Barriers to the Pipeline - Interim Report

Women in Aviation/Aerospace Australia
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Abstract

A survey of female experience and perception of the Australian aerospace and aviation sectors is presented. Approximately 180 respondents completed the survey, of which 86% were female. The survey cohort included a range of career stages and levels of education, and spanned from support and engineering roles to flight crew. Passion for the sector itself was considered by the majority to be the strongest "lever" for driving female recruitment into the sector, while the male domination of the industry was considered the greatest "barrier". There was a general dissatisfaction with the availability and visibility of information regarding career opportunities in the sector, despite respondents rating this as highly important. In the free-text response section, many respondents spoke of the sexism, discrimination and implicit and explicit bias they had experienced. Several respondents indicated that despite a successful career, they found the work environment sufficiently hostile that they would not recommend young women pursue a career in the sector. The results of this preliminary analysis suggest that while improving public understanding of the opportunities available in the aerospace sector is an important step to improving female representation in the industry, the leaks from the pipeline can be attributed more to sexism and discrimination than any other single factor.

1   Introduction

The aviation and aerospace sector suffers from unusually low female representation. This is most extreme amongst pilots, with women holding only approximately 6% of plane, helicopter and balloon licenses [6]. There is similar poor representation in technical service roles, and while engineering representation is a little better, it still falls below female workforce participation in the broader engineering sector [5]; aerospace engineering has one of the lowest proportions of female graduates amongst the engineering disciplines [1]. While there have been a number of studies specifically regarding female aviators [8, 7, 4, 3, 2], there is little research on the experiences of women in the broader context of the Australian aviation and aerospace industry.

To address the paucity of data regarding female perception and experience of the Australian aviation industry, Women in Aviation/Aerospace Australia, along with academic partners Monash University, RMIT University, and the University of New South Wales conducted a survey of aerospace professionals. In this report, we present a preliminary summary of the data, focusing on reportage of raw data, but eschewing for now more rigorous or sophisticated statistical analysis.

2   Methods

Survey data were collected through the platform Qualtrics, with survey recruitment being primarily through LinkedIn and dissemination through professional networks. 181 respondents completed the demographic information, with 86% of respondents being female, 12% male, and 4% non-binary or undeclared. Other demographic data are included in Table 1. The survey cohort includes a broad distribution of ages, though with relatively fewer respondents in the 55+ age bracket; this may be a reflection of the fact that historically female representation in the industry was even lower than today, or it may reflect the use of platforms such as LinkedIn as the primary distribution mechanism. About three quarters of the

Table 1: Table 1: Respondent Demographic Data

Age Range	Frequency	Percentage
18-24	15	8%
25-34	51	28%
35-44	60	33%
45-54	45	25%
55-64	9	5%
65+	2	1%
Highest level of Education	**Frequency**	**Percentage**
Year 12	16	9%
Bachelor	79	43%
Diploma or Professional Training	26	14%
Masters or Above	61	34%
Major	**Frequency**	**Percentage**
Aerospace Engineering	35	20%
Engineering (non-aerospace)	27	16%
Aviation and Aviation Management	36	21%
Management, Business, or Arts Degree	24	14%
Science Degree	16	9%
Other	35	20%
Current Profession	**Frequency**	**Percentage**
Air Traffic Controller	9	5%
Airline Professionals	7	4%
Airport Professionals	3	2%
Aviation Regular or Government Agency	10	6%
Engineer	44	25%
Flight Crew	31	17%
Higher Education	7	4%
Other	54	30%

cohort have at least an undergraduate qualification, with the majority of the remainder having diplomas and other certifications. The cohort also represents a broad range of roles; engineering and flight crew were the two most represented groups within the cohort, though the most-selected response was actually "Other", indicating the diversity of roles in the aerospace sector.

