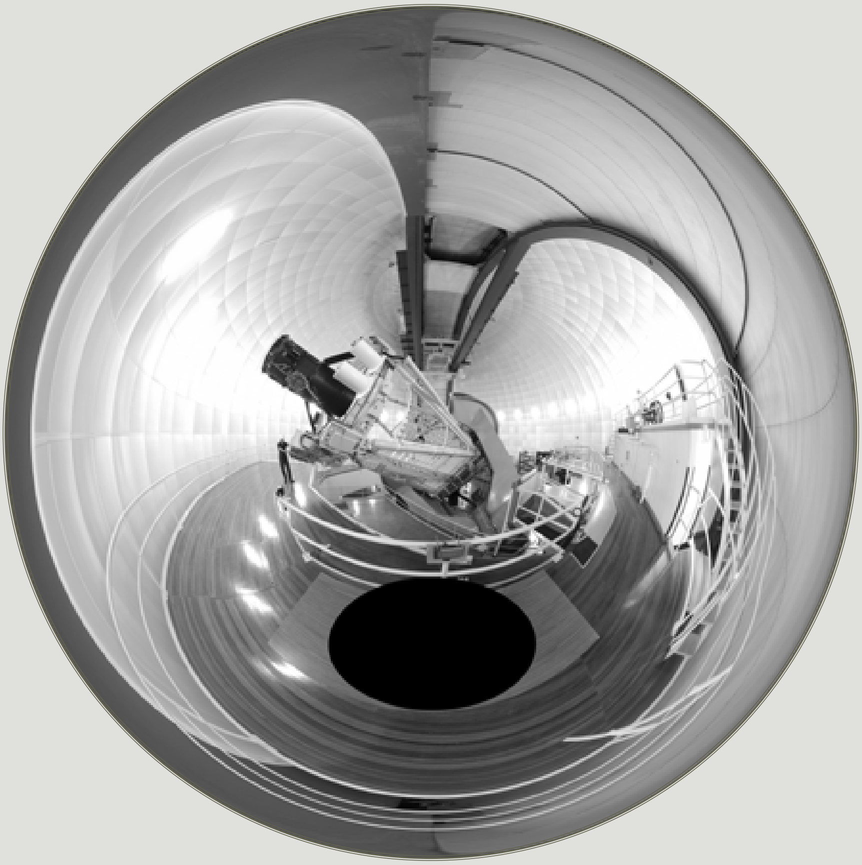
Anglo-Australian Observatory

Annual Report
of the
Anglo-Australian Telescope Board

1 July 2009 - 30 June 2010



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Annual Report Website: http://www.aao.gov.au/annual/

ABN: 74 599 608 295

ISSN 1443-8550

Cover Design: Australian Astronomical Observatory

Computer Typeset: Australian Astronomical Observatory

Cover Photo: Fred Kamphues. The panorama of the Anglo-Australian Telescope was composed of 75 high resolution images, shot on a special panoramic head to avoid parallax. The full hemispherical panorama was stitched with PTGui software on a powerfull Intel i7-965 processor. The circular projection creates a fisheye effect.

Picture Credits: Jeremy Bailey; Liz Cutts (Coonabarabran Times); James Gilbert; Anthony Heng; Anthony Horton; Justin Huntsdale; Julie Just; Fred Kamphues; Steve Lee; David Marshall Photography; Bonita Mendis; Robert Sharp; Mark Sims (Mark Sims Photography, Hertford) Chris Taylor; Grant Turner, (Medikoo); Chris Walsh; Tim Wheeler.

Senator the Hon Kim Carr,

Minister for Innovation, Industry, Science and Research

Government of the Commonwealth of Australia

David Willetts, MP

Minister of State for Universities and Science

Government of the United Kingdom of Great Britain and Northern Ireland

In accordance with Section 14 of the *Australian Astronomical Observatory Act (Transitional Provisions) 2010*, and in accordance with Article 8 of the Agreement between the Australian Government and the Government of the United Kingdom to provide for the establishment and operation of an optical telescope at Siding Spring Mountain in the State of New South Wales, I present herewith a report by the Anglo-Australian Telescope Board for the year from 1 July 2009 to 30 June 2010. The report summarises the operations of the Board for the period under review and includes financial statements in accordance with the provisions of the Agreement. This is the final report of the Anglo-Australian Telescope Board.

Matthew Colless

Professor Matthew Colless
Director
Australian Astronomical Observatory

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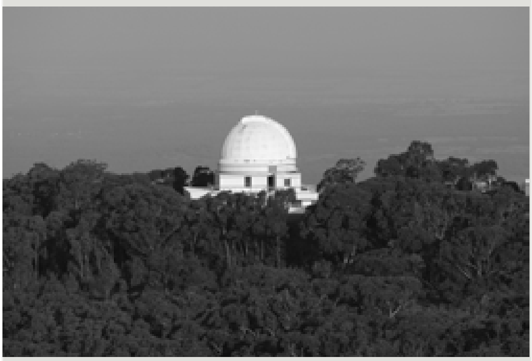
Statement of purpose



Top: Anglo-Australian Telescope.
Bottom: UK Schmidt Telescope.
Photos: Fred Kamphues

The Anglo-Australian Observatory (AAO) provides world-class optical and infrared observing facilities enabling Australian and British astronomers to do excellent science. The AAO is a world leader in astronomical research and in the development of innovative telescope instrumentation. It also takes a leading role in the formulation of long-term plans for astronomy in Australia.

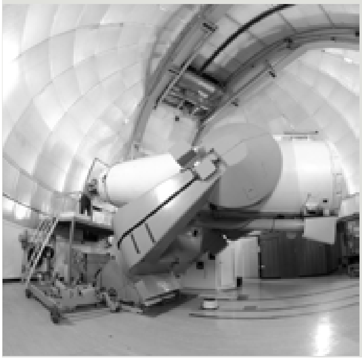
History & governing legislation

In 1969, the governments of Britain and Australia decided to establish and operate a large optical telescope in Australia for use by Australian and British astronomers. *The Anglo-Australian Telescope Agreement Act 1970*, which commenced in February 1971, gave effect to this decision. The Act established the Anglo-Australian Telescope Board (AATB) as the independent bi-national entity that owns and operates the telescope, with funding provided by the Governments of Australia and the United Kingdom.

The 3.9-metre Anglo-Australian Telescope (AAT) was opened in 1974 on Siding Spring Mountain near Coonabarabran in north-west NSW. In 1988, the operation of another telescope on the same site, the 1.2-metre UK Schmidt Telescope (UKST), which opened in 1973, was transferred to the AATB. These two telescopes, together with the Eastwood headquarters facility and instrumentation laboratory, collectively form the Anglo-Australian Observatory (AAO).

The Anglo-Australian Telescope Board ceased operating on 30 June 2010. The United Kingdom government in

Above: Inside the Anglo-Australian Telescope.
Below: Inside the UK Schmidt Telescope.
Photos: Fred Kamphues



2005 indicated its intention to withdraw from the Anglo-Australian Telescope Agreement with effect from 1 July 2010. The Australian Government, as part of its May 2009-10 Budget announcements, agreed to take over the AAO as a fully Australian-owned entity from 1 July 2010, and has agreed to meet its ongoing operational requirements. Legislation to give effect to this change received Royal Assent in March 2010:

- *The Australian Astronomical Observatory Act 2010* commenced on 1 July 2010 and establishes the new AAO - the Australian Astronomical Observatory, the Statutory Office of Director of the AAO, and lists the functions of the AAO.
- *The Australian Astronomical Observatory (Transitional Provisions) Act 2010* which deals with the transfer of staff to employment under the Public Service Act, the transfer of AATB assets and liabilities to the Commonwealth of Australia, and the repeal of the Anglo-Australian Telescope Agreement Act 1970.

