregation); lack of accessibility; under-representation in general; overt discrimination; missions not designed for diverse people; spacesuits or other uniforms/protective material not designed for diverse bodies; issues with colonial and gendered language in the sector (“colonise” space, for all “mankind”).

She found that over 66% of participants felt unable to address these issues. Whilst over 40% of participants felt their organisations were open to tackling some of these issues, 62% believe their organisation is unwilling to resolve their diversity, inclusion, accessibility and equity concerns in the space sector.

Dr Stephenson's research also found substantial instances of bullying, harassment, discrimination, ableism, sexism, racism and ageism in the global space sector.

% of participants who responded “Probably yes” or “Definitely yes”

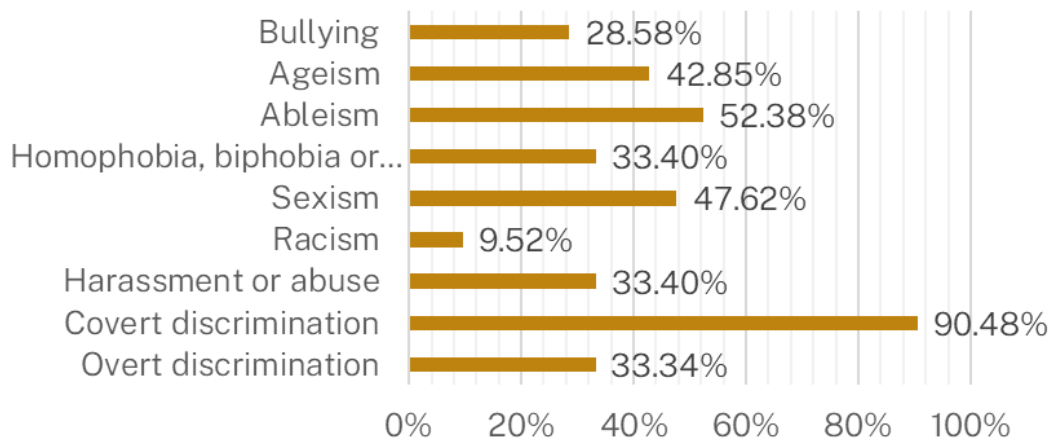


Figure 1: Survey responses to workplace discrimination

Most notably, over 90% of participants reported probably or definitely experiencing covert discrimination in the last 12 months. Although there are sample size limitations, these initial statistics are revealing, with more than half of respondents answering that they did not feel they were able to get support from their space organisation when they encountered the above.

85% of respondents believed their country should provide a stronger leadership role on diversity issues in the space sector, and many had suggestions. These included: leadership commitments; commitment to develop policy further; accessibility commitments; targets or quotas in recruitment, promotion; specific statements of support for individual minoritised groups; targets or quotas for leadership; diversity training for staff; gender-responsive budgeting; support for training and career development for under-represented groups; targets or quotas across different types of work (addressing horizontal segregation); support networks for under-represented groups; reference groups/advisory groups; gender-mainstreaming across all work; general statement for diversity, inclusion, equity and belonging; better education, and; enforcement/accountability measures.

Overall, there were a number of key findings across the quantitative and qualitative data shared.

- There remains a ‘credibility gap’ where women and gender minorities are often perceived as less credible or expert.
- The securitisation and military influence of many space sectors has a gatekeeping effect on diversity, with difficulties encountered gaining security clearance in some states in particular.
- Women-led start-ups often experience ‘hollow support’ - reporting being much more likely to receive training opportunities than funding.

- Women were found to experience both ‘glass cliffs’ and ‘glass ceilings’ - under-represented in leadership, and then often in precarious positions when they finally do make it to leadership.
- Informal employment criteria were often found to be gendered - requiring evidence of tinkering, coding, building, or even watching space-related sci-fi in their free time, or as a kid growing up.
- Finally, the research found that space does not only have a pipeline problem, with some countries having a majority of STEM students that are women. Rather, space does not only involve STEM roles, and too much focus on the pipeline, sidetracks effort from the reality that there remain issues with women and gender minorities’ experiences once they get in the space sector - retention and progress remain critical issues.