In addition to the demographic questions, respondents were asked five questions in a five-point Likert scale, with options ranging from "Strongly Disagree" to "Strongly Agree", "Least Important" to "Most Important" or "Least Satisfied" to "Most Satisfied", depending on the question. These questions concerned four fundamental topics: What are some levers that encourage people to work in the aerospace sector (Q1), what are some barriers that discourage people from working in the sector (Q2), what information sources help inform the decision to work in the sector and how satisfied are you with the availability of these sources (Q3, combining two separate questions in the survey), and what search channels did you use to access this information (Q4). Respondents were also asked to rank a selection of industries in terms of preference relative to the aviation sector, though that question is excluded from this analysis. At the end of the survey, respondents were given a free-text response option "What else would you like to share with us, in addition to the above? Please share with us here." Some of these responses are included in the discussion, which have had minor edits for grammar and typographical errors.

3 Results

3.1 Levers

Q1. The following are often described as 'Levers' that encourage people to choose to work/study in Aviation/Aerospace sector. Please read each statement carefully and indicate your level of agreement between 'Strongly Disagree' and 'Strongly Agree'.

Q1_1 Inherent passion/love/interest in the sector.

Q1_2 Perceived as a fun/adventurous/rewarding profession with prestige and glamour.

Q1_3 Perceived opportunity to demonstrate my knowledge, capabilities and attributes such as technical skills, leadership, communication and confidence.

Q1_4 Perceived profession-related benefits and pride such as opportunity to travel, meeting more people, higher income, lifestyle.

Q1_5 Perceived employability enabling job/career changes.

Q1_6 Exposure to and availability of science/technology/maths/aviation courses at a young age.

Q1_7 Encouragement received to take maths/science/technical/aviation/aerospace courses in secondary college.

Q1_8 Exposure to and availability of a role model and/or mentor.

Q1_9 Exposure to, and availability of all sources of support from family, school, peers, and society etc.

Q1_10 Perceived opportunity to share my travel experience and become an influencer on social media and other platforms.
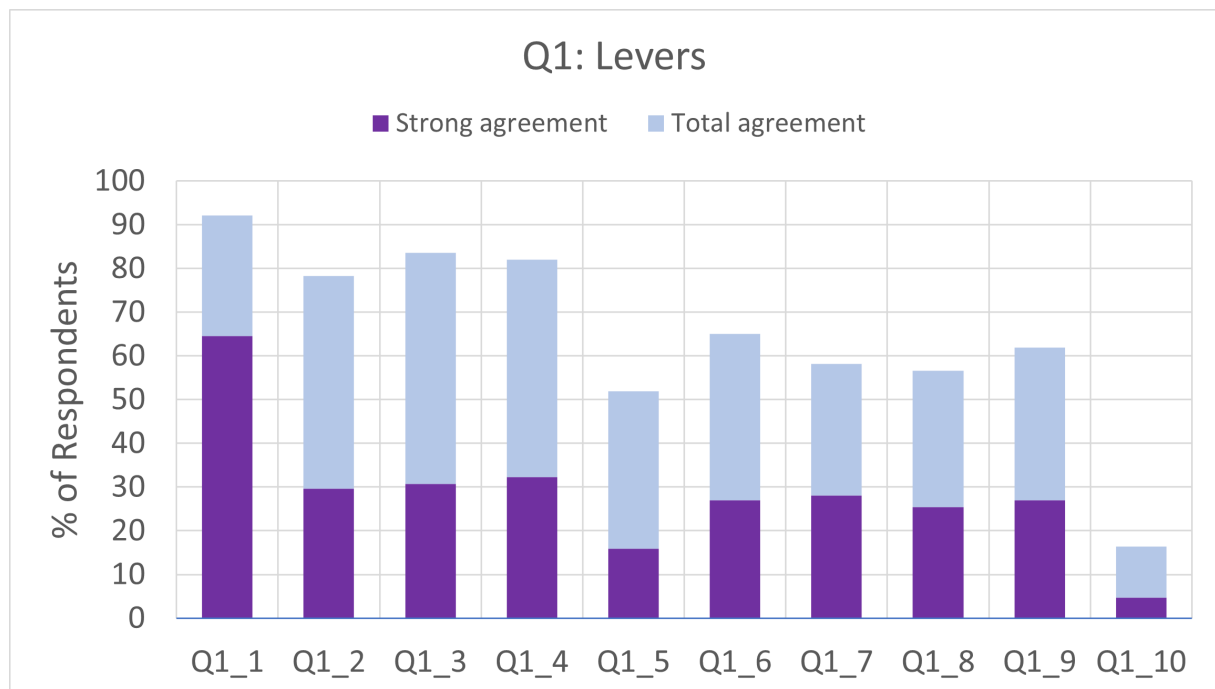

Figure 1: Percentage of respondents indicating "Agree" or "Strongly Agree" for Q1.

