

NCA-AAL Large Telescope Access Working Group

Final Report June 2026

Executive Summary

In February 2026 the National Committee for Astronomy and AAL convened a Large Telescope Access Working group (LTAWG) to prepare a set of options to ensure that Australia is in the best possible position to ensure it has appropriate alternative access to world-class optical astronomy facilities should the government choose not to pursue full ESO membership after the conclusion of the 10-year Strategic Partnership. The LTAWG met weekly to canvass ideas while building upon the report of the Decadal Plan Working Group 2.1 on [International and Space Facilities](#).

The recommendations of the LTAWG can be summarised as follows:

1. Any assessment of access to 8m-class facilities must consider how they would deliver most effectively against the science needs of the Australian astronomy community, based on a number of key parameters that will need to be agreed in advance of access being sought.
2. Australia should seek to secure time, preferably via a secure partnership, on one or more of the Keck, Subaru, Gemini, and Magellan telescopes, with at least some of that time providing access to the entire southern sky.
3. Australia should establish a new bilateral Strategic Partnership with Japan and/or Chile with a view to maximising the opportunities for Australian benefits, including securing ALMA access in addition to optical facilities.
4. Australia should maintain AAT science operations for so long as the facility continues to support Australia's optical astronomy leadership and ensure it is embedded as an instrument testbed with a view to transitioning to a multi-use facility.
5. The Australian astronomy community should identify potential in-kind contributions that could leverage additional observing time while enabling maximum funding to remain on-shore, including observing time on Australian-operated facilities, instrumentation, software, and data services.
6. Australia should work to maintain its share of the GMT at close to the current level. As the project moves into its construction phase, additional investments will be made by the other international partners, to which Australia should seek to contribute - especially through Australian-led instrumentation.

LTAWG Membership

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Prof. Joss Bland-Hawthorn (U. Sydney)
Prof. Karl Glazebrook (Swinburne University of Technology)
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1. Partnership/Time Purchase Arrangements

In order to maintain Australia's current scientific standing in optical/near-infrared science and instrumentation as the SKA moves towards delivering science outcomes, the astronomy community **requires up to 60 (with a minimum of 45) nights per annum on 8m-class facilities**, based on the average level of access secured during the ESO Strategic Partnership. The 2026-35 Decadal Plan details the need for this level of access, as well as the specific classes of instrumentation required to fulfil the science priorities of the Australian astronomy community.

A portfolio at this level would enable continued instrumentation development, large-scale projects with significant national and international collaboration, and competitive small programs across a range of instrument capabilities that serve our wide community and offer return on investment to Australia. A partnership with one or more facilities would give Australia influence in the strategic direction of the facility and enable leadership of collaborative large programs and the instrumentation opportunities that lead to industry returns.

A minimally viable portfolio would result from direct purchase of nights from available facilities, with a preference for larger purchases from fewer facilities. Appropriate facilities for this purpose include the Magellan, Keck, Gemini, and Subaru telescopes. Some fraction of the purchased nights must provide coverage of the entire southern sky to maximise overlap with current national investments in radio facilities such as the SKA and its precursors, as well as the Vera C. Rubin Observatory.

The timing of access to 8m-class facilities will be a critical aspect of any arrangement to replace the ESO Strategic Partnership. Australia's current access to ESO facilities under the Strategic Partnership will cease at the end of Period 118 in April 2028, with the last opportunity for applications in this cycle closing in Sep 2026. Replacement partnership arrangements would need to be in place in sufficient time to allow time assignment on relevant facilities ahead of access by January 2028.

8m access options

The 8m-class facilities across the globe provide a variety of capabilities and access models summarised in [Table 1](#), each presenting benefits and challenges. Not all of the available 8m class facilities offer the capabilities needed by the Australian astronomical community in order to maintain its current levels of scientific leadership. The key science questions prioritised by the Decadal Plan have specific instrumentation requirements (cf. Section 5.1 of the Decadal Plan).