The functions of the Australian Astronomical Observatory include the following:

(a) to operate, construct, develop and maintain national optical astronomy facilities;

(b) to support optical astronomy facilities;

(c) to consult and co-operate with other persons, organisations and governments on matters relating to optical astronomy;

(d) to facilitate access to optical astronomy facilities;

(e) to develop, manufacture and provide instrumentation for optical astronomy facilities;

(f) to support the development, manufacture and provision of instrumentation for optical astronomy facilities;

(g) to support, encourage, conduct and evaluate research about matters relating to optical astronomy;

(h) to support, encourage, conduct and evaluate educational, promotional and community awareness programs that are relevant to optical astronomy;

(i) to publish (whether on the internet or otherwise) reports, papers and information relating to optical astronomy;

(j) to advise the Minister about matters relating to optical astronomy;

(k) to implement Australia's international obligations in relation to optical astronomy;

(l) such other functions (if any) as are specified in the regulations; and

(m) to do anything incidental to or conducive to the performance of any of the above functions.

This is in line with an Australian Government review in 2006, which recommended that the AAT continue operating, and that the AAO evolve into the national optical observatory supporting not just the AAT, but also Australia's involvement in the Gemini and Magellan telescopes and future facilities such as the Giant Magellan Telescope (GMT).

The AAO becomes part of the Department of Innovation, Industry, Science and Research (DIISR) from I July 2010.

Ministers responsible

At 30 June 2010, the Minister responsible in Australia was Senator the Hon Kim Carr, Minister for Innovation, Industry, Science and Research.

The Minister responsible in the United Kingdom for the Research Councils, and through them the AATB, was David Willetts, MP, Minister of State for Universities and Science.

Senator the Hon Kim Carr, Minister for Innovation, Industry, Science and Research, pictured here with Professor Tanya Monro at an event announcing the Super Science Fellowships.
Photo: Chris Taylor

Designated agencies

Pursuant to Article 1 (2) of the Anglo-Australian Telescope Agreement, each Government acts through an agency designated for the purpose. These Designated Agencies are the Australian Department of Innovation, Industry, Science and Research (DIISR) and the Science and Technology Facilities Council (STFC) of the United Kingdom. These agencies are jointly responsible for implementing the Agreement. One Board member from each country has been nominated to represent their respective Designated Agency on matters relating to the Agreement.

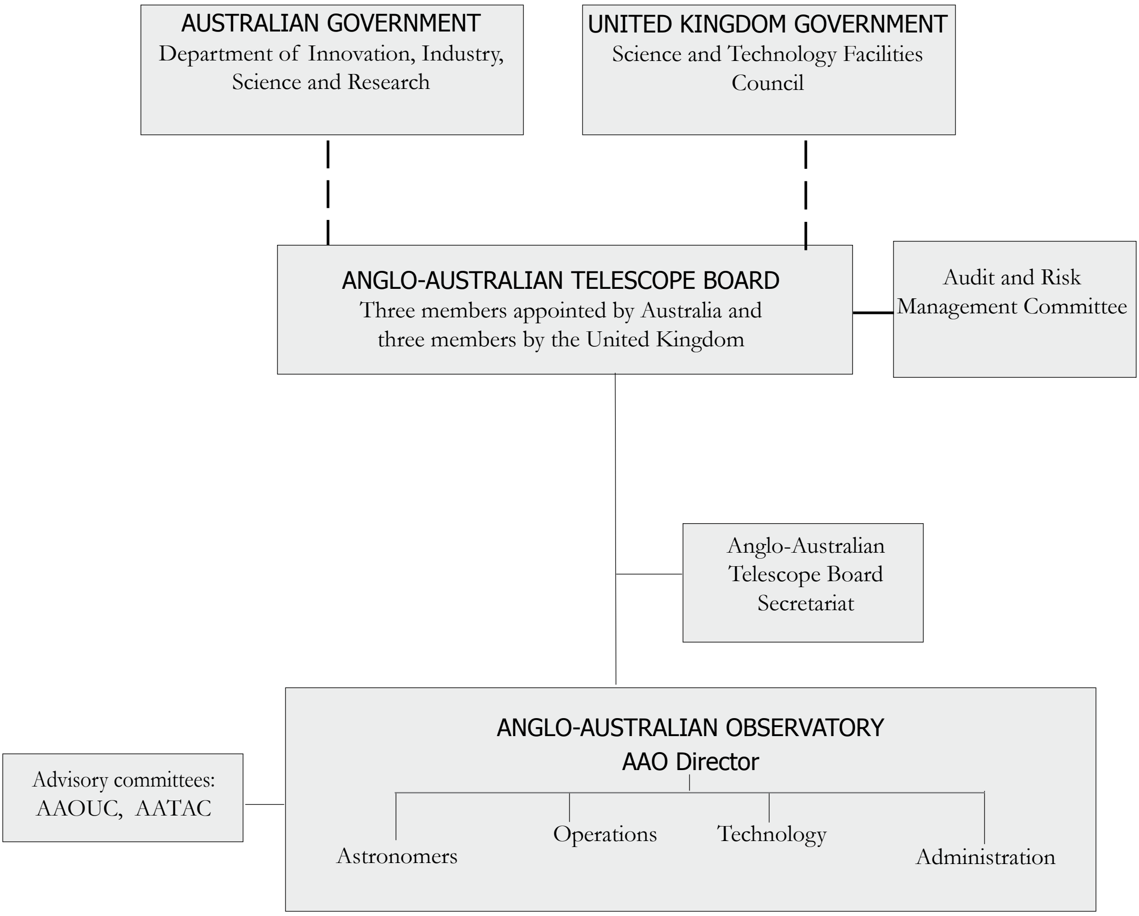
Structure of the AAO

The AATB oversaw the operations of the AAO. The Observatory has active and internationally recognised research, instrument science and instrumentation groups. Figure 1.1 shows the structure of the AAO. These groups are critical to the maintenance of the AAO's two telescopes, to the support of other international facilities in which Australia is involved, and to the development of state-of-the-art instrumentation for the AAO and other international facilities.

AAO Director

The AAO Director, Professor Matthew Colless, is responsible for the successful operation of the telescopes, for providing the best possible facilities for all telescope users and for ensuring that the Observatory maintains its high standing in the international scientific community. The Director also actively pursues his own scientific research. Professor Colless is a Fellow of the Australian Academy of Science, a Fellow of the Royal Astronomical Society and an Adjunct Professor at the School of Physics, University of Sydney.

Figure 1.1 General structure of the AAO



Audit and Risk Management Committee

The AATB has an Audit and Risk Management Committee to monitor and improve its corporate governance. Details of the Committee are included in Appendix D.

AAO Users' Committee

The Anglo-Australian Observatory Users' Committee (AAOUC) advises the Director on aspects of the Observatory's operation. It is drawn from users of the AAT and UKST. Details of the Committee are included in Appendix E.

AATAC

Observing time on the AAT during 2009-10 was allocated by a single bi-national panel, the Anglo-Australian Time Assignment Committee (AATAC), details of which are included in Appendix E.