## 3.2 Themed session #4 — Inspire through storytelling: women professionals in the space sector

In this session, experts shared their lived experience as women working in the space sector/STEM fields, including opportunities, challenges, and motivations. The speakers were Cécile Deprez (German Aerospace Center (DLR)), Gulchehra Kokhirova (Director, Institute of Astrophysics, National Academy of Sciences of Tajikistan), Anita Antwiwaa (Head of Department, All Nations Space Systems Technology Laboratory, Ghana) and [Stephanie Wan](#) (Associate Director, KPMG Australia /Strategic Partnerships Advisor, [Methuselah Foundation](#), Australia).

Stephanie spoke about the importance of building community, which can happen at the grassroots level especially when individuals identify gaps. She shared her development of the Adelaide Space Ladies Happy Hour, as well as her participation at the ACT Government/ANU in Space Diversity in Space Conference as examples.

Additionally, she emphasised it is not only important to recognise “diversity” and “inclusion”, but to go deeper for a sense of “belonging”. Her talk resonated with many of the under-represented minority communities, as it means not just having a seat at the table for the purpose of representation, but also to be heard and comprehended.

## 3.2 Canadian Space Agency panel

This panel was introduced by Lisa Campbell, President of the Canadian Space Agency, and featured a video message from Dr Jennifer Gibbons, CSA Astronaut. The panellists were Veronica Cesco (Associate Programme Officer, UNOOSA), Zainab Azim (Founder, Global Initiative & Vision for Education, University of Toronto), Mishaal Ashemimry (Advisor to CEO, Saudi Space Commission), and [Alice Gorman](#) (Flinders University).

A focus of the panel questions was what has changed since the first Space4Women Expert Meeting in 2017. Alice Gorman was a delegate at that meeting, held at UN Headquarters in New York City, and in 2020 was one of the first cohort of Space4Women mentors. She observed that the issues discussed were the same: numbers of women in space industry had not moved significantly over this period, and women were reporting no decrease in discrimination. However, she noted that the efforts of UNOOSA had resulted in the creation of more formal and informal networks between women of different nations; and the sharing of experiences was as powerful as ever.

## 3.3 Poster presentations

The Expert Meeting also featured a poster session, with many posters presenting the results of data collection and specific initiatives addressing the gender gap in space industry. There were two Australian posters.

### 3.3.1 Diversity at the Frontier: the space sector, poster by Elise Stephenson

This poster summarised findings presented in Themed Session 3, as below, on women and minoritised groups' experience in the space sector, as well as what they would like to see change in the space sector. ([View full size here](#))

# Diversity at the Frontiers: the Space Sector

Dr Elise Stephenson, Deputy Director of the **Global Institute for Women's Leadership**, Australian National University and Fulbright Fellow, University of Washington, is conducting research on diversity in space to better understand gender and other forms of diversity in the global space sectors. This research acts as a "gender and diversity audit" of the space sector, mapping representation, experiences, issues and opportunities for diverse groups across the sector.



**Dr Elise Stephenson**  
elise.stephenson@anu.edu.au  
@EiseintheWoods

So far, the research has involved:

- Interviews (n=32 - globally)
- Online Survey (n=161 - globally)
- Survey at Diversity at the Frontiers conference (n=73 - mostly Australian)
- 3 Expert Workshops held in Australia (n=45 - mostly Australian)

We would love for you to contribute to this important research!

### BARRIERS EXPERIENCED

**Growing in**

Do you feel you are able to influence your organisation to make improvements in diversity, equality, accessibility and inclusion?

Definitely yes	9.52%
Mostly yes	19.05%
Maybe or maybe not	33.33%
Mostly not	14%
Definitely not	24%

**Glass ceilings:**  
Women & minoritised groups critically under-represented in leadership

**Credibility gap:**  
Women & minoritised groups perceived as less credible or expert

**Glass cliffs:**  
When women & minoritised groups do make it to leadership, they report being constrained by their role or the precariousness of their position, company, etc.