The two 10m telescopes of the **W.M. Keck Observatory** on Maunakea in Hawaii are owned and operated by a consortium of American universities. They have an existing partnership with Swinburne University of Technology. The Keck consortium has expressed interest in Australia joining as a partner or purchasing nights; details of the level of partnership would need to be negotiated. A partnership would ideally provide a comparable number of nights as the ESO Strategic Partnership, as well as instrument development opportunities. The Keck instrumentation suite is well-matched overall to the Australian community's current needs (based on the Decadal Plan and Australian ESO usage over the last 8 years) and well equipped with adaptive optics capabilities. However the Keck telescopes have limited visibility of the southern sky. It is less clear that buying nights on Keck or entering with a small

partnership share will result in the same collaborative opportunities afforded by e.g. a nation-level agreement. Australia could help to build a Keck Wide-field Imager, but would need to ensure national access for over a decade before that facility would be completed and deliver science observations.

The single 8m **Subaru telescope** is owned and operated by Japan and is located on Maunakea in Hawaii. A category of Subaru partnership is available which offers 25 nights/year (US\$2M/yr) including multi-partner program access, large program access, and access to instrumentation contracts. Subaru is still actively looking for partners but this option would provide less than half of the current access to 8-metre-class facilities. The Subaru instrumentation suite is well matched to the wide field strengths of the Australian community and in 5-10 years will be well suited to partial SKA follow up. In the short term however Subaru lacks key capabilities for our community, in particular for optical and infrared integral field spectroscopy (these capabilities represented almost 30% of 8m ESO requests, and were used by 3 of the 4 Large Programs won over the last 8 years). Subaru lacks a precision radial velocity capability for exoplanet work, and has limited visibility of the southern sky.

Follow-up of SKA and LSST sources from Hawaii would be limited to those north of -30° , making 1/2 of the southern hemisphere inaccessible. For populations of objects distributed evenly across the sky (e.g. galaxies) this impact will be modest, but for many interesting targets south of -30° (e.g. the Magellanic Clouds, the Galactic bulge and centre) access to just Hawaii-based telescopes would mean Australia relying solely on the AAT or (eventually) GMT for that science. Given this context, access to a southern 8m-class telescope would be a highly desirable complement. In this regard some form of access to the international **Gemini Observatory**, with its twin 8.1 m telescopes in Hawaii and Chile uniquely providing full coverage of both hemispheres, warrants consideration. Australia built, and continues to deliver, some of the most reliable Gemini instruments (NIFS, GSAOI, NGS2, GHOST, and the new Gemini North Adaptive Optics bench), providing a solid basis for further instrument upgrades, visitor instruments, and personnel secondments that could yield significant additional nights of southern hemisphere access.

The **Magellan consortium** of American universities and institutions operates two 6.5-metre optical/infrared telescopes at Las Campanas Observatory in Chile – optimal for synergies with both the SKA and LSST. Accessing Magellan time is likely to be possible on short and flexible timescales. The Magellan facilities also connect Australia closer to the GMT community and instrumentation teams. There is no clear path to full Australian partnership in the Magellan consortium within the coming 3-5 years. Magellan access would therefore require buying nights from existing Magellan members (e.g. Carnegie, MIT, U. Michigan) or via in-kind contributions. The twin 6.5m telescopes have a smaller aperture than the 8m Subaru and 10m Keck, and fewer adaptive optics-enabled instruments than Keck.

Other 8m-class facilities are available (e.g. SALT, LBT, GranTeCan) and have been considered by the LTAWG, but largely discounted on the basis of an instrumentation suite that is viewed as either uncompetitive and/or not well-matched to the needs of the Australian community.