Appointed by the Australian Government

Chair
Professor Warrick Couch, ARC Professorial Fellow, Swinburne University; appointed 5 November 2004 to 30 June 2010

Dr Ian Chessell, South Australia's Chief Scientist; appointed 22 March 2007 to 30 June 2010

Professor Bryan Gaensler, ARC Federation Fellow, University of Sydney; appointed 1 January 2009 to 30 June 2010

Appointed by the UK Government

Deputy Chair
Professor Stephen Warren, Department of Physics, Imperial College London; appointed 1 March 2006 to 30 June 2010

Professor Sean Ryan, Head, School of Physics, Astronomy and Mathematics, University of Hertfordshire; appointed 1 January 2008 to 30 June 2010

Dr Colin Vincent, Head, Astronomy Division, STFC; indefinite appointment from 5 April 2006

AAT Board members Colin Vincent, Ian Chessell, Stephen Warren and Sean Ryan at the Royal Observatory, Greenwich (ROG). The final meeting of the AAT Board was to have taken place at the ROG with all members attending. However the spread of volcanic dust over Britain from Iceland's Eyjafjoell Volcano prevented two of the three Australian Board members from travelling. Also unable to travel were the AAO's Director and Executive Officer. Those four joined the meeting by video conference between ROG and the AAO in Sydney.

2 The year in review

Review by the Director

Matthew Colless

Professor Matthew Colless, FAA, FRAS. Photo: Mark Sims

The AAO's mission

The mission of the AAO is to provide world-class observing capabilities that enable its user community of optical astronomers to do outstanding science. This involves three essential activities: first, ensuring appropriate access and high-quality support for existing front-rank telescopes; second, providing powerful and innovative instrumentation for those telescopes; and, third, participating in the development of the pre-eminent facilities of the next generation.

The AAO was originally founded in 1974 to support the 3.9-metre Anglo-Australian Telescope (AAT) located on Siding Spring Mountain near Coonabarabran in northwestern NSW. In 1988 the AAO also took over responsibility for the 1.2-metre UK Schmidt Telescope (UKST) at Siding Spring. More recently, the AAO has taken on the role of providing support for Australian access to large overseas telescopes: in 2006, the AAO began supporting the nights that Australia buys on the twin Magellan 6.5-metre telescopes in northern Chile, while in 2008 the AAO began to operate the Australian Gemini Office, supporting Australia's involvement as a partner in the two Gemini 8.1-metre telescopes, one in Hawaii and the other in Chile.

The new AAO

On 30 June 2010, the UK's involvement in the AAO, which has been gradually ramping down over the past five years, officially ceased. This marked the end of an extraordinarily close and productive partnership between Australia and the UK in the Anglo-Australian Observatory. It is arguable that there has never been a more successful scientific joint venture between the two countries, as witnessed by the contents of these annual reports, which stretch back over 40 years to 1970, four years before the official opening of the Anglo-Australian Telescope in 1974. The timeline on pages 23-26 gives an overview of just a few of the many discoveries and research highlights that emerged from the Observatory during this period.

The AAO paid tribute to the 36 prolifically productive years since the AAT was opened with a highly enjoyable and memorable symposium held on 21-25 June 2010 in Coonabarabran. The goals of the conference, which was titled Celebrating the AAO: Past, Present and Future, were to review the history and accomplishments of the Observatory, to present some of the current research from the facilities the AAO operates (AAT, UKST) and supports (Gemini, Magellan), and to look to the future of the AAO, considering the development of the organisation, new instruments for the various telescopes, and some of the ambitious new science goals. In addition, there were a variety of public talks and other events reflecting the AAO's commitment to public outreach and education. The symposium revived many old friendships, recalled dozens of scientific triumphs (and a few setbacks), and formed a fitting memorial to one of the most outstandingly successful scientific collaborations in the two nations' histories. In an official ceremony to mark the transition, attended by representatives of both countries, hundreds of balloons were released into the AAT dome and the AAO's new name was unfurled on a giant banner – the moment captured in a picture by David Malin (left). The proceedings from the symposium, to be published later in 2010, will provide a fitting memorial to the history, people and achievements of the Anglo-Australian Observatory.

Balloons in the Dome. The AAO in transition from Anglo-Australian Observatory to Australian Astronomical Observatory. Photo: David Malin

From 1 July 2010, the AAO becomes the Australian Astronomical Observatory, part of the Australian Federal government's Department of Innovation, Industry, Science and Research. In this new phase of its existence, the AAO will be Australia's national observatory for optical astronomy, supporting all of Australia's major optical telescopes both here and overseas. This new chapter for the Observatory promises to be as exciting and productive as the previous decades.

Science highlights

During 2009-10, the AAO's staff and users made a range of fascinating discoveries relating to objects ranging from Earth-like planets around other stars to the enormous sound waves that echoed around the universe after the Big Bang.

An observation that demonstrated the AAT's versatility, and the professionalism of its staff, involved capturing images of a space probe's crash into the Moon. The IRIS2 infrared camera on the AAT caught the moment that the Japanese Kaguya probe impacted the lunar surface – one of only two telescopes to successfully record the event, which provided information on the process of cratering on the Moon.

As well as being versatile, the AAT is also capable of persistence and precision. The Anglo-Australian Planet Search (AAPS) is an AAT Large Program that has been measuring the Doppler motions of stars in order to detect exoplanets. This requires highly precise velocity measurements sustained over long periods (for example, 12 years in the case of the AAPS). Previously the AAPS has detected 32 planets orbiting other stars. This year, after two long contiguous observing runs, the AAPS announced the exciting discovery of three 'Super-Earths', rocky planets like our own, with masses 24, 18 and just 5 times the mass of the Earth. The other discovery, 12 years in the making, was a Jupiter-mass planet in a Jupiter-sized orbit – the first such solar system analogue to be found because of the long period of the orbit (13.7 years). Together, these discoveries increase the likelihood that other solar systems may harbour Earth-like planets in habitable orbits.

The other virtue of the AAT is that it encourages ambitious programs. The WiggleZ and GAMA Large Programs are both very large galaxy surveys, but with quite different goals. The WiggleZ survey aims to measure the imprint of vast sound waves from the Big Bang in the distribution of galaxies at a time when the universe was only half its present age. These waves have a fixed size that can be used as a standard ruler to measure the way that the geometry of the universe changes over time. This in turn gives a vital clue to the nature of the mysterious Dark Energy that makes up 70-75% of the overall energy content of the universe. Nearer to home, the Galaxy And Mass Assembly (GAMA) survey is using spectra from the AAT and multi-wavelength imaging covering the ultraviolet through to the mid-infrared to study the way in which galaxies form and evolve.

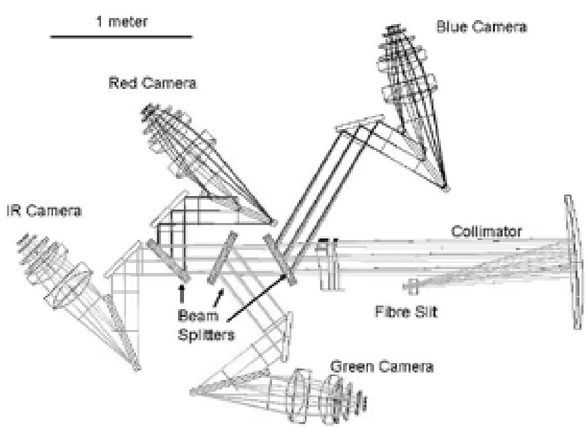
The WiggleZ Team, on the occasion of their first full-team meeting at the University of Queensland in October 2008.
Photo: Peter Firth, UQ

The UKST is also undertaking a very ambitious program: the RAVE radial velocity survey of up to a million stars in our own Galaxy, mapping their orbits and properties in order to try to unravel how the Milky Way was formed. This program is being carried out on a user-pays basis by an Australian and international team, who provide the funding required to cover the AAO's costs in operating the telescope. The project is currently expected to run through 2011 and possibly 2012.

These large programs, together with the many smaller projects carried out on the AAT, Gemini and Magellan, are enabling Australian astronomers to have a strong impact on international research over a wide range of fields.