**Hollow support for startups:**  
Women & minoritised groups report being more likely to receive intangible forms of support (training) rather than funding

### WHAT THOSE WORKING IN THE SPACE SECTOR WANT

**From government:**

**From policy more broadly:**

1. Leadership commitments; commitment to develop policy further; accessibility commitments
2. Targets or quotas in recruitment, promotion
3. Specific statements of support for individual minoritised groups
4. Targets or quotas for leadership; diversity training for staff; gender-responsive budgeting; support for training and career development for under-represented groups
5. Targets or quotas across different types of work; support networks; reference groups/advisory groups
6. Gender-mainstreaming across all work
7. General statement for diversity, inclusion, equity and belonging
8. Something else: e.g. Better education, enforcement /accountability measures, gender equal procurement and funding practices

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### Staying in

**Pay gaps:**  
Women & minoritised groups report lower salary than peers of similar background and in similar roles

**Lack of access / location matters:**  
Participants report being unable or unwilling to work at certain launch sites or bases, ranging from not gaining clearance (particularly for other nationalities), to not feeling safe (particularly for trans people and women)

**Genteel toxic masculinity:**  
Instances where (mostly) men in power could be seen to do and say the right things, yet were still found to engage in discriminatory, biased, and sometimes explicitly sexist behaviour

**In the last 12 months, have you experienced:**

Bullying	28.58%
Ageism	42.85%
Ableism	52.38%
Homophobia, biphobia or...	33.40%
Sexism	47.62%
Racism	9.52%
Harassment or abuse	33.40%
Covert discrimination	33%
Overt discrimination	90%

### Getting in

**The securitisation of space has a gatekeeping effect:**  
security clearances impact on ethnic diversity in particular

**Space doesn't (only) have a pipeline problem:**  
Too much focus on the pipeline ignores the reality of what happens once women & minoritised groups get to the space sector

**Space has a branding problem:**  
Perceptions that space is 'elite', 'cool' and 'exclusive', lack of transparency, expectation that space is only for those with STEM qualifications

**Informal employment criteria often gendered:**  
Employment criteria looking for evidence that candidates tinker, build, code, or watch sci-fi in their free time

**Do you feel represented in the space sector?**

Strongly agree	4.76%
Somewhat agree	28.57%
Neither agree nor disagree	4.76%
Somewhat disagree	19.05%
Strongly disagree	42.86%

Take the 10-15 min survey.

## TELL US ABOUT YOUR EXPERIENCES!

You can participate in either a survey or interview - or both!

Book a 1:1 interview slot.

Figure 2: Diversity at the Frontiers: the Space Sector. Poster by Elise Stephenson

### 3.3.2 A colonial space: women and rockets in Australia, poster by Alice Gorman

This poster looked at the history of women in Australian space, as a context for understanding the current situation.

In the 1960s, one of the busiest rocket launch sites in the world was located in South Australia. Woomera was established as part of a joint agreement with the UK, who looked to the wide-open expanses of their colonial territories to test rockets and nuclear weapons. Outback Australia was thought to be 'empty' and hence suitable for the dangerous activities of missile and rocket testing.

However, the Woomera range displaced several Indigenous nations. Aboriginal people were excluded from the 'Space Age' by virtue of their perceived timeless existence in the 'Stone Age' of the past. Space was a male-dominated business, with women relegated to domestic or menial computing tasks, and Aboriginal women lowest in the hierarchy.

Australian women's earliest involvement in space was as protestors, rather than scientists. In the 1940s a massive movement grew across Australia opposing the establishment of a rocket range for weapons development, so soon after the devastation of the Second World War. They also opposed the removal of Aboriginal people from their lands in order to make way for the Woomera rocket range. Aboriginal and women's organisations were key players in the protest movement.

