

National Committee for Space and Radio Science

Working Group on Shape of Australian Space Research and Industry Community

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June 2020 data analysis report

Introduction

The above Working Group met in 2019 at the Australian Academy of Science for a one-day workshop on creating a short survey to assess the shape of the Australian space research and industry community. The 13 questions were validated and opened to a Town Hall meeting at the Australian Space Research Conference in September 2019. Revisions were made, and in late December 2019, the survey was launched on the Australian Academy of Science's website. The survey ran until March 23, the same day as COVID-19 closed Australia, making for little to no impact on the survey from the pandemic.

The survey was distributed via several electronic address databases and invited responses from 'those studying, employed in or otherwise contributing to the Australian space science community'. Organisations which distributed the survey include the Academy of Science, the Australian Space Agency, the Australian Space Research Conference, the Australian Space Industry Forum, the National Space Society of Australia, the Australian Youth Aerospace Association, the Mars Society of Australia, the Australian Institute of Physics, the CSIRO, the Space Industry Association of Australia, the Engineers Australian National Committee on Space Engineering, and various university groups (e.g. ANU Institute of Space, UNSW Australian Centre for Space). While there is overlap between these various databases the survey is likely to have reached most of the target audience.

A copy of the survey instrument appears in the Appendix.

The survey was analysed by Carol Oliver by hand, except for the word pictures and frequency of words, which was undertaken by Isabelle Kingsley using the qualitative analysis software NVivo. The raw database of 212 respondents had one duplicate and one person from outside of the Australian space community. These were eliminated, leaving a database of 210 respondents. The previous Space Decadal Plan survey, in 2015, posed 82 questions and elicited 72 fully completed and 45 partly completed responses.

Responses to the 2020 survey came from all areas of the sector, undergraduates through to very senior researchers and administrators. Answers to open-ended questions were mostly thoughtful, carefully considered, and often pessimistic regarding future prospects for growth of the research sector. One notable outcome of the 2020 survey is that not much has not improved since 2015 despite an almost 100% bigger sample. It is now five years on,

and with nearly two years of having an Australian Space Agency – one of the most pressed-for needs in the 2015 survey. There are some exceptions, one being the coalescing of opinion around Australia positioning itself on its strengths within international needs and missions, perhaps galvanised by the Moon and Mars contract to which the Australian Government has committed.

Some areas were not covered in the 2015 survey, so there is nothing to compare them to – for instance, the four open-ended questions about jobs, willingness to go overseas, and what Australia should focus on going forward. Following is a discussion of demographics and employment results followed by an analysis of four open-ended questions.

1. Demographics

Of the 210 respondents, 86% identified as Caucasian and 9.5% non-Caucasian, 4% preferred not to say, and just one person identified as Aboriginal.

Respondents were evenly split into the three age categories: 18-35 (35%), 36-50 (28%) and 51-65 (31%). The remaining group, 66+, consisted of 13 male respondents (6%).

Almost a third of respondents came from New South Wales (33%), with a relatively even split between Queensland (12%), Victoria (14%), South Australia (13%), Western Australia (14%) and the ACT (12%). The smallest number of respondents were from Tasmania (3%). There were no respondents from the Northern Territory.

Just under a fifth of the respondents were female (19%), slightly less than in the 2015 survey (21%). It is remarkable and concerning that the gender proportion has not improved. Of the remaining respondents, 79% were male, and 2% preferred not to say. Females comprise 24% of both the 18-35 and 33-50 age groups, but only 14% of the 51-65 category, with none in the 66+ group.

Most of the respondents are in their mid-career (39%) with 20% identifying as late career. However, in the pipeline categories, 19% are in their early career or post-docs, 17% are PhD students, and 5% are undergraduates.

Most respondents believe space-related career skills are transferable (73%) or somewhat transferrable (20%) to other careers.

2. Employment

Three-quarters of respondents currently have space-related jobs (74%). Of the remainder, some are retired, and the remaining cohort consists of volunteers. There is no indication among the volunteers that they are currently seeking space-related paid employment.

As in the 2015 space survey, universities are the biggest employer, which is unsurprising given the research, development and teaching nature of higher education. Of the 210 respondents, 56% work in universities (72% in 2015), 15% in for-profit companies, 9% in

Government departments, 8% in Government funded bodies (in 2015, these were grouped together and accounted for 15% of respondents); 4% in non-for-profit companies and 8% in other employment (contractors and volunteers). The number of contractors and those working in for-profit and not-for-profit companies together equals 22% of respondents in the commercial world in 2020, compared to just 5% in the 2015 survey. While this could indicate growth, there are other factors to consider, including the broader reach of the 2020 survey.