Telescopes and instruments

The future of the science to be done with the AAT is being shaped by two current projects: the major NCRIS-funded efforts to refurbish the AAT and construct the HERMES spectrograph. The AAT refurbishment project is proceeding well, with replacement and upgrading of several major telescope infrastructures, including the dome and telescope axis encoders, the fire alarm system, the primary mirror elevator, and the air-conditioning and ventilation system. Additional measures have also been taken to further improve dome safety for staff and users. The HERMES project is also making good progress. Thanks to additional funding from Astronomy Australia Limited (AAL), provided under the EIF program, HERMES will now be a four-channel spectrograph covering the range from 350nm to 950nm in four 20-30nm bands. HERMES is expected to see first light in 2012. It will carry



HERMES will be a four-channel spectrograph covering the range from 350nm to 950nm with four 20-30nm ranges. It will carry out massive surveys of stellar chemical abundances in the Milky Way. Image: Sam Barden

out massive surveys of stellar chemical abundances in the Milky Way, with the goal of identifying the stellar associations that formed together and so reconstructing the formation sequence of our Galaxy.

As well as this major new instrument, the AAO is continuing to upgrade its existing instruments on the AAT. The CYCLOPS fibre feed for the UCLES high-resolution spectrograph saw first light in June 2010, and the GNOSIS OH-suppression fibre feed for IRIS2, currently under construction (see below), is expected to come on-line in 2011. The AAO has also obtained support from AAL (again under EIF) to upgrade the detectors on AAOmega, increasing the effective efficiency shortward of 400nm in the blue channel and extending the instruments response out to nearly 1 micron. These new instruments and upgrades will keep the AAT highly competitive for years to come.

Innovative technology

The long-term success of the AAO's instrumentation program, and the scientific impact of the AAO's telescopes, depends in large part on incorporating unique and powerful new technologies in the instruments that it builds. The AAO has had great success in the recent past with fibre-fed multi-object spectrographs and their fibre positioning robots. Now the AAO is looking to new applications of fibres as photonic devices for manipulating light in a variety of ways.

In collaboration with the University of Sydney and the Astrophysikalisches Institut Potsdam, the AAO has secured an Australian Research Council LIEF grant to build GNOSIS, an OH-suppression fibre feed for IRIS2 on the AAT. GNOSIS will suppress a couple of hundred lines in the near-infrared J-band, darkening the night sky by as much as a factor of 20 and making the AAT the most sensitive telescope for near-infrared spectroscopy in this band. This will be the first such device ever built and is conceived as a prototype for a full J and H band system that the AAO hopes to build for the GNIRS spectrograph on Gemini.

The Instrument Science group, along with collaborators in Australia and overseas, is also exploring other, more ambitious uses of photonic devices in astronomical applications, including hexabundles (multiply-cored fibres for use in integral field units) and integrated photonic spectrographs ('spectrographs on a chip'). In addition, the group is also developing the starbugs concept for self-motivated miniaturised fibre positioning units driven by piezo-electric actuators. Starbugs have application to complex and highly parallelised fibre positioning systems, and the AAO is specifically developing them for the MANIFEST fibre system proposed for the Giant Magellan Telescope.

People

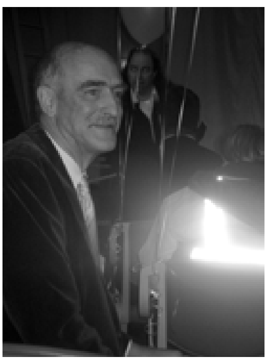
The AAO is also aiming to provide better research support for its users and for students. There are currently three UK and three Australian undergraduate summer scholars working at the AAO each year, a long-running tradition that has kicked-off a number of successful careers (including that of the current Director). This tradition will continue, with the new AAO supporting both Australian and international undergraduates. The AAO also provides up to three PhD top-up scholarships each year to encourage graduate students (and their supervisors) to work with AAO astronomers, and an Honours scholarship in conjunction with Macquarie University.

The AAO has been fortunate to attract Dr Chris Lidman as an ARC Future Fellow. Chris will be working on distant supernovae and the high-redshift universe during his five years at the AAO. The ranks of AAO astronomers will swell further in the next couple of years, after the award of four ARC Super Science Fellowships to Matthew Colless and Andrew Hopkins. The new Super Science Fellows (one of whom will start in 2010 and the others in 2011) will work on the Galaxy And Mass Assembly (GAMA) survey that is currently being carried out on the AAT.

Left Dr Chris Lidman, ARC Future Fellow working on distant supernovae and the high-redshift Universe, pictured here with Malcolm Smith (Cerro Tololo, Chile) at the AAO Symposium in June 2010. Photo: Liz Cutts, Coonabarabran Times

A new program which started in 2010 is the AAO Distinguished Visitors program. Each year, the AAO will support a small number of eminent researchers to make extended visits to the AAO. This year the AAO was fortunate to have Prof Andrew Connolly, Prof Richard Ellis, Prof David Koo and Prof Kim Vy Tranh coming to work with staff astronomers for periods of weeks to months. Another distinguished visitor was Dr Guy Monnet, who is spending a sabbatical year at the AAO after retiring as the European Southern Observatory's Head of Instrumentation.

Two senior staff left the AAO during the year: Chris McCowage retired from the position of Operations Manager, having run the AAO's telescopes at Siding Spring for nine years; the new Operations Manager is Doug Gray, who had previously been managing the AAT refurbishment program. The other loss was Roger Haynes, Head of Instrument Science, who left the AAO to take up a leadership position with the newly formed astrophotonics group at the AIP in Potsdam. The new Head of Instrument Science is Jon Lawrence, who had previously held a joint position between the Instrument Science group and Macquarie University.



Professor Fred Watson was made a member of the Order of Australia. Photo: David Jauncy

To cap the various distinctions achieved by AAO staff during the year, Fred Watson was made a Member of the Order of Australia for his services to astronomy and public education in the Australia Day Honours list.

Outlook

The funding for the new AAO is only part of a wider picture of strong Australian Government support for astronomy that also includes additional funding for the Australian SKA Pathfinder (ASKAP) and an SKA science and data centre, the naming of Space Science & Astronomy as one of three 'Super Science' initiatives that will include 30-40 new early-career research fellowships in the field, and the provision of $88.4 million to pay for a ten per cent share in the construction of the Giant Magellan Telescope (GMT) and enhance Australian involvement in the telescope and instrument contracts. Part of this funding will support the

AAO's proposal to carry out a design study for a facility fibre feed system for GMT called MANIFEST.

At this fresh new beginning for the AAO, it's appropriate to take stock of where the Observatory stands and where it plans to go from here. This is timely, as the Australian community is currently engaged in its Mid-Term Review of the Decadal Plan for astronomy. What then is the AAO's role over the next five to ten years? In a nutshell…

- The AAO will provide cutting-edge instrumentation for the AAT to allow it at least another decade of successful, high-impact research based on its powerful existing suite of instruments and the unique new facilities currently under construction: the HERMES high-resolution multi-object spectrograph, which will probe the stellar content and formation history of the Galaxy, and the GNOSIS OH-suppression fibre feed for IRIS2, which will make the AAT the most sensitive near-infrared telescope in the world. The AAO will also continue to exploit new opportunities to upgrade existing instruments and develop new capabilities for both the AAT and the UKST.
- The AAO will facilitate Australian access to the world's largest optical telescopes, currently achieved through partnership share in the Gemini 8-metre telescopes and buying time on the Magellan 6.5-metre telescopes. The AAO aims to enhance this access by developing potent new instrumentation for these telescopes and by providing value-added support for Australian users, both in proposing for time and in extracting the best science from the time they are awarded.
- The AAO will plan for the longer term, as the community seeks to shift the focus of its resources from the current mix of 4-metre and 8-metre telescope access towards a greater emphasis on larger apertures, including at least the equivalent of twenty per of an 8-metre telescope and ten per cent of an ELT. As a way to achieve these Decadal Plan goals, Australia is currently participating in the re-negotiation of the Gemini partnership and has invested in a 10 per cent share of the construction of the Giant Magellan Telescope. The AAO will continue to play a significant role in maintaining and reviewing these arrangements in order to ensure that the requirements of the community for world-class facilities are being met.
- Finally, the AAO will continue to perform high-impact research, both on its own and, more commonly, in collaboration with researchers from other Australian institutions and from overseas. The award of one Future Fellowship and four Super Science Fellowships to the AAO, and its participation in the recently announced Centre of Excellence for All-sky Astrophysics (CAASTRO), will significantly increase the AAO's research capability and productivity over the next few years. The AAO will also continue to communicate the excitement of astronomical discoveries to the public through a variety of education and outreach activities.