Women were keen for space – but their participation at Woomera was limited by ideas of women's roles. Even as scientists, women were expected to perform housekeeping or menial work as human 'computers'. In 1958, a newspaper called Woomera 'a place to find a husband', with 'five or six men for every girl'. Later, skilled women were able to rise to positions of responsibility, such as Superintendent of Instrumentation. However, Aboriginal women were only ever employed as domestic servants at Woomera.

The 'urge to explore' is often presented as a universal human characteristic and a rationale for space exploration. In the eyes of British and Australian governments, Aboriginal people were not thought to share in this urge. By their 'race' they were excluded from the Space Race. Australia, as a settler nation, has to address the uneasy nexus of race and gender not only in its past, but in how it envisages its future in space.

# A colonial space: women and rockets in Australia

## Acknowledgement of country

I write from the traditional Country of the Kaurna people of the Adelaide Plains and pay my respect to their Elders past, present and emerging. I recognise and respect their cultural heritage, beliefs and relationship with the land and extend that respect to other Aboriginal Language Groups and other First Nations.

## Introduction

In the 1960s, one of the busiest rocket launch sites in the world was located in the red deserts of South Australia. Woomera was established as part of a joint agreement with the UK, who looked to the wide open expanses of their colonial territories to test rockets and nuclear weapons. Outback Australia was thought to be 'empty'.

The Woomera range displaced several Indigenous nations. Aboriginal people were excluded from the 'Space Age' by virtue of their perceived timeless existence in the 'Stone Age'. Space was a male-dominated business, with women relegated to domestic or menial computing tasks, and Aboriginal women lowest in the hierarchy.

## Contested space: protesting Woomera

Australian women's earliest involvement in space was as protestors, not scientists. In the 1940s a massive movement grew across Australia opposing the establishment of a rocket range for weapons development so soon after the devastation of the Second World War. They also opposed the removal of Aboriginal people from their lands in order to make way for the Woomera rocket range. Aboriginal and women's organisations were key players in the protest movement. Margaret Tucker and Doris Blackburn were two prominent women involved in the campaigns. Woomera was not just about space: the protest campaign was a significant chapter in the growth of the Aboriginal rights movement in Australia.



Doris Blackburn | 1889 – 1970

Doris Blackburn was only the second woman to win a seat in the House of Representatives, where she served from 1946 to 1949, in the years when the Woomera rocket range was being planned and surveyed. In 1947 she became notorious as the only MP to vote against the Atomic Energy Bill.

When she visited the Woomera Rocket Range, she became aware of the impact on Aboriginal people. Working with Aboriginal activists such as Margaret Tucker and Doug Nichols, she was involved in the establishment of the Aborigines Advancement League and the Federal Council for Aboriginal Advancement.

In later life she served as the president of the Women's International League for Peace and Freedom.



Margaret Tucker | 1904 – 1996, Wiradjuri nation

Margaret Tucker was removed from her family at age 12 and sent to train as a domestic servant. In the 1930s she became political active campaigning for Indigenous rights, including the 1939 Cummeragunja walk-off.

She was a founding members of the Aborigines Advancement League in 1932 and worked with Doug Nichols, Bill Onus and others on the Woomera protest movement which mobilised the nation and highlighted the inequities of Australian government policies for Aboriginal people.

In the 1960s she founded the United Council of Aboriginal and Islander Women and in 1964 was the first Indigenous appointee to the Victorian Aborigines Welfare Board. She was awarded an MBE in 1968. Her autobiography, *If Everyone Cared*, was published in 1977.