Table 1: Summary of 8m class facilities split by instrumentation capability

	Keck [USA]	Subaru [Japan]	Gemini [USA, Canada, Argentina, Brazil Korea]	Magellan [USA]	Fraction of time requested on comparable ESO instruments
Hemisphere	North (+20)	North (+20)	Both (+20 & -30)	South (-29)	
Open to partnership?	Yes	Yes	Yes	No	
High-Res Spectroscopy (Optical)	HIRES R~85K, 0.3-1.0 μm KPF R~98K, 0.44-0.87 μm ESI R~13K single object echellette	HDS R~160K	MAROON-X R~80K, 0.5-0.9 μm (North) GHOST R=56K/76K, 0.38-1.0 μm (South)	PFS R=38K-190K, 0.39-0.74 μm MIKE R=65K+85K, 0.33-0.95 μm	UVES (12%)
High-Res Spectroscopy (Infrared)			IGRINS-2 R=45K, 1.5-2.5 μm (South)	**MAGNIFIES (on sky in ~3 years) 1-5 μm	CRIRES (1%)
Wide-Field MOS (Optical)	DEIMOS 16'-long multislit R~5K	PFS 2400 fibres over 1.25deg diam FoV FOCAS 6' circle multi-slit	GMOS 30-60 slits over 5.5' FoV (Both)	IMACS up to 15.4' long multislit, R=20K M2FS - 256 fibres over 30' FoV at R~1500-32K	FLAMES (11%)
Wide-Field MOS (Infrared)	MOSFIRE 6.1'x6.1' 46 slits 1-2.3 μm	MOIRCS 60 slitlets 7'x4' 1-2.2 μm	FLAMINGOS-2 R~1K-3K, multi-slit 6' x 2' FoV, 1.0-2.4 μm (South)		
IFU Spectroscopy (Optical)	KCWI 20'x33' image slicer 0.35-1.0 μm		GMOS 5"x7" lenslets, 0.4-1.1 μm (Both)	LLAMAS 35"x35" lenslets, 0.34-1.0 μm R=1000-2500	MUSE (35%)
IFU Spectroscopy (Infrared)	OSIRIS 8'x8' R~3600, 1-2.3 μm (AO)		GNIRS 1.25"x1.80", R=1200-19000, 1.0-5.4 μm ; or 3.15"x4.8", R=1700-7200, 1.0-2.5 μm (North)	ROSIE 52"x26" slicer, R=1000-15K, 0.4-1.0 μm	KMOS (3%)

	SCALES 2"x2" R~50-5K, 2-5 μm (AO)				ERIS/SINFONI (4%)
Slit Spectroscopy (Optical)	LRIS R~300-500	FOCAS R~300-5000	GMOS R=200-8800 (Both)	MagE R=4100, 0.32-1.0 μm	XSHOOTER (18%)
Slit Spectroscopy (Infrared)	NIRES R~2700 echellette 1-2.3 μm NIRSPEC R~25000 1-5.5 μm	IRCS R~100-700 1-2.2 μm	GNIRS R=1200-18000 1.0-5.4 μm (North) FLAMINGOS-2 R=1000-3000, 0.9-2.5 μm (South)	FIRE R~500, 2500, 0.85-2.3 μm	
Optical Imaging	LRIS 6'x7.8' DEIMOS 16.7'x5'	HSC 1.5° diam FoV	GMOS 5.5"x5.5" (Both) Alopeke/Zorro speckle mode imaging, 5.6" FoV (Both)	MegaCAM 24'x24' IMACS 12' diam FoV MagAOX 0.65-0.9 μm	^FORS2 (6%) ^SPHERE (2%)
Infrared Imaging	NIRC2 10"x10" to 40x40", 1-5μm (AO) SCALES 12"x12", 1-5μm (AO)	MOIRCS 4'x7', 1-2.2 μm IRCS 21", 54" field, 1-2.2 μm (AO)	GNIRS 99"x10" 1.0-3.3 μm (North) FLAMINGOS-2 6' round FoV, 0.9-2.5 μm (South)	FourStar 10.8'x10.8', 1-2.3 μm	HAWK-I (3%)

**Not yet offered in regular science operations; ^cannot distinguish imaging vs spectroscopy proposals

2. Establish Bi-national Strategic Partnerships

Compared with purchasing nights, Strategic Partnerships provide an opportunity to secure more stable amounts of observing time over longer timescales, and a greater prospect of undertaking Large Programs on a collaborative basis. A Strategic Partnership would also provide the opportunity for Australia to have access to the Atacama Large Millimetre/sub-millimetre Array (ALMA) through mechanisms beyond the Open Skies process. A Partnership also offers the opportunity for Fellowships and professional training to increase scientific and engineering collaboration. Country-to-country level Strategic Partnerships may also present an opportunity for Australia to point to concrete bilateral engagements and strengthen diplomatic relations with key economies.