About 8% of the respondents have casual jobs, and a smaller number are on contracts (5%). The majority (39%) have full time or part-time (24%) ongoing work. However, 17% of the respondents identify as volunteers, and 7% do not give any employment.

One stand-out feature was that of the 11 respondents on contracts, almost half of them were female – which is disproportionately high, given the respondent cohort is more than 80% male.

3. Open-ended Question 1

Please add comments if you wish to expand on the answer to the question “Do you think there are impediments to remaining in the space-related area and if so, what are they?”

The most common concerns regarding ongoing employment in the sector were “lack of funding” (38%), “instability of employment” (22%), and “poor career prospects” (13%). Of the 15% who reported no such impediments, many were in high-level government or university positions, students, or retired. Of lesser concern, but mentioned a few times was “work-life balance” (almost 2%).

The negativity concerning employment relates specifically to Australia; for example:

“...there are few space-related postdoctoral opportunities in Australia”.

“The majority of space-related opportunities are based overseas and can involve relatively high barriers for entry for foreigners”.

“...there are very few available opportunities for people to obtain jobs in the space industry in Australia and often jobs that do become available require at least some experience overseas”.

“The Australian space industry is still quite small and fragmented. If you lose an existing space job, it can be difficult finding another role in the industry”.

A claim made by one respondent is that tenders by other nations are limited to national companies, but Australian bids are open to anyone.

A word cloud generated in NVivo underscores majority thinking on the “lack of funding” perspective, with funding in Australia mentioned 57 times. Lack of opportunities in industry and research also top the word count and is reflected in the word cloud.



In contrast to negativity on funding and job stability in Australia, the view of job prospects in the space industry generally is relatively strong, including in the critical beginning of the pipeline, the PhD students. Of the 36 PhD student respondents, almost 60% thought that their prospects of space-related employment were good to excellent. Another 27% of respondents thought there were “some” job prospects, with only 13% of students (representing five individuals) believing their prospects of space-related employment were “little to none”.

The positive attitude toward prospects is not limited to the beginning of the pipeline - it reflects across early, mid and late-career respondents with 61% saying that prospects of space-related employment were good to excellent. Another 29% thought there were “some prospects” with only 9% saying prospects were “little to none”.

Nearly three quarter (74%) of respondents believed they had skills transferable outside space science employment.

4. Open-ended Question 2

Where do you see Australia developing a role in space in the next five to ten years?

Participating in international missions were the most commonly supported space role for Australia in the next five to ten years, many citing areas that Australia has, or could have, niche capability. In the NVivo word cloud, missions stand out as the fourth most used word after space, Australia and development, being used 57 times by respondents. Industry and satellites were the fifth and sixth most used words – and often with associated phrasing in sensors and other instruments, remote sensing, Space Situation Awareness, GNSS, the geography of Australia’s location, Earth observation, communications, mining, medicine and robotics. There were at least 37 mentions of launch capability among respondents, as reflected in the upper right quadrant of the word cloud.



A common thread of satellites, services and instrumentation ran through a number of comments, for example:

“Niche capabilities in technology and manufacturing, enhanced satellite and debris tracking, aerospace medicine, environmental management”.

“Niche sensors, cubesats, systems/concepts, taking advantage of our geographic location (testbeds, collaboration with overseas entities).”

“In extremely niche areas of space with very focussed technologies. Piggy backing onto NASA missions”.

“...our niche competitive advantage in various domains of space-related technology. Global leadership therein should be a key strategy”.

Geographical position came up frequently, for example:

“Australia’s main strength is geopolitical”, and “Using our geographical advantage and our strong research expertise”.

There were opposing views on launch capability such as:

“We do not have the infrastructure to support large scale launch and rocket manufacturing”, but...

...“Launch site and infrastructure, cubesats, satellite scientific payload design and build, Australian science leads on international Earth observation and interplanetary missions”.

Although not mentioned as often, some respondents felt very strongly that STEM education and outreach was necessary to keep an open pipeline for future talent, for example:

“Some publicly-funded science/exploration missions will be necessary to inspire the next generation to do the learning necessary to provide the future workforce”.

5. Open-ended Question 3

Would you go, or have you gone, overseas to pursue a career in space-related activities?