## Woomera: basic facts

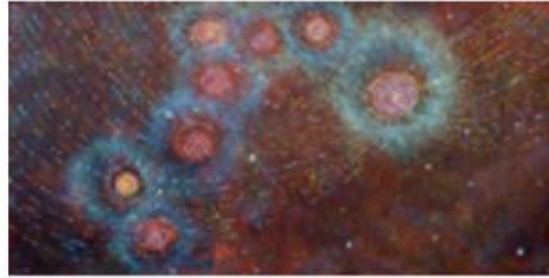
- Early Cold War rocket range for weapons development
- Dates: 1947 – present.
- Development of sounding rockets, missiles, satellite launch
- Australia's first satellite: WRESAT-1 in 1967
- Traditional country of Kokatha, Pitjantjatjara, and many others
- International cooperation with US, UK, Europe (ELDO, Apollo missions, UK Prospero satellite)

## Conclusions

- Unfree labour, manifested here as forced domestic service for Aboriginal women, is a theme which runs through many national space histories.
- The 'urge to explore' is often presented as a universal human characteristic and a rationale for space exploration. In the eyes of British and Australian governments, Aboriginal people were not thought to share in this urge. By their 'race' they were excluded from the Space Race.
- Australia, as a settler nation, has to address the uneasy nexus of race and gender not only in its past, but in how it envisages its future in space.
- Lessons from the past: collective, cross-cultural action.

## Alice Gorman

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Alma Nungarrayi Granites | Yanjirpirri Jukurpa – Seven Sisters Dreaming. Image courtesy of Japingka Aboriginal Art.

## The stars bring the earth into being

Aboriginal people have the oldest continuous astronomical tradition on Earth, from at least 65 000 years ago until the present day. Across Australia, from the coast to the desert, the Pleiades constellation is a key part of this tradition. The stars are seven sisters, who journey between Earth and the dome of the sky to escape the unwelcome attentions of men. Their movement creates law, ritual, knowledge and country: the valleys, hills and waterholes, and the red dunes of the desert. The cycle of ceremony, strongly associated with women's business, unites Earth and the night sky into a single 'dreaming' space.

The landscape of the Woomera rocket range is created by the actions of the Seven Sisters.

## Women at Woomera 1940s – 1970s

Wives, mothers, servants, computers

1948: 1200 men / 8 waitresses

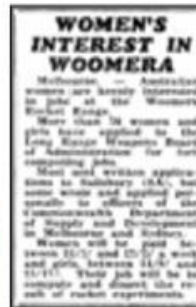
1953: 400 wives

1950s: 'computers', domestic servants

1960s: highest birth rate in Australia

1970s: end of Australia's first space age

Women were keen for space – but their participation at Woomera was limited by ideas of women's roles. Even as scientists, women were expected to perform housekeeping or menial work as human 'computers'. In 1958, a newspaper called Woomera 'a place to find a husband', with 'five or six men for every girl'. Later, skilled women were able to rise to positions of responsibility, such as Superintendent of Instrumentation. Aboriginal women could only be domestic servants in white households.



News (Adelaide, SA) September 1949



Advertiser (Adelaide, SA), October 1953

Full references available on request.



Advertiser (Adelaide, SA), July 1954.

Figure 3: A colonial space. Women and rockets in Australia. Poster by Alice Gorman



## 4.0 Initiatives

A number of initiatives discussed at the meeting provide inspiration for future projects.

[Jennifer Breslin](#), Director at [Futuristas](#), gave insights into increasing accessibility and diversity in national space policies and education initiatives globally, and their positive and negative effects on women's success in space careers. For example, NASA introduced a double-blind application and assessment process for access to the Hubble programme, and as soon as gender identifiers and names were removed from the applications, the success gap between women and men was reduced from 6% to 1%.

[Yulia Akisheva](#) talked about the [Our Giant Leap hackathon](#), run by the Space Generation Advisory Council (SGAC). The hackathon took the theme “How can space technology and know-how help make a leap forward towards gender equality on Earth?” and was held in Daejeon, South Korea on August 14th and 15th 2022 in conjunction with the UNOOSA Space4Women meeting. This hackathon was unusual in directly highlighting gendered issues and could provide a good model for future events. (The [2023 hackathon](#) was held in conjunction with the Expert Meeting in Montréal).

