

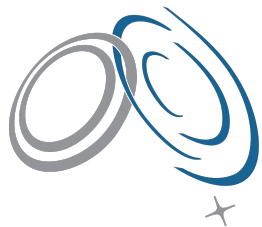


Astronomy
Australia
Limited

Coordinating Access and Managing Engagement with Large Optical Telescopes

Actions to secure
Australian optical
astronomy into the
next decade





Australian access to optical astronomy infrastructure over three decades

Before ESO: 2007 - 2016

During ESO: 2017 - 2027

After ESO: 2028 - ?



Anglo-Australian Telescope

Australian Government owned and operated

Sector agreed to take over AAT Consortium, with AAL as Manager, ANU as Operator, Government as Owner



8m access

Limited access to 8m facilities (Gemini, Subaru, Keck, and Magellan)

Access to ESO optical telescopes through Strategic Partnership at ~\$12m per year for ~45-60 nights with instrumentation, large programs



Next-gen facilities

Australia invested \$75m into the Giant Magellan Telescope (GMT)

Pathway to Extremely Large Telescope access with ESO membership

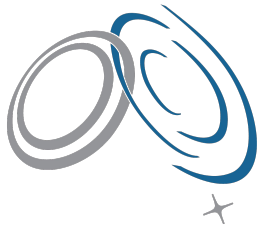


Instrumentation, data and software

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AAO instrumentation divested to Astralis, funded through NCRIS at \$5m/year (indexed). Domestic data and software capability grows with support from NCRIS.





Australian optical astronomy benefits for society

Optical astronomy investment

Technology spillovers

- Investment in instrumentation drives translational technologies e.g., mining, agriculture, environmental science
- Industry partnerships increase Australian expertise and export potential
- Data processing techniques directly benefit industry and other research, including high speed comms for space, AI applications

Societal benefit

- Translational tech and data expertise supports *Ambitious Australia* pillars, including Health and Medical, Defence, Resources and Technology
- Support for AAT drives jobs and tourism to regional Australia
- Australian leadership in int'l astronomy drives new investment

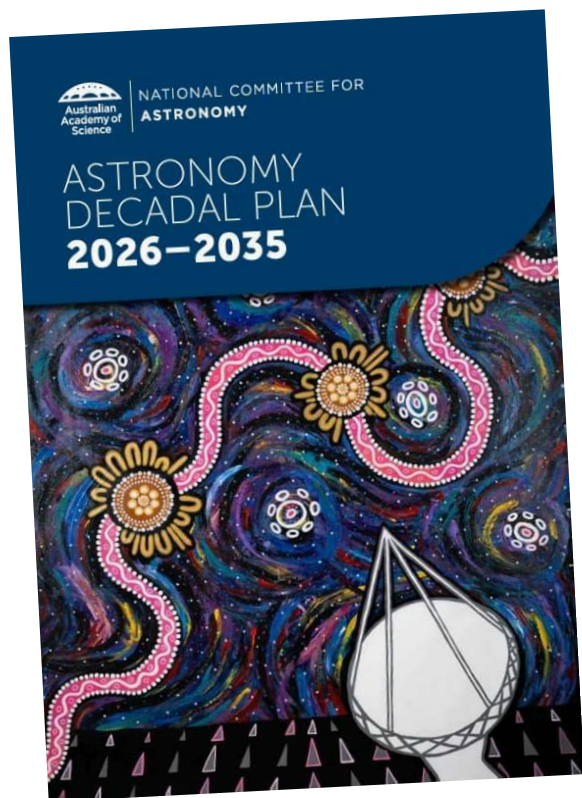
Inspiring STEM workforce

- A strong Australian astronomy sector fosters increased uptake in STEM courses
- Significant proportion of astronomy graduates enter high-need data and technical positions.
- Boosts Australian AI, software engineering, advanced manufacturing, and defence

Australian investment in optical astronomy supports 120 advanced instrumentation engineers; trains 100s of PhD students a year; underpins the work of 600 Aust. astronomers; and currently delivers \$330m in benefit to Australian economy each year



Australian astronomy **science priorities** for the next decade



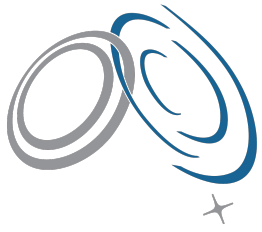
Priority Action 1A: Secure access to large optical telescopes and ALMA

“To answer the exciting astrophysical questions of the next decade ... it is critical that Australia secures access to **8-metre-class telescopes**, a **next-generation 30-metre-class telescope**, and the **Atacama Large Millimeter/submillimeter Array (ALMA)**.”