Willingness to seek a space-related career overseas is sharply marked by age – the younger, the more like a person is open to the idea. Indeed, some point to it as almost a necessary rite of passage:

“There are very few available opportunities for people to obtain jobs in the space industry in Australia, and often jobs that become available require at least some overseas experience”.

Others point to most jobs being overseas:

“The majority of space-related opportunities are based overseas and can involve relatively high barriers for entry to foreigners”.

Some respondents point to lack of opportunity in Australia:

“...there are few space-related postdoctoral opportunities in Australia”..

Females express the same willingness as males to go overseas in the 18-35 age group but this diverges in the other age groups, unlike males. The key reason cited from females only is family, for example:

“No, not in the short to medium term, due to family constraints”.

“No, due to family commitments, I have not pursued a career overseas.”

In the word cloud generated by NVivo, the most used word after space, Australia, and overseas is “yes” – used 63 times while “no” is not in the top 20 most-used words. Work is used 51 times, career, 45 times, and opportunities, 40 times. The word family is used 14 times, and most likely associated with a resistance or simple ‘no’ to the idea of uprooting the family to take up a position overseas. One theme threading through responses is a preference for Europe as a destination for space-related opportunities rather than the US.



6. Open-ended Question 4

What is your area of space-related work and/or study?

The respondents represent a very wide number of careers within the broader areas of science, technology, engineering and education. The most common word used after ‘space’ was engineering, mentioned 31 times and in phrases of up to 11 words, closely followed by satellites, research, science, and systems. Communications, instruments, education, observation, development, space policy and space weather, were also commonly used words. Some of the correspondents work in astrophysics (mentioned 21 times), planetary studies and – although not regarded as being in the space science category, astronomy.



In summary

The 2020 survey shows little change from the areas covered in 2015. In the remainder, apart from a few minor surprises, views are expressed in four open-ended questions. In Question 1 and Question 3, it is clear that the community views job prospects in Australia to be very low, funding opportunities limited and where available not aligned to the timelines required in space-related activities. Given the low job prospects in Australia, there is a general willingness to seek positions overseas except where family commitments prevent that consideration.

The space science research workforce remains predominantly mid-career Caucasian men, while females are mostly in the youngest age group.

In Question 2, the Australian Space Agency's commitment to NASA's Moon and Mars missions may be partly responsible for an international outlook. This is coupled with the recognition that Australia's key advantages are its geography and niche capabilities in instrumentation, satellites, software, SSA and GNSS. There is an appetite for launch capability but this is not currently on Australia's horizon.

Question 4 confirms that the community is largely space-related science, technology and engineering. Education is recognised as the way to inspire the next generation.

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8 June 2020

Appendix

RESEARCHER/INDUSTRY SURVEY

- Q1 What is your gender? (M, F, other or prefer not to disclose)
- Q2 What is your age group? (18-35, 36-50, 51-65, 66+)
- Q3 How do you identify? (Caucasian, non-caucasian, Aboriginal and Torres Strait Islanders)
- Q4 What state or territory do you or study in? (NSW, Victoria, ACT, Queensland, South Australia, Western Australia, Northern Territory, Tasmania)
- Q5 Which organisation do you work or study with for space-related activities? (Government departments or operational agencies; Government-funded research agencies; University; for-profit company; not for profit; other)
- Q6 What is your career stage? (select more than one if applicable) (undergraduate student; higher degree student; postdoc; early career; mid-career; late-career)
- Q7 Outside of your studies, how would you characterise your space-related activities? (Ongoing full time; Ongoing part-time; Contract; Casual; Voluntary; N/A)
- Q8 How do you regard your prospects for entering or remaining in space-related employment? (Little to none; Some; Good; Excellent)
- Q9 Do you think the space-related skills you are gathering or have are transferable outside of space-related employment? (No; Somewhat; Yes; I don't know)
- Q10 Do you think there are impediments to remaining in the space-related area and if so, what are they? (Stability of employment; Poor career prospects; Lack of funding; Location; Work-life balance; Work culture/discrimination; N/A). Please add a comment if you wish to expand on the answer.
- Q11 Where do you see Australia developing a role in space in the next 5 to 10 years? (**Open-ended**)
- Q12 Would you go, or have you gone, overseas to pursue a career in space-related activities? Please explain response or say if this question is not applicable to you. (**Open-ended**)
- Q13 What is your area of space-related work and/or study? (**Open-ended**)