Vera Pinto Gomes spoke about the [European Commission Gender Equality Strategy](#), which requires promoting gender equality in all EU policies. This has required the development of tools, training for EU staff on how to include gender mainstreaming in the policy cycle, and training industry in implementation. It took 10 years to get agreement across EU member states on a law requiring 30% of Commission membership to be women. The challenge now is the implementation of gender mainstreaming in policies.

A step taken by the EU Commission was to require that women be included in panels, hackathon teams, and photographs used to represent the organisation. This strategy was successful because it was being driven from the top down.

One lesson learned: with the first [CASSINI](#) hackathon, there were not many teams and no women at all. Since then, there have been explicit marketing and messaging requirements to show photos of women on stage and in winning teams; to create promotional materials that show women; to go to participating companies and tell them if they have a woman in the team, they want her to do the pitch; to tell teams they have to have women in their team. While some might see this approach as overly prescriptive, it was successful in increasing the participation of women.

Whole-of-Government approaches: The Canadian whole-of-government approach to data collection through the DDAP was one initiative with potential to make a difference.

Rahima Kandahari, Deputy Assistant Secretary for Science, Technology and Space Affairs at the US Department of State, highlighted that the current US government has prioritised equity and diversity as a whole-of-government approach:

- The [US Interagency Strategy on Women's Economic Security](#), announced by Vice President Kamala Harris, calls for increasing participation of women in STEM.
- The [US Strategic Framework for Space Diplomacy](#), announced by Secretary of State Antony Blinken, includes commitments to equity and inclusivity, as well as acknowledgement of the importance of Women's voices in diplomacy from the Women, Peace and Security agenda.
- The [White House Science and Technology Policy](#) task force with the mission to grow diversity, includes a 5% target increase of women in the space workforce.

## 5.0 Gender mainstreaming toolkit

Gender mainstreaming is a strategy for making all genders' concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of a particular action or activity. Throughout the week, participants contributed to the development of a gender mainstreaming toolkit for the space sector. Whilst this was an important activity and will create a highly useable tool, there were also a number of reflections and concerns.

Primary among our concerns was that there was not enough use of gender tools/insights from other sectors, not enough dialogue between sectors, and not enough use of the evidence to design the tools.

There is a need to work across different groups and communities with expertise in equity, diversity and inclusivity in particular. This is a common error in creating "diversity in STEM" or "diversity in the workplace initiatives" - starting from scratch rather than bringing in experts in Inclusion, Diversity, Equity and Accessibility (IDEA).

In addition, only one man was an official delegate to the Expert Meeting. The absence of men at gatherings such as this is always a disappointment: more male allies are needed to ensure that gender diversity is a mainstreamed issue, and not just an issue for women. There is evidence to demonstrate that diverse and inclusive workplaces are more innovative, more creative, retain their employees for longer, and therefore more competitive. Aside from the business case, diverse backgrounds and perspectives are needed to solve the technological and governance issues in the space tech sector, since homogenous approaches lead to limited lenses on problems, and therefore limited solutions.

## 6.0 Conclusions and recommendations

There is limited data available for the participation of women and gender minorities in the Australian space sector. Surveys of the Australian space industry have consistently reported a gender disparity of at least 80%; for example, surveys by Asia Pacific Aerospace Consultants in 2010, 2011 and 2016 showed only 14-16% of the Australian space workforce were women. Studies by Horner et al (2016, 2017) examined the gender balance of the annual Australian Space Research Conferences, which showed that women participated in the conference at a higher proportion than their representation in the general space community, at around 25-26%. But as the Expert Meeting highlighted, statistics such as these only take us so far. We need more detailed and nuanced data to understand the factors that lead to low participation.

Dr Elise Stephenson, [Dr Cassandra Steer](#) and Professor Meredith Nash's inaugural [Diversity at the Frontier: Gender Equality in Space Conference](#) in April 2023 has sought to collect data on some of the gaps, finding in their report that exclusion and discrimination are common. Women and traditionally marginalised groups have historically been and continue to be both actively and passively excluded from the space sector, in roles, leadership, funding/economic opportunities and policy. From recruitment criteria and gendered language to equipment design and unequal pay, numerous obstacles are slowing progress towards diversity, inclusion, equity and belonging in the workforce. In addition, continued inequalities present major risks, driving organisational under-performance, poor staff retention, stifled innovation and posing threats to reputation, credibility, and security.