“The alternative to ESO membership would be a distributed portfolio of telescope access to multiple facilities ... This would include increasing Australia’s share in the **Giant Magellan Telescope (GMT)** to at least 10%.”

Priority Action 1B: Capitalise on Australia’s engagement with the SKAO and strengthen radio and optical scientific connections

“Maximising science with the SKAO can only be achieved with a strong scientific workforce and **access to global, large-scale optical and millimetre facilities** (such as ESO). The big science questions that Australia will solve demand **information across the electromagnetic spectrum**, married with theoretical research for interpretation.”



Sector consultation in light of **decision not to join ESO**

Nov 2025

NCA commenced contingency planning

Dec 2025

AAL and NCA formed working group from across astronomy sector for alternative access to large optical telescopes.

Focus on understanding costs involved in securing access to best facilities until one or more ELT-class facilities come online.

Feb 2026

Large Telescope Access Working Group (LTAWG) commenced meetings

April 2026

LTAWG concluded meetings and finalised options

Minister announced decision not to join ESO

May 2026

NCA-AAL Townhall with astronomy community (over 300 participants)

Early career researcher (ECR) consultation

July 2026

Briefings to Minister's Office/DISR, Heads of Astronomy Departments
Astronomical Society Annual Science Meeting - Town halls
Consolidation of community feedback



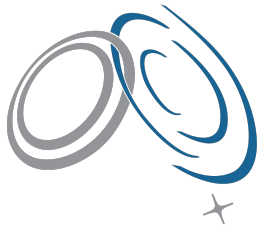
Early career researcher **consultation**

"Our science even with the **SKAO** will be limited without solid **multiwavelength** follow-up options."

"Whether this access will exist at all. **It's seeming like we will have no access to anything**, even the AAT, **within as short as 5 years.**"

"I am worried that **junior researchers will not get the ability to lead larger collaborations** that need significant telescope access, but can only be Co-Is on the next decade of large ESO programs."

"Concerned it will limit overall **Aus. astronomy diversity of expertise** ... will continue to end with ECRs being encouraged/driven to postdocs internationally and leaving Aus so **Aus astronomy community will suffer outflow of top researchers, and dwindling breadth of expertise.**"



Consultation outcomes: Australian optical astronomy infrastructure - **three 'actions' for the next decade**

1. Maintain our sovereign optical astronomy capability

Ensure **support for the AAT** while it still conducts competitive science

Enhance synergies with the SKA-Low and its precursors in Australia (MWA and ASKAP)

Grow our leadership in the SE Asia region through Australian SKA Regional Centre and regional node for LSST

2. Retain access to world leading 8m optical telescopes

To maintain the science leadership we have built over the last decade, **secure ~45-60 observing nights per year**

Pursue 1-2 partnerships to meet the community's needs with greatest ROI

Leverage our geographic advantage and **maintain a Southern hemisphere capability**

Pursue ambitious science by **supporting large programmes and national-scale science**

3. Secure access to next gen. 30m-class optical telescopes

The **Giant Magellan Telescope (GMT)** presents the only opportunity to ensure our science leadership grows with the next generation of facilities

Secure our leadership in **building GMT instruments through timely investment**

Leverage our sovereign capability in instrument building, software engineering, data and compute



Continued operations of the Anglo-Australian Telescope

Current state

AAT operations co-funded by a consortium of Australian universities, DISR (via AAL), and paid time to **June 2027**. In anticipation of Australia becoming a full member of ESO, universities committed to spend \$2.46m per annum on AAT through to December 2028. An extension to 2030 could be made subject to co-funding.

University-funded key science surveys aim to run to approx 2030, but don't cover the full costs to operate the facility. Operating costs as a research infrastructure facility approx. **\$5m/year**.

Proposed future state

Anchor **critical domestic capability in regional NSW** with a range of science and non-science benefits:

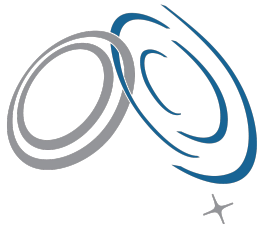
Performs **critical astronomical discovery work** to leverage Australian access to international facilities

Leverages **Dark Sky benefits unique to Australia** (unlike other 4m facilities globally)

Enables **new astronomy instrumentation research, demonstration, and testing**

Training capability for the next generation of Australian astronomers

Each of these options require time and funding to give confidence as new customers consider the opportunity to benefit from the site. This will be discussed further at a 23-24 July workshop.