Option 1: Japan

There may be scope for Australia and Japan to trade observing nights on facilities of reciprocal interest, boosting instrument development collaboration, with other opportunities to be explored. Since 2017 the nodes of the Astralis – National Optical Instrumentation Consortium have maintained their engagement with Japan on both the ULTIMATE-Subaru and the SCEXAO facilities, and a number of Australian astronomers have been part of the 5 year (and recently renewed) [Super-IRNET](#) JSPS-funded collaboration. Japan is a member of the ALMA East Asia consortium (along with Taiwan and South Korea) which contributes 25% of the total ALMA budget + antennas and receiver packages, getting ~25% of the ALMA time in return. Australia might seek to join the ALMA East Asia consortium, contribute its radio technology expertise, and apply for ALMA time on an equal footing with astronomers in the ALMA consortium. Japanese institutions are partners in the Australian-led Murchison Widefield Array (MWA) consortium, have a strong role in the CTAO and an active mid-frequency Very Long Baseline Interferometry (VLBI) community. Together with Korea, Thailand and Indonesia, Japan has expressed interest in low-frequency VLBI, as being led through the [LAMBDA](#) project within CSIRO that is placing standalone SKA-Low stations across Australia (and eventually across Asia). Japan is on the pathway to becoming a full member of the SKAO.

There is a compelling opportunity to pursue a Strategic Partnership with Japan to enable Australia to become a long-term partner in the Subaru Telescope, providing access to instruments including the newly-commissioned PFS (Prime Focus Spectrograph); SCEXAO (Subaru Coronagraphic Extreme Adaptive Optics) feeding visitor instruments including the Australian-built VAMPIRES; and the opportunity to collaborate on delivering significant components of the upcoming ULTIMATE-Subaru Ground Layer Adaptive Optics system, including the imager and/or IFU spectrograph it will feed.

In exchange Japan could receive a share of time on the AAT (the only 4m-class telescope and the only southern hemisphere wide-field optical telescope that Japan would have access to),

and potentially time on existing ATNF facilities, expanded collaboration in VLBI, and active involvement in future ATNF projects, such as an aperture array or ASKAP upgrades.

Option 2: Chile

As host country to more than half of the world's total optical/IR collecting area, Chile has long enjoyed a guaranteed 10% share of observing time on these facilities, awarded to astronomers and graduate students based at Chilean institutions by the CNTAC (Chilean Telescope Allocation Committee). Typical oversubscription factors are between 2 for the smaller telescopes, and 4 for the larger telescopes. Chilean institutions contributed receiver optics for the ALMA Band 1 and Band 2 receivers, and are also partners in the Multi-Object Optical and Near-infrared Spectrograph ([MOONS](#)) consortium, contributing to mechanical, opto-mechanical, and systems engineering aspects of this new VLT instrument.

A strategic partnership with Chile could centre around collaboration and exchange of personnel via Fellowships, Studentships, and secondments. Australian researchers hosted at Chilean institutions would be eligible to apply through CNTAC. Access to Australian HPC/GPU facilities and expertise, both for data processing as well as theoretical modeling and simulations may also be of interest. There are recent indications that the Chilean government is keen to move beyond being merely a host country, to being an active technological contributor to these observatories, creating opportunities for Chilean institutions to collaborate with CSIRO Space & Astronomy on radio technologies, and with Astralis on optical/IR development.

Critically, this is the only pathway for Australia to access the milli-arcsecond resolution capabilities of the Very Large Telescope Interferometer (VLTI) without relying on the ESO Open Skies process. While Australian demand for VLTI time has made up <2% of total ESO requests, Australia is making significant contributions to the new Asgard visitor facility on the VLTI which has no GTO, and so any usage can only come via the ESO proposal process.

3. Instrumentation, Software and Data In-kind Contributions

Australia's long-term success in astronomy depends not only on scientific vision but on sustained investment in the specialised technical workforce that enables it. Precision instrumentation experts, scientific software engineers, and data engineering specialists form the backbone of modern observational capability. They design, build, operate, and optimise the complex systems that turn photons into knowledge. As global astronomy becomes increasingly data-intensive and instrumentally sophisticated, maintaining and growing this cadre of highly skilled Australian engineers is both a national asset and a strategic imperative.