Over 90% of respondents indicated that inherent passion and interest were a key motivator in choosing the aerospace sector. Over 60% of respondents indicated "Strongly Agree", more than twice as high as the next highest category. Prestige, fringe benefits, and the opportunity to demonstrate technical competence were considered by a majority to be significant levers as well, though the level of strong agreement was only half that of inherent passion in the sector. Employability was generally not perceived as a major motivator for working in the aviation industry, and perhaps unsurprisingly, very few respondents were motivated by the desire to share travel experiences on social media.

3.2 Barriers

Q2. The following are often described as 'Barriers' that discourage people from choosing to work/study in Aviation/Aerospace sector. Please read each statement carefully and indicate your level of agreement between 'Strongly Disagree' and 'Strongly Agree'.

> **Q2_1** Perceived cost and time required in order to become a professional.
>
> **Q2_2** Perceived demand of ongoing training.
>
> **Q2_3** Perceived male-domination of profession.
>
> **Q2_4** Societal/family/peer pressure to choose non-traditional professional career.
>
> **Q2_5** Historical hiring patterns of the industry.
>
> **Q2_6** Perceived harassment/discrimination/double standards for different genders for recruitment and promotion in work environment.
>
> **Q2_7** Perceived industry uncertainty and volatility that might give rise to redundancy down the track.
>
> **Q2_8** Perceived challenges of job change and work/life balance after having a family.
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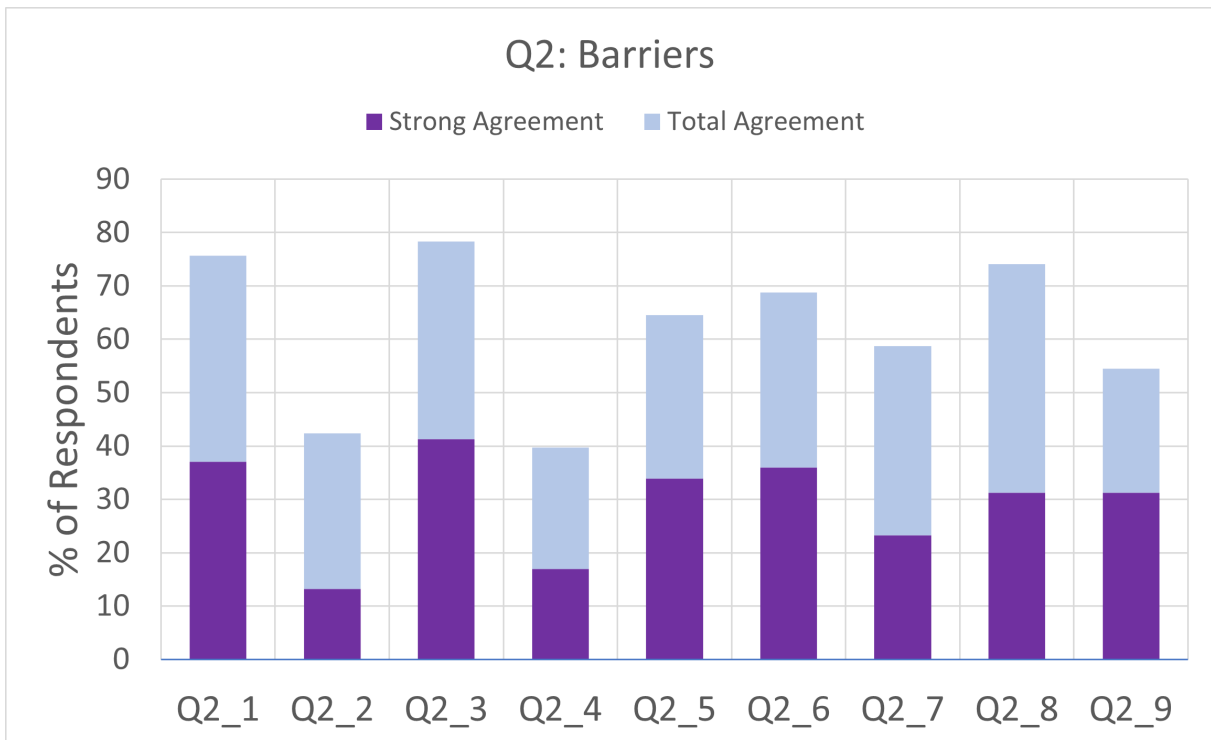> **Q2_9** Employer's gender, equity, inclusion and diversity policies are unknown.

