International Centre for Radio Astronomy Research

Communications and downlink - Opportunities for Australian contribution to Space missions

Simon Ellingsen

International Centre for Radio Astronomy Research

University of Western Australia

Curtin University

GOVERNMENT OF WESTERN AUSTRALIA

THE UNIVERSITY OF WESTERN AUSTRALIA

ICRAR is a joint venture between Curtin University and The University of Western Australia and receives support from the Western Australian and Australian Governments.

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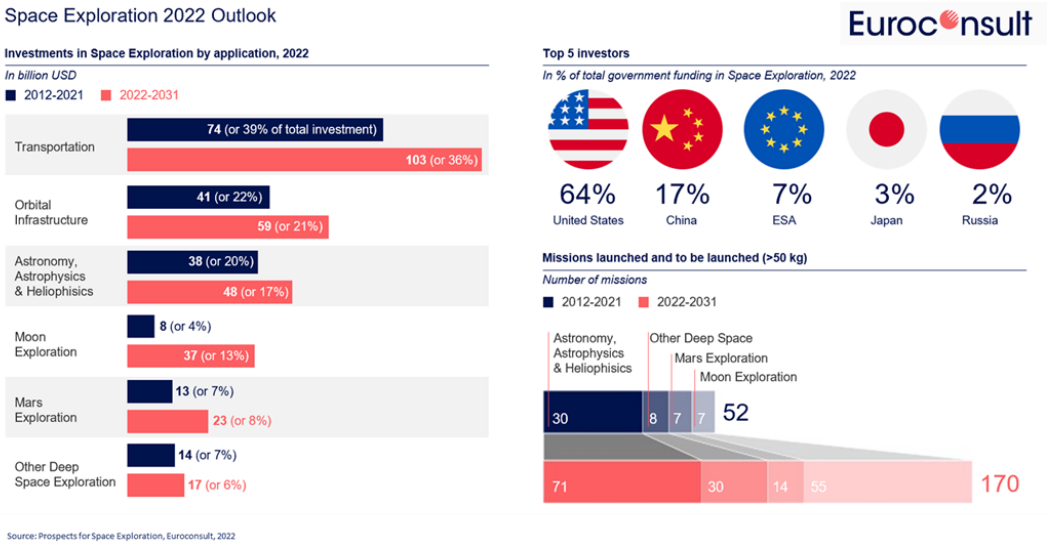
What does the UK’s shortest serving Prime Minister – Liz Truss, have to do with this talk?

Ground Support for Space Missions

- The ground support segment is an unglamourous, but important aspect of space missions it provides:
  - Upload of commands for both the science observations and spacecraft activities
  - Downlinking of science data and instrument/spacecraft monitoring
- The number of missions in orbit and their data requirements continue to increase, but existing ground segments are already at full capacity.