Build on our **synergies** with Australia's substantial commitment to **the SKA**

Australia has the potential to build on its leadership, geographic role and large scale investment in the SKAO through a more modest investment in optical astronomy facilities.

Access to world-leading optical astronomy facilities is essential to maximise the science return from SKAO by driving new scientific discoveries that require multi-wavelength observations.

Key SKAO partners have full membership of ESO, allowing them to leverage a suite of the world's leading optical astronomy facilities including the ELT.

As one of the few SKAO partner countries with no planned access to world-leading optical telescopes after 2028, **Australian astronomers risk missing out on some of the most important discoveries with SKAO.**

Multiwavelength information is critical to form a complete view of celestial objects components (gas, dust and stars), their distribution and interactions. We are turning our data and software capabilities to start synthesising multi-wavelength data. Australia's leadership in this area forms part of the value we can bring to overseas partnerships, but we need access to optical facilities to make this possible.



We learn more about the Universe by exploring the cosmos at different wavelengths. Astronomers increasingly rely on information from multiple observatories—like radio and optical—to make next-generation discoveries.
Image Credit: NASA/University of Chicago.

Strategic Partnership: Japan

Japan has expressed interest in working with Australia in astronomy, space, and advanced manufacturing efforts. Their portfolio includes the Subaru Telescope, ALMA access, and more.

Subaru as a foundation

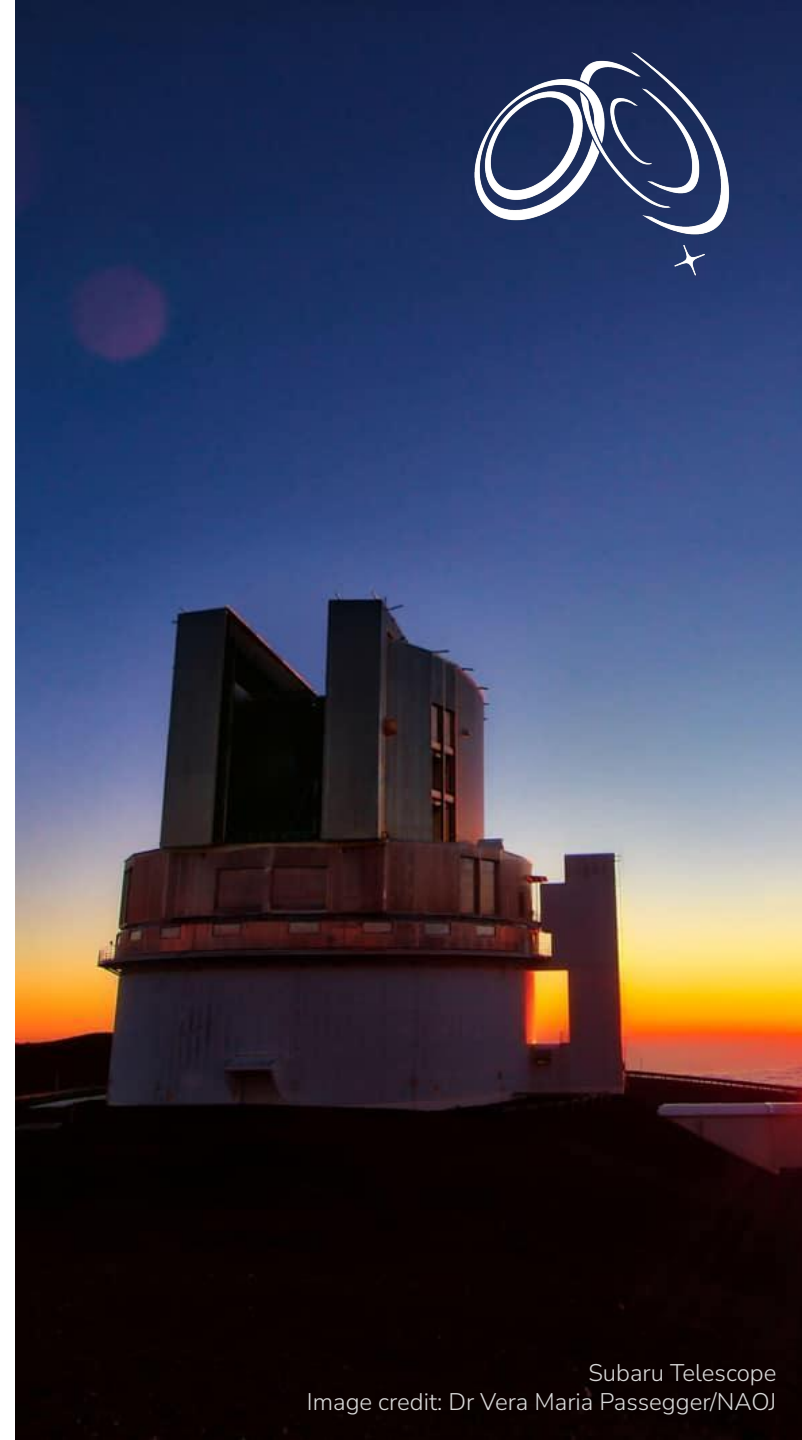
Japan wants to make Subaru an **international observatory** with >3-year partnerships. Partners can **propose and build instruments**. They also gain a seat on the newly-formed Board of Directors to **guide policy and development**.