Figure 2: Percentage of respondents indicating "Agree" or "Strongly Agree" for Q2.

The perceived male domination of the profession was identified by almost 80% of respondents as a significant barrier to entry, with over 40% strongly agreeing. Almost as prevalent were concerns around training costs and time commitments, and perceived inflexibility in working arrangements conflicting with having a family. Active harassment and discrimination were cited as a factor by almost 70% of respondents, with almost 40% strongly agreeing. Societal/peer pressure around traditional gender roles in employment was one of the least-cited factors, though it must be noted that the wording of the question was quite ambiguous, and it is unclear how respondents interpreted it. While cost of initial training was considered a significant barrier, other non-gender-specific concerns such as job volatility and ongoing training demands were generally of lower priority.

3.3 Information and Role Models

Q3. For each of the following statements, indicate how important you believe availability and exposure to information and role models are, when making sector based career choices. Please read each statement carefully and indicate the level of importance to you between 'Least Important' and 'Most Important', and indicate your level of satisfaction between 'Least Satisfied' and 'Most Satisfied'.

Q3_1 Availability of aviation/aerospace/science and technology courses in secondary college.

Q3_2 Availability of information about the aviation/aerospace diploma and degree programs provided by high education institutions and training organisations.

Q3_3 Availability of information about the prospective career development of the sector.

Q3_4 Availability of both generic and specific information about a prospective individual employer, including but is not limited to its recruitment policies, career development opportunities, gender equity/inclusion/diversity policy and so on.

Q3_5 Exposure to role models/mentors as early as where it is possible.

Q3_6 Exposure to the industry and its operational environment at an early age. This could be a site visit to the airport/airline, or a flight for a holiday, or a face-to-face chat with an aviation/aerospace professional such as Pilot/Air Traffic Controller/Engineer/Consultant.