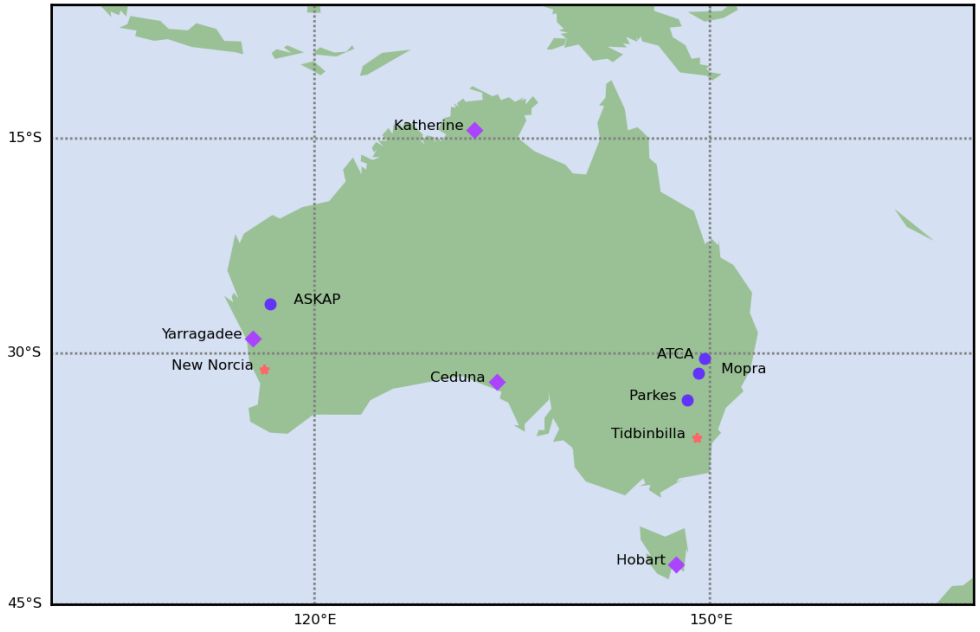


Note the predicted increase in Moon, Mars and Deep Space missions

The Opportunity

Australian radio astronomy infrastructure can relatively easily provide downlink support for space missions:

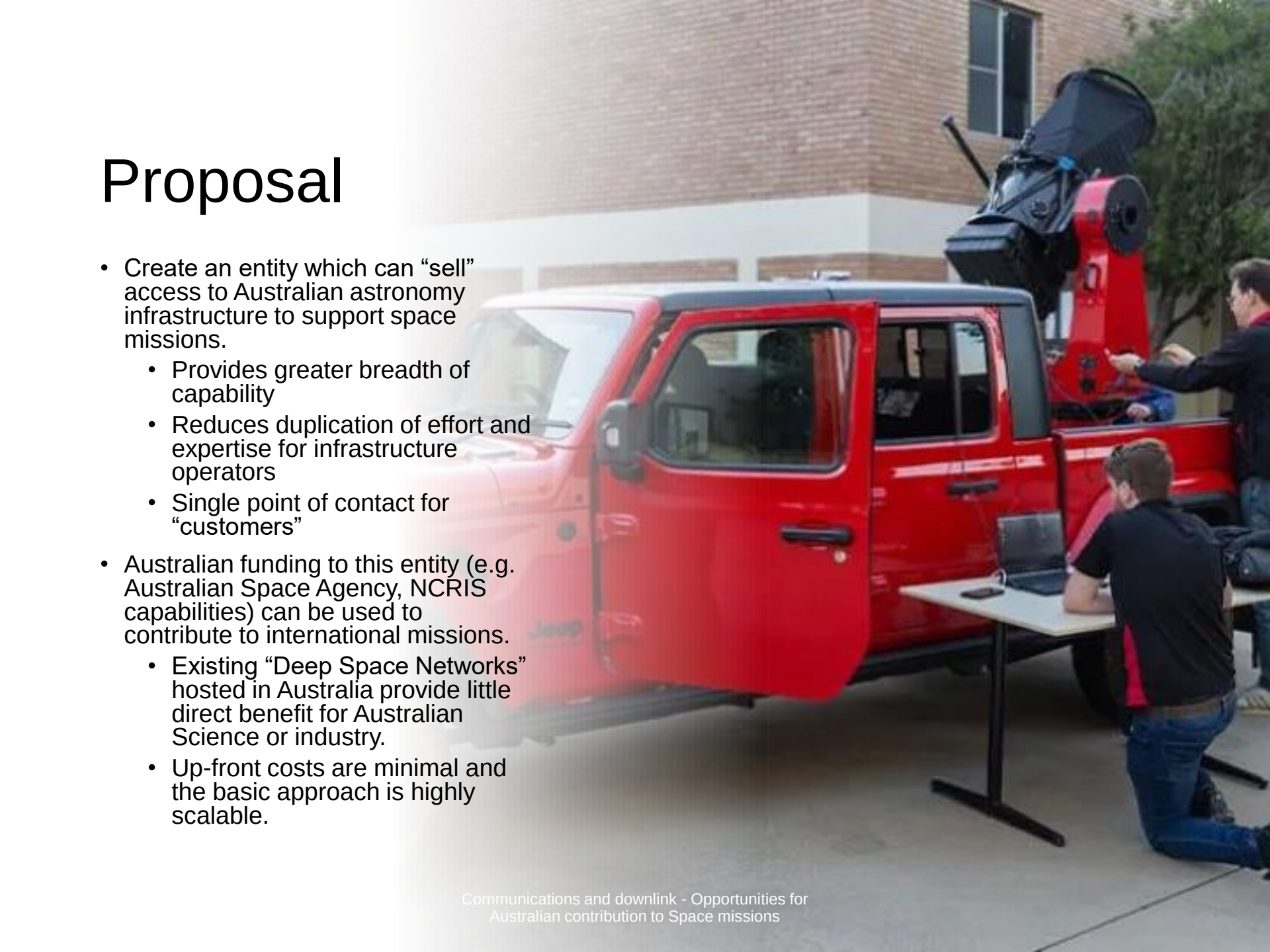
- CSIRO Space and Astronomy (Mopra 22m, Parkes 64m, ATCA)
- University of Tasmania (Hobart 26m, Ceduna 30m, AuScope 3x12m – Hobart, Katherine, Yarragadee)