This outline of the way forward for the AAO assumes a reasonably predictable future. However, experience teaches that the road ahead is full of unexpected twists and turns, and that to survive and prosper an organisation must be far-sighted, nimble, and well resourced. Thanks to the Australian Government, the Australian Astronomical Observatory is appropriately funded for the foreseeable future; now it is up to the AAO to have the vision and agility to respond to whatever that future holds.

Review by the Chairman of the Board

Warrick Couch

Professor Warrick Couch, Chair, AATB. Photo: Mark Sims

With this being the 40th and final Annual Report for the AAO under its life as the Anglo-Australian Observatory, it is highly significant in that it marks the end of what has been a long and remarkable era of scientific discovery and collaboration between Australia and the United Kingdom. As part of the changes that will come into effect at the end of 2009-10, with the creation of the new AAO – the Australian Astronomical Observatory – the Anglo-Australian Telescope Board (AATB) will cease to exist. Hence, this is the last report by its Chair. Thus, as well as highlighting the key events and developments of the last year, it is also fitting that it contain some valedictory remarks.

This past year has been one of transition for the AAO, as well as one with the usual high level of activity and development over all areas of its operation. With the funding for the new AAO being announced in the 2009-10 Federal Budget, and it being determined that it would operate as a Division within the Department of Innovation, Industry, Science and Research (DIISR) shortly thereafter, there was an enormous amount of work to do to ensure a smooth and seamless transition from the old to the new organisation from 1 July 2010. All the staff of the AAO are to be commended for taking this additional requirement in their stride, in particular the many training and induction activities that they were required to attend. The Board is also very grateful to the Director and Executive Officer for their tireless efforts in dealing with the myriad of meetings and transition issues throughout the process, and to DIISR for the provision of extra resources to see the process through.

Gratifyingly, these preparations for change had no impact on the scientific productivity of the AAO and its telescopes. As detailed in the Science Highlights section of this report, important discoveries continued to be made with both the AAT and UKST, with the major large surveys being carried out on both these telescopes being particularly prominent. A particular highlight was the Anglo-Australian Planet Search (AAPS) which this year discovered three 'Super-Earths' – rocky planets like our own but with masses from five to twenty times larger. The ability of the AAPS to be conducted over long and contiguous periods of time on the AAT was vital to these discoveries. Furthermore, the 12 years of repeated monitoring and patience of this project's investigators paid off with the discovery of a 'Jupiter analogue' – a planet around another star with the same mass and orbit size as Jupiter. These discoveries represent a significant advance in understanding whether solar systems like our own exist elsewhere and whether planets like our own orbit in similarly 'habitable' zones around other stars. To cap this off, attention was also turned to our own Moon, where the IRIS2 camera on the AAT captured in spectacular fashion the impact of the Japanese Kaguya probe onto the lunar surface, providing important information on the process of Moon cratering.

Over the years, the AAO has built an international reputation that is second to none in its innovative use of optical fibre technology in astronomical instrumentation. This last year was notable for further significant achievements in this area. Firstly, a novel fibre-based feed consisting of a close-packed bundle of 15 hexagonal fibres was completed and deployed with the AAT's high resolution UCLES spectrograph. This will significantly increase the spectral resolution of UCLES and make it more efficient through being able to collect all the incoming light from target objects. In addition to this example of how optical fibres can be used to collect light from astronomical objects and feed it into a spectrograph more efficiently,

AAO Director Prof Matthew Colless with former Director Donald Morton and retired AAO night assistant Kevin Cooper looking at the 2dF field plate. Photo: Jonathan Pogson

the AAO is at the forefront of the development of fibre systems that can suppress the bright contaminating emission of air-glow lines from the earth's atmosphere at near-infrared wavelengths. Having already demonstrated fibres can be successfully used in this way, the AAO's efforts are now focussed on its application to near-infrared spectroscopy, first on the AAT and then subsequently on the 8-metre Gemini telescopes. This involves the construction of a device called GNOSIS, the initial prototype version of which will be capable of suppressing several hundred lines in the near-infrared H-band, thereby reducing the sky contamination by a factor of 20. This feed will give the AAT's IRIS2 instrument unrivalled sensitivity for spectroscopy at these wavelengths. Given the enormous potential this technology has for near-infrared astronomy, it was extremely pleasing that the GNOSIS project was awarded a substantial Australian Research Council LIEF grant, thereby allowing the AAO (in collaboration with the University of Sydney) to maintain momentum and leadership in this area. In addition, the AAO was successful in winning a contract to undertake a feasibility study of a system called MANIFEST, that will incorporate the aforementioned (as well as new) technologies into a sophisticated fibre system that will feed many of the instruments on the next generation 25-metre Giant Magellan Telescope.

The importance of continuing to make enhancements to the AAT's instruments to give them a competitive edge was recognized via two major funding allocations from Astronomy Australia Limited's $10 million Education Investment Fund (EIF) grant. One of these is to replace the CCD detectors in the AAOmega spectrograph with more sensitive devices, giving this work-horse survey instrument much improved performance, particularly at very blue and very red wavelengths. The second allocation was for the new high-resolution fibre-fed spectrograph HERMES that is currently under construction and due to have first light in 2012. This was to fund an additional fourth channel to give the spectrograph full coverage of the 350 to 950nm range, and in particular be able to observe spectral lines that are critical to the success of the "galactic archaeology" project planned for this instrument.

To conclude what will be the final review by the AATB Chair, I would like to offer a few reflections from an AATB perspective. At the risk of stating the obvious, there is no doubt that the way the AAO was set up under the *Anglo-Australian Telescope Agreement Act 1970*, with it being an independent institution owned and operated by an independent board, has been an extraordinarily successful model that will be held up as one of – if not the – most shining exemplars of how to run an international telescope facility. But in my view this success would not have come without two other critical ingredients: excellent working relationships and excellent people. From an AATB perspective, the most important working relationship

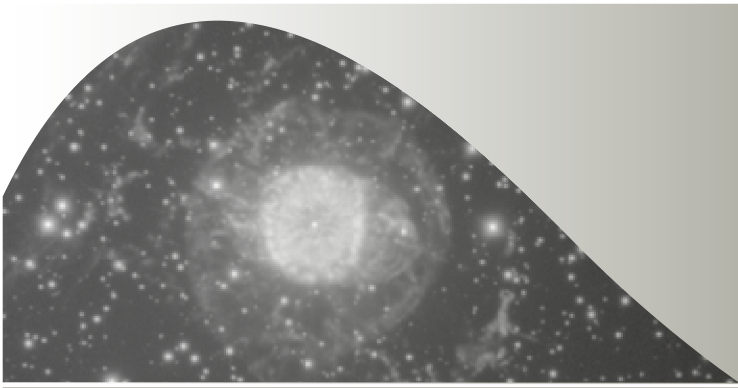
Left to right: AAO Director Prof. Matthew Colless, UK Deputy High Commissioner Jolyon Welsh and Parliamentary Secretary The Hon. Richard Marles MP celetrate the Anglo-Australian Observatory becoming the Australian Astronomical Observatory.
Photo: David Malin

has been between it and the AAO staff, in particular the Director and the Executive Officer. The ability of the AATB to, throughout its life, work so cooperatively with the staff, without micro-managing the day-to-day management of the AAO, has been an important element to the success of the organisation. The excellent working relationships within the AATB and the bipartisan approach to ensuring the best outcomes for the AAO and both the Australian and UK communities as a whole have also been another important factor. Finally, the AAO has been exceptionally fortunate to have had so many talented, dedicated and loyal people on its staff ever since it was formed.