Information gaps also hamper policy design and success. Little is known about the intersectional opportunities and challenges faced by women and traditionally marginalised groups in the Australian space sector, as well as more generally on a global scale. More research and data collection are needed to gather specialised insights and go beyond reliance on findings from other industries, which may face different issues.

It was also found that diversity is an overlooked opportunity for the space sector. Many of the practical and existential challenges facing the sector could be addressed by including and recruiting from a more diverse talent pool. As the space industry continues to grow, with the establishment of new government institutions and policies, there are many opportunities to circumvent workforce shortages in other industries and increase innovation through considered, diverse teams and design. As such, government plays a key role in setting the agenda and holding industry accountable. With the Australian Space Agency committing to both a Thought Leadership Paper and a Diversity and Inclusion Statement for the space sector in 2023, there are opportunities to leverage these key actions to demonstrate leadership and provide support to the rest of the sector.

## Our recommendations are:

- As emphasised at the Expert Meeting, there is a need for better and more nuanced quantitative and qualitative data, which records numbers, perceptions and experiences. Organisations in a position to collect this data include CSIRO, SIAA, and SASIC, as well as universities - such as the project already being led by the Global Institute for Women's Leadership at the ANU.
- Given the growth in the Australian and New Zealand space sectors, we propose that Australia should host a Space4Women Expert Meeting in the next few years. There is no formal bidding process, but interest has been registered with UNOOSA.
- There is an opportunity to lead an online Australia-led side event at the 2024 Space4Women expert meeting. This may involve partnering with other organisations, for instance, [Women in STEMM](#) Australia, the National Space Society [Women in Space Chapter](#), or the fledgling Diversity in Space Network in Australia.
- There is an opportunity to lead diversity-focused side events at the 2025 IAC in Australia.
- There is an opportunity for federal and state governments, as well as industry partners, to support the establishment of a national network for diversity in the space sector. The co-authors of this report form part of the founding group for this network in 2024, together with other leaders in the Australian space sector.
- Both government and industry have the opportunity to make tangible and public commitments to diversity and equality, and partner across the space sector to collect accurate and timely data that could help the Australian space sector thrive.
- A draft statement on diversity and inclusivity was produced for the Australian Space Agency in 2023, by the Global Institute for Women's Leadership in collaboration with ANU Institute for Space and the Australian Centre for Space Governance. Given that the Minister for Industry and Science was extremely supportive of the consultation on improving diversity in STEM in 2023, adopting a sector specific statement backed up by research and data would be a welcome and very positive move in 2024.

## 7.0 References

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Horner, Jonathan, A.C. Gorman, Ann Cairns, and Wayne Short 2016 The gender balance of the Australian Space Research Community: A snapshot from the 15<sup>th</sup> ASRC, 2015. In Graziella Caprarelli (ed) Proceedings of the 15<sup>th</sup> Australian Space Research Conference, Canberra

Stephenson, E, Steer, C, Nash, M, Hayes, J, Furman, S, Vacaflones, I, Dhillon, K and N. Hartanto 2023 Diversity at the Frontier: Gender Equality in Space Conference Insights Paper, [https://giwl.anu.edu.au/sites/default/files/Space\\_Conference\\_Insights.pdf](https://giwl.anu.edu.au/sites/default/files/Space_Conference_Insights.pdf)

