

29 January 2010

House Standing Committee  
on Industry, Science and Innovation  
Parliament House  
Canberra, ACT 2600

### **Submission to the inquiry into Australia's international research collaborations**

#### *0. Background.*

The National Committee for Astronomy (<http://www.aao.gov.au/nca>) is one of the National Committees of the Australian Academy of Science. The NCA exists to foster astronomy in Australia, to liaise with international scientific bodies, and to advise the Council of the Academy on relevant matters. The NCA acts as the peak scientific body for astronomy in Australia, with the aims of promoting the national value and benefits of the astronomical sciences, facilitating community-wide strategic planning initiatives, and managing relations between Australian astronomers and the International Astronomical Union.

Astronomy Australia Limited (<http://www.astronomyaustralia.org.au>) is a not-for-profit company limited by guarantee whose members are those Australian universities and research organizations conducting astronomy research. AAL acts as the peak infrastructure body for astronomy in Australia and its core business is to manage programs that provide astronomers with access to national optical/infrared and radio astronomy infrastructure. AAL's vision is to provide an efficient structure to facilitate Australian investment in astronomical facilities and to be recognized by the stakeholders of Australian astronomy as the organization to co-ordinate matters of national astronomy infrastructure.

The NCA and AAL offer this joint submission to the inquiry into Australia's international research collaborations. Issues pertaining to each of the inquiries' terms of reference are discussed in the following sections.

#### *1. The nature and extent of existing international research collaborations.*

Australian astronomy has substantial international research collaborations at national, institutional and individual levels that deal with matters including specific research projects, institutional collaborations, international research facilities and the international infrastructure of the discipline.

The major collaborations at the national level include:

- The Anglo-Australian Observatory (AAO), founded in 1974, is one of the longest-running major international facilities. It operates the 4-metre Anglo-Australian Telescope near Coonabarabran in northwestern NSW.
- CSIRO operates the Australia Telescope Compact Array and Parkes radiotelescope. Over 40% of time competitively won on these facilities is for programs led by overseas-based astronomers.
- Australia (represented by the ARC and AAL) currently has a 6.2% share in the two Gemini 8-metre optical telescopes (one in Hawaii and one in Chile) and buys access to the two Magellan 6.5-metre optical telescopes (also in Chile).
- Australia has a 10% share in the 25-metre Giant Magellan Telescope (GMT), which is the US\$700 million next-generation optical telescope being built by a consortium of major US institutions, Korea and Australia (represented by the ANU and AAL); GMT is currently in the design development phase.
- The Square Kilometre Array (SKA) next-generation radio telescope, which Australia aims to host and which is expected to cost on the order of €2 billion. SKA is 19-nation international collaboration. As part of international collaboration in radio astronomy, CSIRO has formal MoUs with institutions Canada, Germany, China and Netherlands.
- The Australian SKA Pathfinder (ASKAP), currently under construction in Western Australia, is a collaboration with the Dominion Radio Astrophysical Observatory of Canada. The survey science programs to be carried out with ASKAP involve over 350 astronomers from 161 institutions in 11 countries.
- Australia is also involved in the Murchison Widefield Array (MWA) program, a joint Australian-US-Indian project to build a low frequency telescope at the Murchison Radioastronomy site in WA.
- CSIRO operates the Canberra Deep Space Facility, including the 70-metre radio telescope, with funding in part from NASA, for spacecraft communications and radio astronomy research.

Some examples of significant collaborations at the institutional level, of which there are many, include:

- UNSW is collaborating with Chinese institutions to study the potential of astronomical sites on the high Antarctic plateau in the Australian Antarctic Territory.
- The AAO, the University of Sydney and the Astrophysikalisches Institut Potsdam in Germany are collaborating on a research program in astrophotonics, applying photonic technologies to astronomical instrumentation.
- The AAO and the Research School of Astronomy & Astrophysics at the ANU collaborated with various international institutions (including Gemini and GMT) to design and build astronomical instruments for large optical telescopes.
- Swinburne University of Technology is collaborating with Caltech and the Keck Observatory to buy access to the 10-metre Keck telescope.
- The University of Tasmania is a member of the International VLBI Service for Geodesy and Astrometry and also of PLANet, an international collaboration to monitor gravitational microlensing to detect extra-solar planets.

- Graduate students: At the time of the last national survey (for the Astronomy Decadal Plan in 2005) 29% of the 157 students enrolled in Australian PhD programs in astronomy and astrophysics are international students. This is comparable to the percentage of international graduate students in astronomy in the US at the same time (30-33%).

At the level of individual researchers, international collaboration is the norm – there are very few Australian astronomers who do not have international collaborators and/or use international facilities in their research. Conversely, a large fraction of the time (typically 30-40%) on Australian facilities such as the Anglo-Australian Telescope and the Australia Telescope National Facility is used by international researchers (largely, though not entirely, in collaboration with Australian astronomers).