- The upfront cost to develop this capability is very low
- Downlink can be supported in a way which has little impact on astronomy operations (aside from the reduced time

Proposal

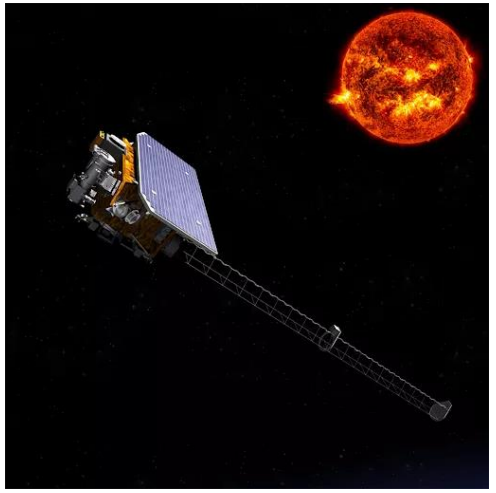
- Create an entity which can “sell” access to Australian astronomy infrastructure to support space missions.
  - Provides greater breadth of capability
  - Reduces duplication of effort and expertise for infrastructure operators
  - Single point of contact for “customers”
- Australian funding to this entity (e.g. Australian Space Agency, NCRIS capabilities) can be used to contribute to international missions.
  - Existing “Deep Space Networks” hosted in Australia provide little direct benefit for Australian Science or industry.
  - Up-front costs are minimal and the basic approach is highly scalable.



The Benefits – International Missions

- Constructing and operating ground segment infrastructure is expensive and outside your own jurisdiction there are many additional complexities.
- Ground segment support provided through an international partnership can reduce operation costs.
- Australia's large land-mass and location (both longitude and latitude) can be very important depending on the timing of mission critical events.

Deployment of NASA's psyche probe from the second stage of Falcon Heavy downlinked through the UTAS 26m antenna in Hobart

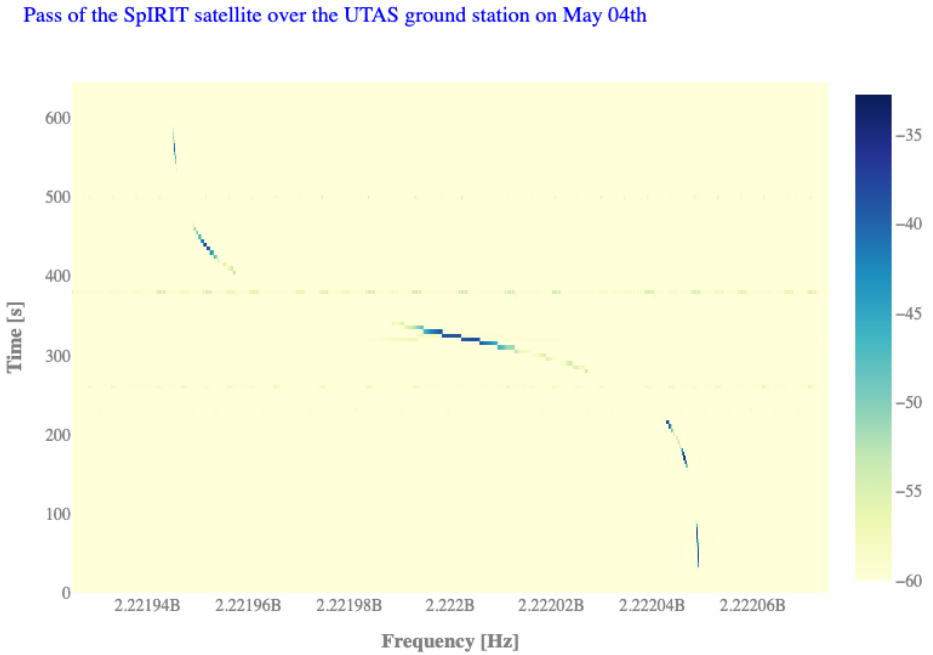


NOAA is looking for partners to support space weather missions such as the upcoming SWOF-L1

A 3m S-band up/downlink antenna at the UTAS Katherine site will support the HERMES constellation – launching in the next few weeks

The Benefits – Domestic Missions

- Australia has launched a small number of cubesats, with numerous other missions in development.
- Ground segment support adds cost and complexity to operations.
- It strengthens Australia's sovereign capability in space-related activities and connections across the sector.