Q3_7 Exposure to support/motivation/encouragement from family/relatives/peers/schoolteachers/career councillors, and society.
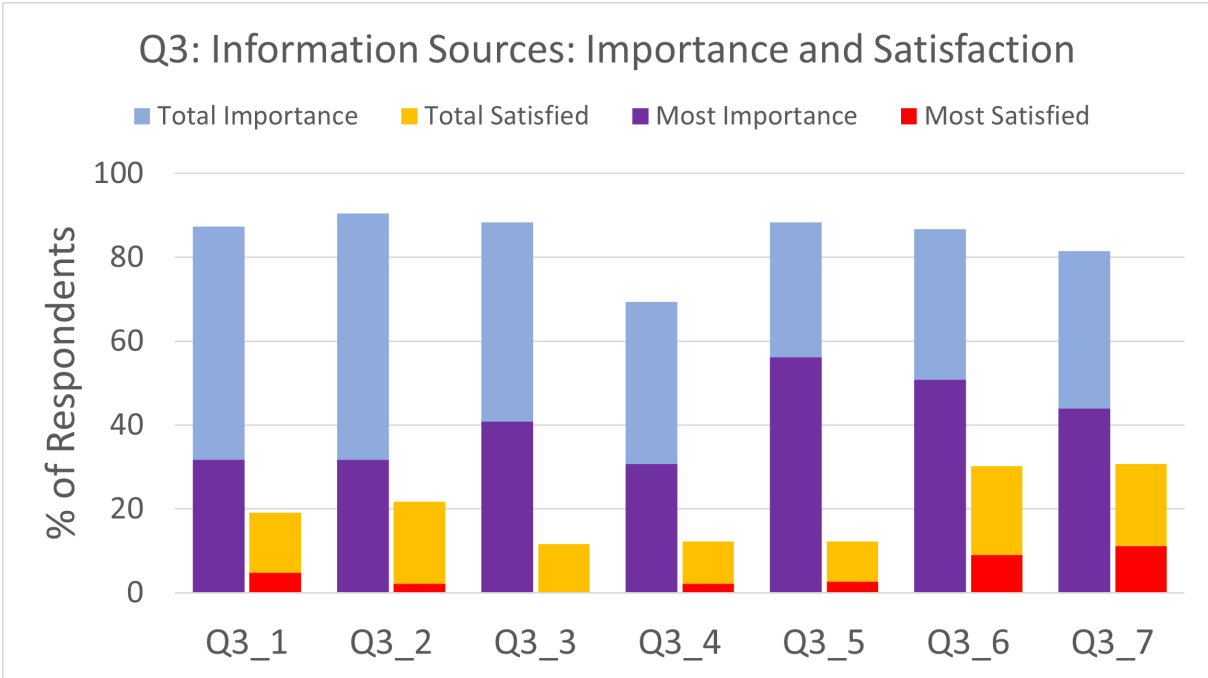

Figure 3: Percentage of respondents indicating "Important" or "Most Important", and "Satisfied" or "Most Satisfied" for Q3.

A majority of respondents considered all seven sources of information and inspiration to be important, and a majority were also dissatisfied with their availability. No more than 10% of respondents selected "Most Satisfied" with the availability of any of these sources. Almost 90% of respondents indicated that the availability of role models was important, with over 50% indicating "Most Important", yet only 12% were at all satisfied with present availability. The highest level of satisfaction was around 30%, for exposure to the industry, and support from family and community.

3.4 Search Channels

Q4. The following statements relate to the channels you may have used to search for information about the industry, mentors and/or role models. Please indicate how strongly each statement applies to you between 'Strongly Disagree' and 'Strongly Agree'.

| |
|---|
| **Q4_1** The school/college/university/TAFE curriculum leaflet/brochures. |
| **Q4_2** The Higher Education program guide. |
| **Q4_3** Company websites. |
| **Q4_4** Mainstream media, such as TV, newspaper, magazines etc. |
| **Q4_5** Social media sites, such as Facebook, Tiktok, Instagram and so on. |
| **Q4_6** Visits/talks/presentations by industry professionals organised by school/Higher Education. |
| **Q4_7** Industry events I attended. |
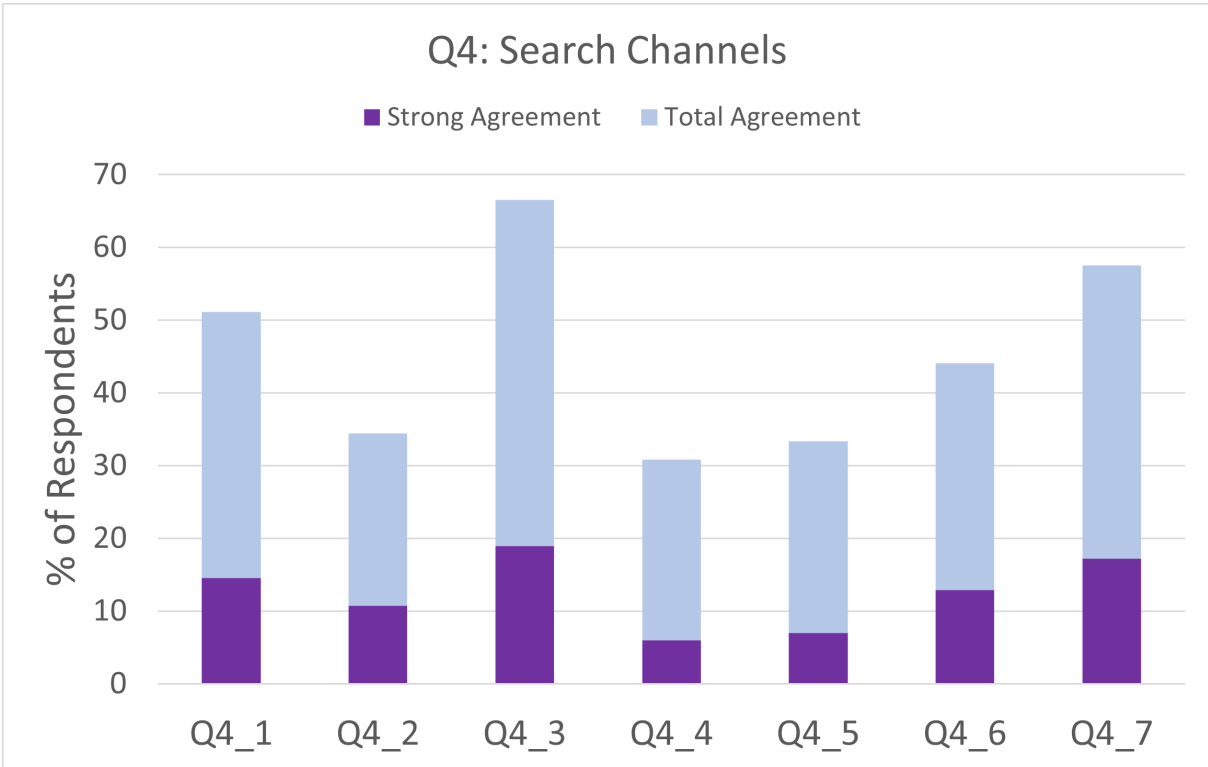
Figure 4: Percentage of respondents indicating "Agree" or "Strongly Agree" for Q4.