At its meeting held in Hatfield UK in April 2009, a very strong desire was expressed by the AATB for there to be a final symposium to mark the end of the Anglo-Australian Telescope Agreement. The main desiderata for this meeting were that it involve as many people as possible who had worked at or been associated with the AAO over its lifetime (and if possible include all its previous Directors), and it should be a celebration of what the AAO had achieved over its almost 40 years of existence. All these desires and more were fulfilled with the very successful "Celebrating the AAO: Past, Present and Future" meeting that was held in Coonabarabran NSW in June 2010. It turned out to be a wonderful gathering of past and present staff (including three of the four previous Directors), users of the telescopes, and friends and associates of the AAO, from both the UK and Australia, all of whom helped to recollect the AAO's history and wealth of scientific and technological triumphs over the years. The meeting included an official ceremony held in the dome of the AAT to mark the end of the Anglo-Australian Observatory and its reincarnation as the Australian Astronomical Observatory. The Australian Government was represented by the Hon Richard Marles MP, the Parliamentary Secretary for Innovation and Industry, and the UK Government was represented by the Deputy High Commissioner, Jolyon Welsh. The Australian Minister for Innovation, Industry, Science and Research, Senator the Hon Kim Carr, made a special pre-recorded speech for the occasion that was played during the ceremony – a gesture that was very much appreciated.

Former Directors and members of the AAT Board together at the AAO Symposium. Names l to r: Malcolm Longair, Russell Cannon, Warrick Couch, Brian Boyle, Bob Frater, Pat Roche, Don Morton, Matthew Colless, Jeremy Mould, Ron Ekers and Richard Ellis Photo: David Malin

In positioning the AAO for its new life as a solely Australian institution, the AATB's primary concerns were that it continue to operate in a stable governance and funding environment, that the AAO retain its identity and international reputation for excellence in telescope operations, instrument development, and astronomical research, that it retain its excellent complement of staff, and that it have a strong purpose and vision for the future. When the AAO becomes the Australian Astronomical Observatory on 1 July 2010, I believe it does so with all these 'foundations' largely in place. We should therefore look forward to the AAO having a bright future, with it continuing to shine as one of Australia's most productive, innovative and world-renowned scientific institutions.



3 Scientific highlights

IRIS2 observes Kaguya's demise

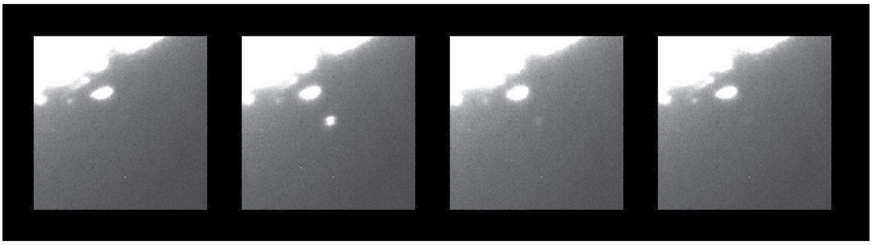


Figure 3.1 Kaguya's demise.
Photo: Jeremy Bailey, UNSW and Steve Lee, AAO

On the morning of 11 June 2009 (AEST) the Japanese lunar spacecraft Kaguya was purposely crashed into the moon, thus terminating its survey mission in a very spectacular fashion. The resulting impact was successfully observed by Jeremy Bailey (UNSW), Steve Lee (AAO) & Hakan Svedhem (ESA/ESTEC) with IRIS2 on the Anglo-Australian Telescope. A bright impact flash was seen within a few seconds of the predicted time, at 18:25:10 UT June 10. The four frames in Figure 3.1 from around impact time show the bright flash in the second frame, and also faintly visible in the third and fourth.

There was only one other successful observation of this impact despite a wide campaign to observe it from a number of locations. Both observations were made at infrared wavelengths. Together with previous observations it now seems clear that these bright impact flashes are only seen at infrared wavelengths.

The value of such events lies in the fact that the mass and speed of the spacecraft are accurately known so we can link the spacecraft to observations of what happened during the impact, and eventually to the properties of the crater produced (which should be observable from future missions). Such observations thus help us to understand the impact process, a process that is extremely important in shaping the surfaces of many solar system bodies.

Of particular interest, is to investigate how well a meteorite might survive an impact on the Moon. The Kaguya impact occurred at a very shallow angle, which maximises the chance of partial survival. Meteorites from Earth that impacted on the Moon early in its history might preserve a record of Earth's early geological history that is largely lost on Earth.

First results from the Anglo-Australian Rocky Planet Search

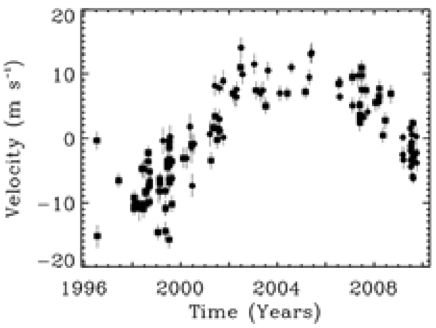
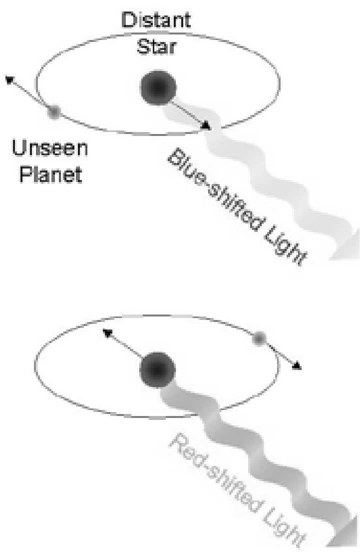


Figure 3.2 "Doppler wobble" measurements of a 0.82 Jupiter-mass planet orbiting the star 23 Librae. The observed curvature is caused by the planet orbiting every 13.7 years.

Figure 3.3 The "Doppler wobble" method explained schematically. An orbiting planet causes a star to wobble, periodically reddening before becoming bluer, changes which can be measured.



Since the first detection of planets orbiting another Sun-like star in 1995, there has been a profound shift in astrophysics toward the planetary sciences. Research on extra-solar planets and the possibility of life in the Universe, which was not long ago considered to be at the fringes, is now at the heart of mainstream science, and the detection of Jupiter-like planets around other stars is now routine. The next challenges in exoplanetary research are to discover other solar systems like our own and to measure the underlying distributions of exoplanet properties to assess models of planetary formation and evolution. A team of astronomers comprising Simon O'Toole (AAO), Hugh Jones (Hertfordshire), Chris Tinney, Rob Wittenmyer, Jeremy Bailey (UNSW), Paul Butler (Carnegie), and Brad Carter (Southern Queensland) form the Anglo-Australian Planet Search, and they have set out to do just this.

The standard theory for Jupiter-like planet formation is the core accretion model. The detection of a population of short-orbit Earth-mass objects would provide observational evidence for this model. The core accretion paradigm, however, cannot currently explain the large range of orbital shapes observed amongst known exoplanets and it requires that gas giants migrate towards their parent stars in order to explain the observed separation of orbits.