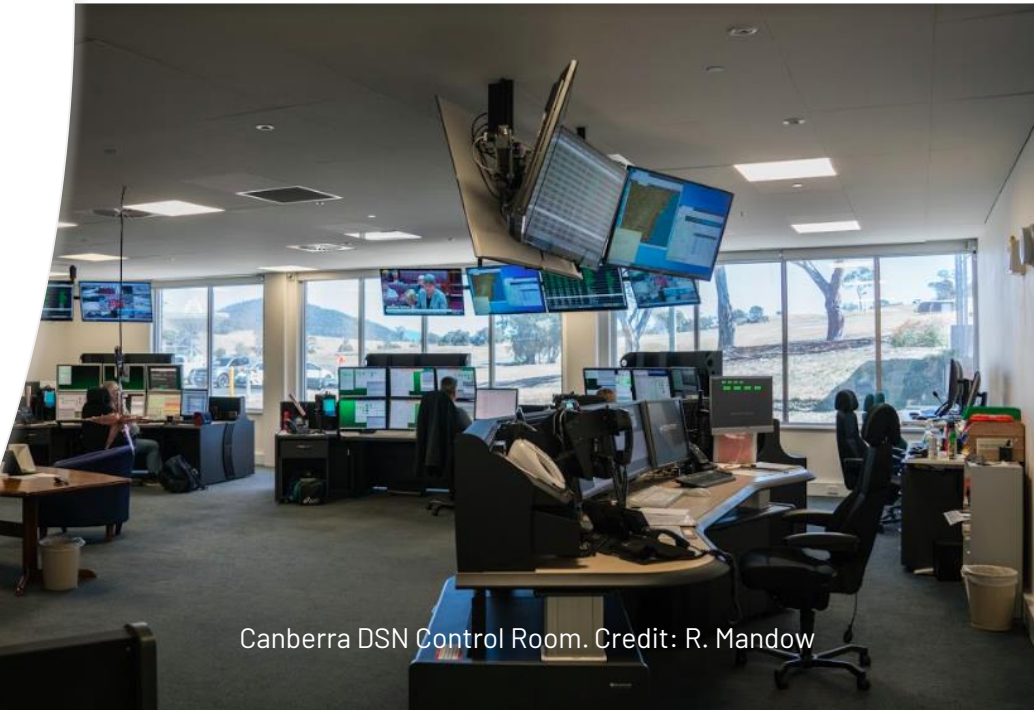
The Benefits – Astronomy Infrastructure

- Current Australian research grants do not cover the full cost of operating astronomy infrastructure facilities, this is an income stream outside of normal competitive grants
- The cost of back-end hardware required to record and decode downlink data is is modest (ball-park $100k).
- It can strengthen multi-disciplinary connections within the Australian research environment and
- Commercial service provision, support of space-based science missions and astronomy can all be supported by the same fundamental hardware.

The Cons

- It reduces the amount of time available for astronomical science on domestic telescopes. If research infrastructure can't provide enough time for the researchers we just created a new problem.
- Operation of a highly heterogeneous set of assets (location, capability, availability and ownership) adds complexity, hence cost.

Domestic ground-station as a service businesses like Nova systems and Capricorn Space should not be undercut by research infrastructure



Canberra DSN Control Room. Credit: R. Mandow

Summary

“Selling” some time on Australian astronomical infrastructure for space-industry related activities is

- Low up-front cost
- Low risk
- Benefits both the infrastructure operator and broader Australian science community
- Strengthens international partnerships

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New money, suit and tie
I can read you like a magazine
Ain't it funny? Rumors fly
And I know you heard about me
So hey, let's be friends
I'm dying to see how this one ends
Grab your passport and my hand

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Blank Space – Taylor Swift