The two search channels that respondents most identified were company websites and industry events; tertiary institution brochures were the third most cited but only slightly above 50%. Less than a third of respondents cited the Higher Education Program Guide, and either traditional or social media as useful channels.

4 Discussions

4.1 The Importance of Role Models

Only 56% of respondents listed exposure to a role model or mentor as a significant factor in their choice to pursue a career in the aviation and aerospace industry in Q1. At first glance this might appear to be in opposition to the general perception regarding the importance of role models, however the responses to Q3 suggest a rather different interpretation. Only 12% of respondents felt satisfied with their access to mentors and role models, but over half of respondents still listed it as a significant factor in their choice. Given that almost 90% of respondents identified exposure to mentors and role models as important, the relatively modest percentage of respondents who cited it as a factor in their own decision is reflective of the historical (and current) paucity of appropriate mentors and role models. This was also identified in the free-text section by several respondents:

> "Once in the industry it is very difficult to find positive female role models and mentors"

Many of the respondents to this survey chose to pursue a career in the aviation and aerospace industry due to their own inherent passion (Q1_1), even in the absence of a role model (Q3_5), but clearly many would have valued such a role model, and several of the free-text responses suggest that despite their rarity, role models are still influential when available:

> "Meeting inspiring women in my field"
> "Seeing role models and identifying with them."

4.2 Gender Disparity and Discrimination

The responses to Q2: Barriers, indicates that both the expectation and reality of gender-based discrimination remains one of the most significant obstacles to women considering a career in the aerospace sector. The vast majority of respondents indicated that the perception of male domination of the industry was a significant barrier, and this was a consistent theme in qualitative comments as well, with references to a *"Boys club mentality"* and the *"lack of support from male peers"*. The issue of a male-dominated industry was also raised repeatedly in the free-response section, eg:

> "Recruitment processes need to change in A/A, a male-dominated industry, to encourage women to apply and recognise that women interpret and respond to job ads differently."

Of more concern however is the high percentage of respondents noting concerns around active abuse and discrimination; almost 70% of respondents cited this as a barrier to entering the industry, which is an indictment on the present state of our sector. This is borne out in a distressing number of text responses when describing barriers:

> "How women are treated during training"
> "perceived discrimination"
> "stories of abuse and discrimination"

One particularly noteworthy barrier description was:

> "perception that you can't be feminine".