The detection of Earth-mass planets also critically tests current search techniques – not so much because of the precision of the techniques themselves, which has constantly improved over the last decade, but rather because planet-hosting stars are becoming the fundamental limiting factor. Indeed, because of its very high precision, the Anglo-Australian Planet Search (AAPS) has played a significant role in the detection of tiny motions on the surface of Sun-like stars. The study of periodic variations in brightness has been established in the Sun for several decades and is known as helioseismology. These variations constitute a significant source of noise for planet searching. Significant improvements to the observing strategy used to search for exoplanets have been made by characterising these effects and determining the optimum way to correct for them. Stellar oscillations are just one form of stellar variability that affects the ability to detect low-mass planets; stellar activity and convection are others. They each have an effect on different timescales – from minutes and hours to days and even years – and the AAPS is attempting to account for each effect as part of an ongoing study.

The AAPS is one of the longest running planet search programs in the world, with over 12 years of observations to date. Prior to this year, the AAPS had announced the detection of 32 new extra-solar planets discovered using the Doppler wobble technique. It has played a major role in the explosion of exoplanet discoveries. The AAPS has also achieved arguably the highest long-term stability of velocity measurements, which is required to detect planets further out – in a similar configuration to our own Solar System – around other Sun-like stars. The precision of AAPS measurements has now reached the level where understanding previously ignored stellar effects becomes important. It also means that the detection of Earth-mass planets is within reach.

The AAPS team was awarded 48 consecutive nights at the end of semester 2006B to search for terrestrial-mass rocky planets orbiting our most stable targets. The campaign monitored 24 inactive, slowly rotating G and K stars searching for five to ten Earth-mass planets with periods between one and ten days. The team was granted a further 47 contiguous nights over July and August 2009 to bring the total number of targets in the survey to approximately 60 stars. The results from these observations provide constraints on numbers of low-mass planets orbiting close to Sun-like stars.

One of the outstanding results from these runs was the discovery of two Neptune-mass (about 18 and 24 Earth-mass) planets and a super-Earth – an object weighing in at only around five Earth masses. The AAPS observations were complemented by observations taken with the 10-metre Keck telescope. The discovery of these planets shows the power of large blocks of contiguous observations to detect the low amplitude variations caused by low-mass exoplanets.

The AAPS team also recently announced the detection of a 0.82 Jupiter-mass planet with a period of 13.7 years, again with complementary observations from Keck. The discovery of this planet – a Jupiter-like planet in a Jupiter-like orbit – demonstrates the importance of the long-term monitoring program of stars similar to the Sun. The survey is only now beginning to discover planets with periods of nine or more years, closer to the 11.9 year orbital period of Jupiter. The AAPS has been granted large program status on the AAT to extend high precision observations to beyond the orbital period of Jupiter.

Discovery of large-scale infall in a massive proto-stellar cluster

From observations by Peter Barnes (U. Florida), Yoshi Yonekura (Ibaraki U.), Stuart Ryder, Andrew Hopkins (AAO), Yosuke Miyamoto, Naoko Furukawa, & Yasuo Fukui (Nagoya U.) on the AAT and Australia Telescope National Facility's Mopra telescope, we have identified a young massive star-forming cloud as undergoing a large-scale collapse, likely on the way to forming a massive young star cluster. Both the size scale and the mass infall rate may be new records among galactic star-forming regions. This object promises to be an important test-bed for refining theories of massive star cluster formation.

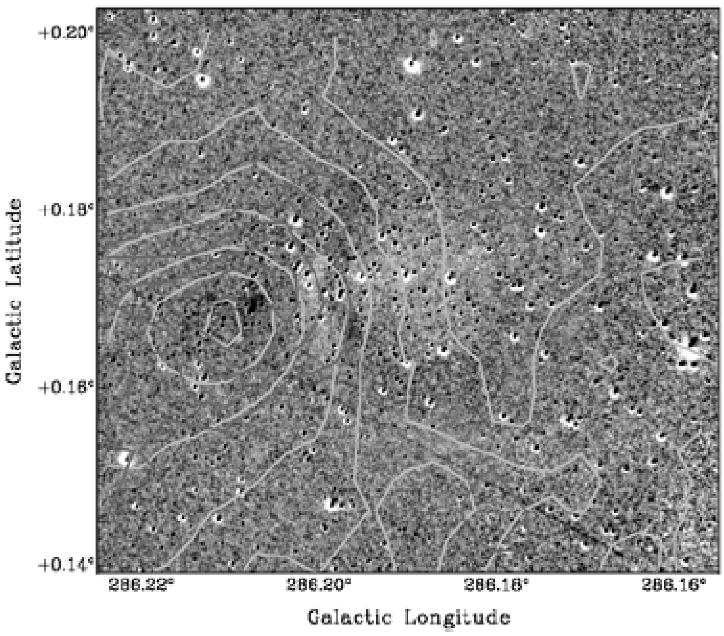


Figure 3.4: IRIS2 imaging of the young massive star cluster BYF 73 in K-band spectral lines. Contours are overlaid from Mopra.

Compared to our understanding of how Sun-like ("low-mass") stars form out of cold, molecular gas, the formation of massive stars and star clusters, which may dominate and drive the Galactic ecology with their high luminosities, massive winds, and chemically enriched ejecta, is not nearly so well understood. This enigma has three causes: the relative rarity of massive star formation, the rapidity of massive star evolution, and the confusing phenomenology of the formation process itself. Because of the first two reasons, the typical massive star formation site lies more than ten times further away than many low-mass protostars, further limiting our ability to decipher the phenomena we see.

To address these issues, the team designed the Census of High- and Medium-mass Protostars as the largest, survey of massive Galactic star-forming regions to date. They reasoned that only with an unbiased survey could they hope to construct a comprehensive picture for massive star- and cluster-formation, including the identification of all significant stages in massive star formation, and their lifetimes. CHaMP was based on the Nanten telescope's molecular cloud surveys of a large portion of the southern Milky Way. Using the Nanten maps they identified 209 massive, dense molecular clumps. They then used the ATNF's Mopra antenna to zoom into the 118 brightest of these.

Among these clumps, very unusual spectral line profiles were noticed in one source, the 73rd on the list. Most of the approximately 20 000 solar mass clump was found to have a very high mass infall rate that was either a new record, or close to it: 0.034 solar masses per year. Moreover, gravitational infall in the gas seems to be the only option for BYF 73: it is far too massive to obtain sufficient support from any other pressure.

By itself, the molecular data and modelling would have been an interesting result. But the clincher came from combining Mopra data with AAT IRIS2 data, using service time to image BYF 73 and a few other interesting CHaMP sources. Figure 3.4 combines IRIS2 and MOPRA data to show the formation of a star-forming region at the edge of a molecular cloud, surrounded by a cocoon of shocked gas ahead of the ionisation front, driven from the already-revealed massive young stars in the nebula. An IRIS2 long-slit spectrum indicates temperatures in the pre-ionised molecular gas that may exceed 4 000 K. But most significant is the location of the centre of the molecular infall revealed in the Mopra maps, precisely where there is a very deeply embedded IR nebula, and stars with very unusual colours.

Indeed, at mid- and far-IR wavelengths this infall centre is the most luminous source of the whole cloud, and is extremely red even at mid-IR wavelengths. The release of gravitational energy alone accounts for at least four per cent of the total luminosity. If the star formation in BYF 73 turns out be as efficient as in other massive, dense molecular clouds, then approximately 6 000 solar masses of gas would be expected to turn into stars. Even at a fraction of this efficiency, BYF 73 is the precursor to a massive, rich, young stellar cluster, before nearly all of the usual hallmarks of such a cluster have had time to develop. However, the speed of the infall is slow and so the timescale for cluster formation —until the infalling gas supply runs out— is quite long compared to what is predicted by some "prompt" models of massive cluster formation.