Alongside measures to secure observing time through purchase or partnership, in-kind contributions of new/visiting instruments, software and data services should be actively explored as a mechanism to return additional observing time. These contributions have a significant benefit in that nearly all the funding that goes into them remains in Australia, to pay for highly-

skilled technical personnel who can live and work locally while carrying out work on behalf of international observatories.

Instrumentation

Australia has an established history of designing and building innovative astronomical instrumentation, characterised by deep collaboration of astronomers and engineers, and spanning across astronomy domains from radio to optical to gravitational waves. However, instrumentation programs also provide key strategic benefit to the astronomical community far in excess of their discovery potential alone: they provide access to state-of-the-art telescopes; keep existing facilities globally competitive; are a valuable bargaining chip when joining large international collaborations; provide diversified astronomy-related training and career paths; and seed spin-off companies and industry engagement. Sovereign instrumentation development also provides opportunities for Australian scientists to drive observatory capabilities, proposing and leading instruments of specific interest to the Australian community.

The Astralis Instrumentation Consortium ('Astralis') was created by moving the instrumentation activities of the former national optical observatory (the Australian Astronomical Observatory) to the University sector. Astralis facilitates coordination of national instrumentation capabilities on the global stage, creating a collaborative platform through which the scale and diversity of expertise required to lead or partner in major instrument projects could be established. Astralis currently supports a range of instrumentation-related activities, from the decade-scale multinational MAVIS facility instrument for the VLT, to seeding industry engagement activities and translational technology development. Most importantly, Astralis has provided a modest but stable base of funding for consortium members, allowing them to successfully collaborate and compete for large and long-term projects that return value to the national community; retain highly-skilled staff through variable project and institutional budget cycles; and invest strategically in developing new partnerships and capabilities, including sizable institutional investments in facilities. The importance of this stability cannot be understated – it is the only way to engage with major projects, and to remain competitive with other countries where long-term funding is well established.

Australia pioneered the use of optical fibres for multi-object spectroscopy, beginning with 2dF on the AAT and 6dF on the UK Schmidt, through to the AESOP fibre positioner for the 4MOST telescope that will drive new multi-year surveys of millions of stars and galaxies, with several key programs led from Australia. Future projects include the MANIFEST positioning system for the GMT that recently passed its Preliminary Design Review. In parallel, the Australian community was an early adopter of the now mainstream technique of Integral Field Spectroscopy (IFS) beginning with the Australian-made Gemini/NIFS instrument, through to the SAMI and now HECTOR instruments on the AAT carrying out large scale multi-object IFS surveys, and the upcoming GMTIFS instrument for the GMT. Australia has growing capabilities in various methods of adaptive optics (AO), now a core technology at all major observatories. Astralis nodes are key partners in many new AO projects, including MAVIS, GMT's laser tomographic AO, Gemini North's AO upgrade, and innovative photonics-based technology for high-contrast imaging at Subaru.

In order to maintain Australian access to GTO on 8m-class telescopes, Australia will need to ensure that its current commitments to deliver instrumentation for 8m-class telescopes are met. In particular the Australian community stands to receive ~120 nights with MAVIS once commissioned. There is scope to obtain additional nights over and above those from time purchase or observatory partnership through additional offers of in-kind contributions of existing instruments in visitor mode; new instruments of mutual interest which could be delivered on relatively short (within 3 years) timescales; or software pipelines and data archive enhancements.

Software and Data services

Australia is globally recognised for delivering high-impact astronomical software, data engineering, and data-intensive research infrastructure. These contributions underpin national participation in major international observatories and enable world-leading science across radio, optical, infrared and gravitational-wave astronomy including:

- Data Central science platform (Macquarie).
- Astronomy Data & Computing Services (Swinburne, Macquarie, Curtin): providing software development and data management services and training, to support community engineering needs.
- Rubin Observatory software and data engineering (Macquarie, Swinburne) that returns data access rights to the Legacy Survey of Space and Time (LSST) to much of the Australian community.
- Instrument and astronomy software via Astralis.
- Data-intensive software and HPC provision (Swinburne).
- National datasets and archives (CASDA, ATOA, GWDC, etc.).
- Contributions from other institutions including UWA, CSIRO and the ANU.