This last comment is consistent with prior research specifically regarding female pilots; most successful female pilots demonstrated higher levels of stereotypically "masculine" behaviour [3]. In the Australian armed forces, not only did female pilots feel that they had to embody masculine behaviour, but even had to subsume their own feminine identify and be "one of the boys" [4].

Some of the responses in the free-text "What else would you like to share" section are particularly damning. Even some of those women who have succeeded in entering the discipline say that the degree of sexism and exploitation means they would not recommend the career to young women:

> "20yrs in. Wouldn't encourage young girls in to ATC it is still far too sexist and discriminatory. Great money but at a psychological toll."

"High stress, generally low paid, exploitative profession. I advise young women stay away"

"my experience in the aviation industry between 2016 and 2021 confirmed with me the rude, sexist, discriminating and bullying environment that many perceive that it is. Extremely disappointing."

These are particularly concerning, given they indicate that whatever progress has been made, for many women currently working in the industry, it is evidently not enough that they would encourage others to follow the path they have forged. The *"very slow and low level of change"* was also noted by one respondent, and multiple respondents highlighted the issue of men in positions of power being particularly biased or discriminatory:

"I absolutely loved my job. But, knew I would never be good enough to lead in the eyes of the leadership team due to their unconscious bias."

"My aviation workplace is dominated by men with outdated and problematic opinions. If this were to change, I would think that we would have a more diverse industry as those who start their path would stick around longer as they would feel safe at at work and their skills valued."

"Exposure to small persistent acts of discrimination from peers/heirarchy within organisations/society is real and draining for women in the profession."

"There are a lot employers that lack females in the upper management roles within these organisations who hold positions outside of administrative ares. There is still a barrier to females being identified for operational roles based on experience. These are still male dominated."

While attraction and retention of women into the aerospace sector is a global problem, several respondents noted that they perceived Australia as particularly bad in terms of bias and discrimination:

"Australia is the only country in the world where women had to go to court to have the ability to fly for an airline - why does India have a 17% female pilot participation? Australian attitudes are backward and parochial."

"Over a decade of experience within the industry, the culture still needs to change - females are often subjected to both biased and unbiased adversities and harassment. . . . there is a significant gender bias in Australia when compared to Europe."

These comments paint a bleak picture of how women experience the aerospace sector. While a great deal of effort is being expended to promote the industry to young women, if women already in the profession are experiencing this level of hostility and discrimination, such outreach efforts are doomed to failure; the pipeline will continue to leak, and this will mean the lack of female role models in senior positions continues.

4.3   Work flexibility and family

Around three quarters of respondents noted that concerns regarding work-life balance and flexible work accommodating the desire to start a family were a significant barrier to entering the industry. This was also repeatedly acknowledge in the qualitative comments for Barriers: *"Ability to work part time"*, *"Lack of Part time work for Engineers"*, *"Not able to have maternity leave"*. These were also common topics in the free-response section:

"or seeing the ability to progress relative to peers if the person is primary carer for their family."

"The aviation industry needs to become more proactive in providing family friendly arrangements in order to retain talent."

> *"Needs to be easier to get part-time work in Aerospace industry, like it is for other areas, e.g. Nursing"*

> *"Organizations need to be doing more to ensure they have good policies in place such as maternity leave, etc."*

While some employers, including notably the ADF, have significantly improved the flexibility of their work offering, it is unclear if this information is being sufficiently advertised.