Potential to **trade time and opportunities** on AAT, ATNF and software development, and **gain access to ALMA**.

National-scale partnership

Japan has expressed interest in Australian collaboration in **astronomy, space science, and advanced manufacturing technologies**.

Starting with an AAL-NAOJ partnership, a **national-scale strategic partnership** could provide astronomers with much-needed access to optical + radio, offer deeper collaboration with the **Japanese space efforts**, and **serve broader government interests**.



Strategic Partnership: **Chile**

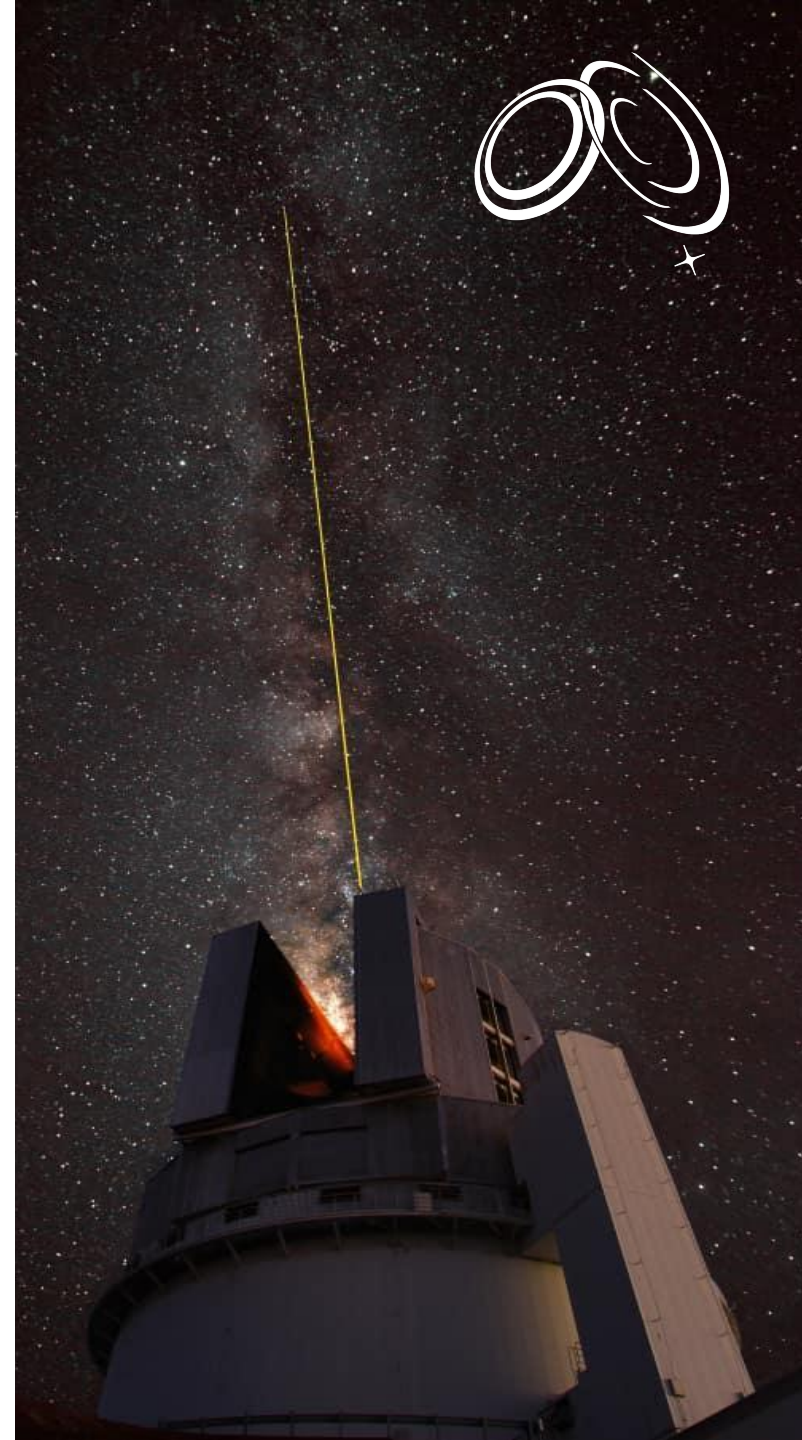
Chile is host to more than half of the world's total optical/IR collecting area, with a guaranteed 10% share of observing time on these facilities, and delivering access to the southern sky.