## Appendix: author biographies

**Dr Alice Gorman** is an internationally recognised leader in the field of space archaeology and author of the award-winning book *Dr Space Junk vs the Universe: Archaeology and the Future* (MIT Press, 2019). Her research focuses on the archaeology and heritage of space exploration, including space junk, planetary landing sites, off-earth mining, and space habitats. She is an Associate Professor at Flinders University in Adelaide and a heritage consultant with over 30 years' experience working with Indigenous communities in Australia. Gorman is also a Vice-Chair of the Global Expert Group on Sustainable Lunar Activities, a Life Member of the Space Industry Association of Australia, a Senior Fellow of the American Institute of Aeronautics and Astronautics, and an expert member of the ICOMOS International Scientific Committee for Aerospace Heritage. She is a regular contributor to national and international space policy, particularly focusing on issues of equity, social justice and rights of nature. She was part of a collective that drafted the first Declaration of the Rights of the Moon in 2021. She also contributed to the Vancouver Recommendations on Space Mining. Asteroid 551014 Gorman is named after her in recognition of her work in establishing space archaeology as a field.

**Dr Cassandra Steer** is Deputy Director - Mission Specialists, of the Australian National University Institute for Space (InSpace). She is also Chair and founder of the Australian Centre for Space Governance. Globally recognised for her expertise in space governance, space law, and space security, she has published widely on these topics, including the application of the law of armed conflict and use of force in outer space. She has consulted to the Australian, Canadian and U.S Departments of Defence, the Australian Space Agency and Australian Department of Foreign Affairs and Trade on these issues. She has taught space law and space security at McGill university, the ANU College of Law, the National Security College and the Australian Defence College. Dr Steer is multilingual, and has lived and worked in five countries, in a range of educational, non-profit and public institutions. Dr Steer is a member of the Australian Space Agency's Technical Advisory Group for Space Situational Awareness, a member of the Space Traffic Management Committee of the International Academy of Astronautics, and a member of the International Institute of Space Law.

**Dr Elise Stephenson** is a multi award-winning researcher, strategist and entrepreneur. She is the Deputy Director of the Global Institute for Women's Leadership, Australian National University (ANU), founded and chaired by Australia's first (and only) female prime minister, Julia Gillard. She is the Gender, Space and National Security Fellow at the ANU's National Security College, an Adjunct at Griffith Asia Institute, and a Fulbright Fellow of the University of Washington. As a political scientist and international relations scholar, Elise focuses on research in frontier international affairs, from researching space policy, to politics and government, diplomacy, national security, intelligence, and the Asia Pacific. Elise was

awarded the 2022 Fulbright Scholarship funded by Monash University for her research on diversity in space, and her first book *The Face of the Nation: Gendered Institutions in International Affairs* is published with Oxford University Press. She is published in the Hague Journal of Diplomacy, Australian Journal of International Affairs, European Journal of Politics and Gender, and two book series, on gender and sexuality justice in Asia and gender and politics in Australia.

**Dr Catherine Grace (MBBS)** is a strategic-initiatives leader, with a focus on emerging opportunities in disruptive technology within the Space and Defence sectors. She is a physician, who has led clinical research projects across a broad range of topics including the impact of gender on physicians' careers. An enthusiastic speaker and multilingual orator, Catherine has also been recognised for contributions to the scientific community with multiple international presentations, community engagement and educational activities. She is currently the Director of the South Australian Space Industry Centre, where she develops and drives the State of South Australia's Space sector leading industry and economic development activities for the state.

**Ms Stephanie Wan** an international space policy expert, and currently leads KPMG's Adelaide office Space Industry practice. She has over 15 years' experience in the space industry, with a focus on aligning international and interagency dialogues with policy priorities and impactful projects. She has lived abroad in multiple countries prior to moving to Australia in late 2021, but spent most of her time previously based in Washington, DC working at US government agencies (NASA HQ, US State Department, US Department of Commerce) on a variety of space issues such as: positioning, navigation, and timing, space traffic management, space operations, commercial space / NewSpace Industry engagement, and STEM workforce planning. Outside of her Australian space activities, she continues to be active in the international space community in championing underrepresented communities, formerly holding leadership positions in the Space Generation Advisory Council and International Astronautical Federation Workforce Development/Young Professionals Programme Committee, and designing creative partnerships for the NASA Deep Space Food Challenge.