4.4   Information about the sector

Survey respondents indicated a general dissatisfaction with the dissemination of information regarding the industry. One theme that was particularly apparent in the qualitative responses is that information about career opportunities tends to be narrow in focus:

> *"Aviation is pigeonholed by schools and education into the airlines and travel industries. Nowhere are teachers, schools or students given the wide range of what aviation and aerospace actually are."*

> *"Aviation is promoted mostly as the glamour of airlines and not enough emphasis on all the other avenues."*

> *"I wanted to go into the Aviation industry, but was only informed about limited career options to do so (Pilot, Ground Crew, Cabin Crew). I wasn't aware of the support roles (HR, Training, Health & Safety, Environment, Engineering) that I could have but still be within the Aviation sector"*

> *"TAFE Courses are severely underrated and not represented to school aged women/school-leavers as options or pathways to a career in Aviation (outside of becoming a pilot which is an Associate Degree program)."*

> *"There's definitely not enough readily available information about career pathways for the aviation/aerospace industry for people who have previously had no exposure. Figuring out how and the best pathways to get qualified has been very difficult."*

Between these comments and the general dissatisfaction with the availability of information regarding the sector, there is an opportunity for education efforts to not only focus on promoting the sector in general, but on the diverse pathways and opportunities it involves.

5   Conclusions

In this report we present preliminary analysis of the raw data collected in the Women in Aviation/Aerospace Australia "Barriers to the Pipeline" survey. The survey received a good number of responses from across the aerospace sector, given that it was largely targeted women who are very underrepresented in the industry. Though progress has been made regarding women's perception of the aerospace sector, the overall picture is of an industry still hostile to women. Most survey respondents indicate that the existing gender imbalance is a significant barrier to women entering the sector, and a majority also note perceptions and experiences of harassment and discrimination. These experiences are sufficiently negative that multiple survey respondents stated that they would not recommend the industry to young women; it is hard to imagine a clearer indictment of the sector than this. The lack of flexibility around part-time employment and maternity leave was also noted by most respondents, indicating that the sector needs to improve both in terms of policies, and the visibility of these policies. There was broad dissatisfaction with the availability of information regarding opportunities in the sector. Multiple respondents particularly noted the lack of awareness around support roles and TAFE qualifications. Satisfaction was low in all areas, but slightly higher concerning company led initiatives (websites, industry visits) than governmental or

other sources. A lack of visible female role models and mentors is an unsurprising consequence of the generally poor representation of women in the field, but the importance of mentors was noted both by those who had access to them and those who had not. The lack of awareness of opportunities within the sector is relatively straightforward (though not necessarily easy) to address, through better dissemination of information from organizations such as A/AA, companies, and the government. The more acute issues of systemic gender discrimination, harassment and bias are less straightforward; multiple respondents noted that the bias and discrimination often come from the upper levels of company hierarchy. While change is needed at all levels, change at the top is evidently particularly critical. The analysis of the data here is relatively superficial; there is no comparison between the experiences of engineers and flight crew, for instance. The small number of women in the field mean that it may be difficult to produce statistically significant results when considering specific demographics, but further analysis is nonetheless recommended.

References

[1] Christianne Corbett and Catherine Hill. *Solving the Equation: The Variables for Women's Success in Engineering and Computing.* ERIC, 2015.

[2] Martina Ferla and Anne Graham. "Women slowly taking off: An investigation into female under-representation in commercial aviation". In: *Research in Transportation Business & Management* 31 (2019), p. 100378.

[3] Yi Gao and Stephen Kong. "Personality types of pilot students: A study of an Australian collegiate aviation program". In: *International Journal of Aviation, Aeronautics, and Aerospace* 3.3 (2016), p. 6.

[4] Deanne Gibbon. "Leaving gender 'in': The Royal Australian Air Force's project to increase the representation of female pilots". In: *Absent Aviators: Gender issues in aviation* (2014), p. 203.

[5] Andre Kaspura. "The engineering profession: a statistical overview". In: *Barton, ACT: Institution of Engineers Australia* (2012).

[6] Jim Mitchell, Alexandra Kristovics, and Ron Bishop. "Glass cockpits in general aviation: a comparison of men and women pilots' perceptions". In: *International Journal of Applied Aviation Studies* (2010), pp. 11–29.

[7] Jim Mitchell, Alexandra Kristovics, and Leo Vermeulen. "Gender issues in aviation: Pilot perceptions and employment relations". In: *International Journal of Employment Studies* 14.1 (2006), pp. 35–59.

[8] Jim Mitchell et al. "How pink is the sky?: a cross-national study of the gendered occupation of pilot". In: *Employment Relations Record* 5.2 (2005), pp. 43–60.