Personnel and secondments

A meaningful partnership with Chile could centre around **collaboration and exchange of personnel**, with Australians based at Chilean institutions eligible for Chilean observing time. Could start with an initial target of 10 nights/year. Could also open access to the **VLT, ALMA** and instruments not available via other facilities.

Data and computing exchanges

There are indications Chile wants to become an active technological contributor to the observatories it hosts; **Australia can offer high-performance computing, access to data and compute, radio technologies, and data processing** expertise to assist.



Securing southern sky access

A selection of facilities have the potential to offer Australia access to the southern sky and ensure a diverse portfolio to allow Australia to diversify instrument contracts and reduce reliance on one overseas facility.

Options include the **International Gemini Observatory** and **Magellan Telescope at Las Campanas**

Gemini

- Twin 8.1m telescopes in Hawaii and Chile. Owned and operated by a consortium of USA, Canada, Argentina, Brazil, and Korea.
- Unique, full coverage of both hemispheres—well-suited to SKA and LSST transient follow-up.
- Potential for instrument upgrades.

Magellan

- Twin 6.5m telescopes in Chile, operated by a consortium of US universities also building the Giant Magellan Telescope (GMT).
- Connects Australia more closely to the GMT community and instrumentation teams.
- Scope for data/software upgrades.



Top: International Gemini Observatory
Bottom: Magellan Telescopes
Image Credits: International Gemini Observatory /NOIRLab/NSF/AURA/P. Horálek (Institute of Physics in Opava), Yuri Beletsky



Maintaining our stake in the Giant Magellan Telescope

The GMT is a US\$2.5 billion facility due to come online in 2036. At 25.4m, it will provide Australia's only guaranteed access to an extremely large (30m-class) telescope.

The US National Science Foundation is expected to invest US\$1.4b after Final Design Review and move the project to Construction Phase.

Australia has invested \$75m into GMT so far. This currently provides an ~11% share, providing 33 nights per year and two seats on the Board – one for the ANU and one for AAL.

Six instruments are in design/construction, three led by Australian teams: GMTIFS, MANIFEST, and the Laser Tomography Adaptive Optics (LTAO) system.

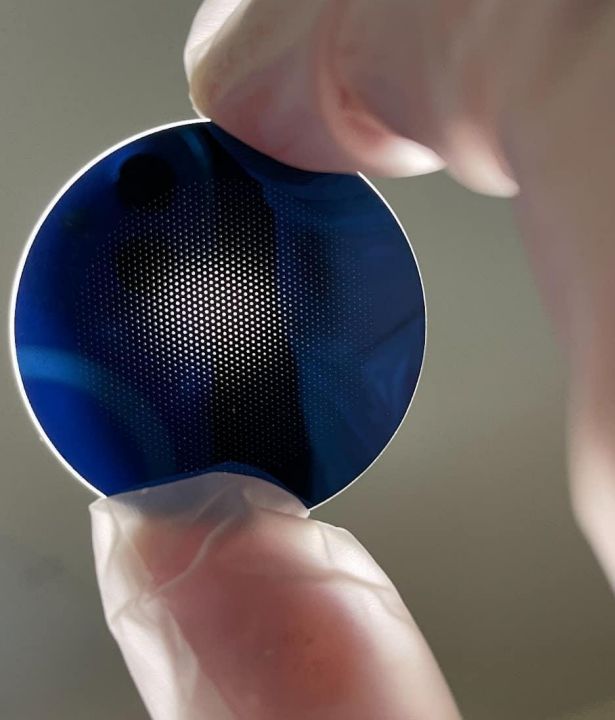
In the race to finish Final Design, **Australia's instruments are at risk of being de-prioritised.** Additional investments are needed.