Australia's Strategic Partnership with ESO has enabled the nation not only to access world-class facilities but also to contribute technical expertise that is central to ESO's operational success. Key Australian contributions to the scientific productivity of ESO's observatories include delivering core scientific data pipelines for the VLT; contributing to the modernisation of ESO's software ecosystem (PyCPL); and instrument software for major ESO projects. Deepening engagement and expanding contributions with Vera Rubin Observatory, SKAO, and GMT can provide long-term, high-impact roles, in areas such as:

- Large-scale data processing.
- Science data platform development.
- Automated operations and scheduling.
- Calibration and data reduction algorithms.
- Workflow optimisation for petascale data volumes.

As Australian industry, particularly small and medium enterprises, faces mounting pressure to adopt AI tools or risk falling behind international competitors, the challenge is not merely access to technology but readiness to use it effectively. AI systems are only as capable as the data that underpins them. Decades of rigorous, large-scale data curation in astronomy research has

produced both proven methodologies and a cohort of experts fluent in applying them. While Australian astronomy does not have a long track record in the AI/LLM space, the ADACS-Swinburne node has recently been tasked by Rubin Observatory with implementing an AI chatbot trained on the extensive project documentation, as part of Australia's in-kind contributions.

Leveraging Australia's existing footprint in optical and related observatories

The Anglo-Australian Telescope (AAT) continues to be a scientifically competitive facility and offers the opportunity for use by partners as an in-kind contribution in return for access to world-class facilities. There continue to be opportunities for the AAT to serve as an instrument testbed to test and de-risk projects before being delivered to customers in overseas facilities. Australia should maintain AAT science operations for so long as the facility continues to support Australia's optical astronomy leadership and ensure it is embedded as an instrument testbed with a view to transitioning to a multi-use facility. A baseline contribution to AAT operations while it continues to undertake internationally competitive science would ensure that it remains as a valuable instrument for the purpose of offering in-kind contributions in return for relevant overseas facilities. There are also opportunities to explore access to ATNF and other non-optical facilities where they are valued by international partners.

4. Securing the Future: Investing in GMT

In addition to ensuring access to 8m-class telescopes following the conclusion of the ESO Strategic Partnership from 2028, Australia's continued astronomy leadership relies on having access to the next generation of optical facilities as they become available. There will be challenges in identifying a pathway to access ESO's ELT in the absence of a new relationship with ESO and/or any of its participating countries. However, Australia has the opportunity to leverage its existing investment in the GMT, by delivering priority access to an instrumentation technology pipeline on this next generation facility.

Building on its existing membership of the GMTO, Australia should continue to invest in construction costs and in-kind instrumentation capabilities to protect Australia's early investment in next generation facilities ahead of them coming online. GMT will provide a broad and powerful instrument suite in its first generation. Of the six instruments in design/construction, two (GMTIFS and MANIFEST) are being led by Australian teams as well as the Laser Tomography Adaptive Optics (LTAO) system.

As expressed in the last two Decadal Plans, the Australian astronomy community has targeted a 10% share (33n per year) of a 30m-class telescope. To raise Australia's share of GMT to this level once the facility moves beyond design and into construction and operations phase would require additional investments by one or both of the Australian Founders (AAL and ANU) as a proportionate share of the US\$400m left for Founder raising in the construction phase (plus ~US\$7m per annum in the post-2035 operations phase).

A more likely option for consideration is an investment of ~US\$90m in-kind towards the instrumentation construction costs in Australia of GMTIFS, MANIFEST and LTAO, plus ~US\$44m (at US\$4m p.a.) in cash in the lead up to Construction Complete. Such an investment would raise Australia's final share of GMT back close to a 7.8% level (~26 nights per year), comparable to the share of the ELT that Australia would likely have achieved by becoming a full ESO member state. If Australia contributes nothing further to construction costs, its share of the final project will drop to 4.1% (roughly 13.5n per year) once the US National Science Foundation joins as a 50% partner after the completion of the Final Design Review.