## 2. *The benefits to Australia from engaging in international research collaborations.*

- It is not a coincidence that astronomy is both one of the most internationalized and one of highest-impact fields of Australian research.
- Access to international facilities. Some international facilities are open-access, but many are not (and the trend seems to be in the direction of less-open access). Collaborations with international researchers based on sharing access to Australian expertise or facilities are a cost-effective and flexible way of allowing Australian astronomers to gain access to otherwise closed-access facilities and resources. Such collaborations need only be engaged in when there is benefit to both parties, but obviously this requires that the Australian collaborator has something of value to the international collaborator – if Australian astronomers do not have unique or at least valuable resources to trade, international collaborations will fall away.
- Access to expertise. The Australian astronomy community is relatively small compared to the international community (around 2% of all astronomers), and therefore cannot have expertise in all areas of the field. International collaborations therefore allow Australian astronomers to tap into a much wider pool of knowledge than is otherwise available.
- Quality assurance and maintenance: Without a high level of international collaboration it would be difficult for either individual researchers or the Australian government to assess the quality of Australian research. Collaborations not only expose Australian researchers and students to the world's best practitioners, they also provide a marketplace for assessing the value of Australian expertise, facilities and other resources.
- Mutual benefits. Because astronomy is a fundamental science with relatively little direct application, there is relatively little reason not to make it as open as possible, and great mutual benefit to all involved in international research collaborations. One exception to this general rule is with regard to astronomical technology, where protection of intellectual property can be important due to the potential for significant commercial spin-off technologies and products (the classic case being the CSIRO Radiophysics development of the technologies underlying the ubiquitous use of WiFi communications).
- Research training and recruitment. Training the best PhD students from overseas provides not only high quality research output for Australia during the time of the students' candidature but also direct and continuing research links between Australian institutions and those in the students' home countries.

3. *The key drivers of international research collaboration at the government, institutional and researcher levels.*

- Researcher level. The key drivers for Australian astronomers to participate in international collaborations are: (i) access to facilities and resources not otherwise available; (ii) access to expertise and skills not available in Australia; (iii) prestige and status from working with the world's best researchers; and (iv) funding opportunities that are otherwise unavailable.
- Institutional level. International collaborations at the institutional level are driven by many of the same issues as the collaborations at the researcher level, with the difference that the scale of the projects is larger, involving a significant group of researchers and/or funding at a level not accessible to individuals. One difference is that while individual astronomers are generally willing to collaborate equally with either national or international colleagues if it is to their advantage to do so, institutions (particularly universities) sometimes prefer to collaborate more with international counterparts than other Australian universities, due to the fact that they are in direct competition with the latter (but not the former) for prestige and funding. Institutional collaborations are therefore occasionally at odds with the optimal collaborative arrangements at both the individual and national level.
- National collaborations. Research collaborations at the national level are generally driven by the need for resources on a larger scale than individual institutions or the Australian government are willing or able to provide. The usual object of such collaborations is the provision of major research facilities, such as large telescopes. However there are also major elements of international professional infrastructure (such as the International Astronomical Union) in which Australia participates on a national level.

4. *The impediments faced by Australian researchers when initiating and participating in international research collaborations and practical measures for addressing these.*

- Researcher level. One of the major impediments to international collaborations at the level of individual researchers is lack of access to sufficient funding for travel. Australian researchers necessarily have higher travel costs than their international counterparts due to our remoteness. This is compounded by the low overall level of funding available through the major grant programs such as the ARC's Discovery-Projects, where travel funding often has to be cut to support basic project elements such as salaries and equipment. While the Access to Major Research Facilities program administered by ANSTO provides some help for astronomers travelling to access overseas facilities, it too is unable to meet all the demands of increasing levels of international collaboration.
- Institutional level. Unlike countries such as the United States, the United Kingdom and the Netherlands, Australian institutions may only offer a small number of international student places in PhD programs, principally through the Government's Endeavour International Postgraduate Research Scholarship scheme (IPRS). However, the low total number of IPRS places available across all disciplines means that international students wishing to undertake PhDs in Australia must attain an extremely high standard of scholarship to even be considered. The consequence of this is that the vast majority of students from the Asia-Pacific region are undertaking their doctoral research in the US, the UK or other parts of Europe.

- National level. The Australian government has been highly supportive of Australian astronomers' involvement in major international research collaborations, particularly for accessing existing large telescopes (e.g. Australia's partnership in the twin Gemini 8-metre telescopes) and for constructing next-generation facilities (e.g. the major investments in the Australian SKA Pathfinder, as a step towards hosting the international Square Kilometre Array, and in the Giant Magellan Telescope). However the actual mechanisms for providing the ongoing operational costs have in some cases (e.g. the Gemini subscription costs) been confused and uncertain, employing a continually varying patchwork of different funding sources with inconsistent renewal criteria and oversight processes. This is in contrast to some other cases (e.g. the Anglo-Australian Observatory), where a rational funding mechanism was built into the facility from the outset.

5. *Principles and strategies for supporting international research engagement.*

- International collaborations at all levels are absolutely essential to the quality, effectiveness and impact of Australian research. The benefits of international research collaborations need to be recognized by a greater focus on such engagement in funding levels and detailed implementation of the Australian government's various research funding programs.
- Commitment to major international projects needs to be considered in whole-of-life terms, including long-term operations costs as well as construction costs. Project lifetime funding mechanisms must be devised to suit the specific durations and governance arrangements of each project, rather than attempting to shoehorn operational funding requirements into poorly-matched generic funding programs.
- With the increasing emergence of astronomical research in Asia, especially China and India, it is important that Australia forges strong international ties within the region. Training students who then take knowledge and research relationships back to their home country is one effective way to achieve this.

The National Committee for Astronomy and Astronomy Australia Limited appreciated this opportunity to provide input on a topic that is of major concern to Australian astronomers, and would be happy to engage further in any future discussions on these matters.

Yours sincerely,

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