Maintaining our stake in the Giant Magellan Telescope

Australia's investment into GMT in the coming years will determine its access to next-generation telescopes for the coming decades. Options are:

- 1.** **Maintain our final share at 26 nights per year** of an extremely large telescope (ELT) - an investment likely to be made via support for in-kind instrumentation construction costs in Australia of GMTIFS, MANIFEST and LTAO, plus yearly cash construction costs in the lead up to Construction Complete, comparable to the share of the ELT that Australia would likely have achieved as a full ESO member state.
- 2.** **Maintain minimum levels** for a single Australian Board member on GMT, at a reduced cost. Exact nights to be confirmed but certainly **expected to be lower than 20 nights/year**.



Leverage our **sovereign capability** in instrument building, software engineering, data and compute



Single, networked capability for Australia's world-leading optical astronomy instrumentation design and manufacture (\$200m revenue in last 10 years)

Single, networked capability for Australia's astronomy-derived computing, software engineering and data expertise

Delivers Australia guaranteed time on new observatories with home-grown instruments, including MAVIS

Delivers Australian access to new observatories via software and compute support, including Rubin Observatory

Can be scaled with new institutions, capabilities, and resources. Ensures optical astronomy investment is spent on-shore and supports Future Made in Australia

Expanding to support other NCRIS capabilities and industry. By scaling in-kind support, ADACS further supports on-shore investment and domestic compute/AI capability



Top: Astrometric calibration mask
Bottom: Swinburne's OzSTAR Supercomputer
Credits: Australian Astronomical Optics/Swinburne University of Technology

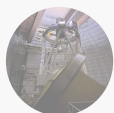


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Proposed future 'after ESO'



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Australian Government owned and operated

Sector agreed to take over AAT Consortium, with AAL as Manager, ANU as Operator, Government as Owner

Support AAT so long as it conducts valuable science; early stage instrument testing; explore space and other commercial uses



8m access

Limited access to 8m facilities (Gemini, Subaru, Keck, and Magellan)

Access to ESO optical telescopes through Strategic Partnership at ~\$12m per year for ~45-60 nights with instrumentation, large programs

8m access prioritised via Partnerships leveraging domestic capability (instrumentation, data and software), limited time purchase



Next-gen facilities

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Pathway to Extremely Large Telescope access with ESO membership

Maintain current or minimum share in GMT via investment in instrumentation and construction

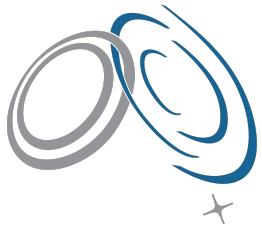


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Grow domestic capability in instrumentation, data and software footprint to facilitate in-kind contributions



Required elements for a future optical astronomy program



AAT

Maintain our sovereign optical astronomy capability through continued support for the AAT for the next 10 years as a strategically important national asset for astronomy and space. Funding ideally ramps down as mixed-use revenue offsets operating costs.

\$50m/10 years



8m access

Retain access to world-leading 8m optical telescopes with funding to access ~50 nights/year on 8m-class telescopes, focused on partnerships with governance influence, instrument development, and southern sky access.

\$75m/10 years



Next-gen facilities

Secure access to next generation 30m-class optical telescopes through Increased funding to maintain Australia's Board membership of the Giant Magellan Telescope. Optimise investment to secure domestic instrument development and manufacturing.

\$72m-\$200m/10 years



Instrumentation,
data and software

Build on and grow existing NCRIS-funded support for instrument development, manufacturing, and translation capability; investment in astronomy-based software engineering, compute, and data processing capabilities

NCRIS-funded

Total min. investment: \$197m/10 years

At least \$130m of this spent on-shore in Aust.