What shapes butterfly Planetary Nebulae?

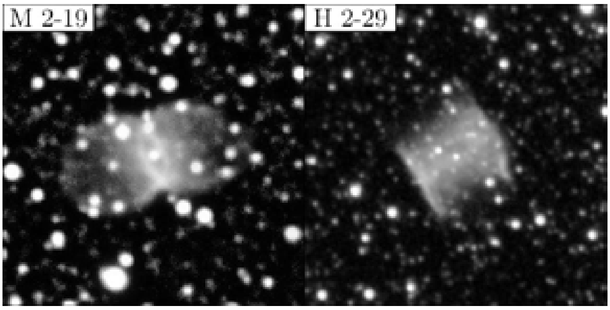


Figure 3.4 Gemini GMOS images of binary central star planetary nebulae M 2-19 and H 2-29 reveal bipolar nebulae with equatorial rings (Miszalski et al. 2009).

It has long been hypothesised that a companion star orbiting the central hot white dwarf star may be responsible for shaping bipolar ("butterfly") planetary nebulae during a common envelope phase (both stars sharing gas back and forth). Joint AAO/Macquarie University PhD student Brent Miszalski (now a postdoctoral researcher at the University of Hertfordshire) and collaborators obtained narrow-band imaging with the Gemini Multi-Object Spectrograph (GMOS) on Gemini South for a sample of planetary nebulae whose central stars showed evidence in OGLE data (a survey for microlensing events towards the galactic bulge) for periodic variability, consistent with being binary systems. They found that between 30 and 60 per cent of these systems have bipolar nebulae (depending on the viewing geometry assumed), the strongest evidence yet linking a common envelope in the central star system to the nebula morphology.

Magellan Telescope finds chemical evidence for the formation of Rocky Planets

As more and more extrasolar planets are discovered, it has been found that the likelihood of a star hosting giant planets increases with the abundance of heavier elements in the star's atmosphere. ANU astronomer Jorge Meléndez (now at U. Porto) and collaborators used the MIKE high-resolution optical spectrograph on the Clay 6.5 m Magellan telescope to compare spectra of the Sun (reflected from the asteroid Vesta) with 10 solar analogs (dwarf stars with spectral type G0–G5) and 11 solar "twins" (stars with physical parameters identical to the Sun). The Sun appears to be depleted in refractory elements relative to the solar twins and to solar analogs known to have giant planets from radial velocity surveys, and is in fact more similar to the solar analogs found not to have giant planets. This suggests that dust condensation may influence the formation of terrestrial planets. One exciting consequence of this is that it may be possible to infer the existence of terrestrial-mass planets on the basis of stellar abundance measurements alone.

Australian Magellan Fellow Dr Ricardo Covarrubias standing in front of the primary mirror of one of the Magellan 6.5 m telescopes at Las Campanas Observatory in Chile. After 2 ½ years of supporting visiting Magellan observers, Dr Covarrubias has now relocated to the AAO for his final research year.
Photo: Stuart Ryder

AAO's Scientific Highlights 1974-2010

Year	Scientific advances	Technological advances
1974	27 April, first light, first images of stars recorded on photographic plates at the prime focus. 16 October, AAT inaugurated.	
1975		The Image Dissector Scanner (IDS), the first digital electronic imaging detector designed for astronomy, allows astronomers to collect much more and better data than ever before.
1976		The versatile RGO spectrograph is used at the Cassegrain focus. It was for a long time one of the most commonly used instruments on the AAT. The Image Photon Counting System mounted on the RGO (IPCS) is commissioned and becomes detector of choice. This system becomes the most powerful in the world for high-resolution spectroscopy.
1977	Optical flashes from a radio pulsar in the constellation of Vela are observed. This was only the second optical pulsar to be observed and the faintest star ever studied at the time.	
1978	Discovery that many X-ray sources coincide with Seyfert galaxies.	
1979	Studies of galaxy NGC 5291 show it to be an unusual gas-rich galaxy. Gas is being stripped from this galaxy and, as a by-product, a host of tiny companion galaxies is being formed.	
1980		A novel infrared instrument, IRPS comes into full operation giving the AAT new power. Detailed IR observations of the Orion nebula are also made, revealing for the first time the violent early stages of star formation.
1981		Charge-coupled devices (CCDs) revolutionise light detection at the AAT. Optical fibres for astronomy are pioneered at the AAO with the use of 25 fibres in a small field. Over time, more fibres are added to this instrument (called FOCAP). By 1991, it has recorded more spectra than any other comparable system in the world.
1982	AAT observations of a quasar (PKS 2000-330) reveal a redshift of 3.78, which makes it the most distant known object in the Universe at the time.	
1983	Infrared observations of the centre of our Galaxy show that the central object consists of several separate components, including congregations of young hot stars, a very tight cluster of cooler stars, and a central concentration of cooler stars probably circling a black hole.	
1984	Discovery of clouds on the dark side of Venus. At certain wavelengths, clouds are backlit by the heat from the planet's surface.	A larger optical fibre mounting system covers the full field of the AAT, greatly increasing the scope for multi-object work.
1985		The Low Dispersion Survey Spectrograph (LDSS) is first used. This revolutionary instrument allows multi-slit low-dispersion spectroscopy of very faint objects.

Year	Scientific advances	Technological advances
1986	Organic molecules are detected in the dusty material streaming out of comet Halley. Discovery of the first quasar with a redshift greater than four, the then most distant known object in the Universe.	
1987	Supernova 1987A, the brightest exploding star since telescopes were invented, blazes forth from a nearby galaxy, the Large Magellanic Cloud. The supernova is visible only from the Southern Hemisphere and the AAT has a prime role in observing it.	There is an urgent need for a very high resolution spectrograph to analyse the light from the supernova. AAO engineer Peter Gillingham designs and builds a spectrograph in under two months—a record time.
1988		The University College London Coudé Spectrograph (UCLES) is commissioned. It has the double advantage of very high resolution and broad wavelength coverage.
1989	Autofib, an automatic optical fibre positioner, is used to show that the globular clusters around the elliptical galaxy Centaurus A are very similar to those in our own galaxy, despite the large differences in morphological type and luminosity between the two galaxies.	
1990		Work begins on the 2dF (Two Degree Field) system. This uses a robotic positioner to place the ends of optical fibres onto the telescope's focal plane, where each fibre can catch the light of one galaxy. Up to 400 fibres can be used, allowing the light from up to 400 galaxies to be captured simultaneously. It is a world-leading instrument.
1991	IRIS observations of a cluster of extremely hot, massive stars located near the Galactic Centre suggest that a burst of star formation may have occurred a few million years ago.	IRIS (the Infrared Imager Spectrograph) becomes the AAO's first instrument to give two-dimensional imaging at IR wavelengths. It is the most complex instrument that the AAO has built to that time.
1992		A new, large format Tektronix CCD is commissioned. This detector has twice the sensitivity of the best CCD previously available.
1993	IRIS observations of the northern outflow of Orion reveal unexpected jets. The jets are a result of an explosion about 1000 years ago and travel at up to 400 km a second.	The IRIS instrument wins the JJC Bradfield Award for engineering excellence from the Institution of Engineers Australia (Sydney Division).
1994	Comet Shoemaker-Levy 9 collides with Jupiter. IRIS observations reveal details of the collisions and later changes at the impact sites. Astronomers using the AAT discover the Sagittarius dwarf elliptical galaxy—at the time, the nearest known neighbour to our Milky Way Galaxy.	
1995		The Two-degree Field (2dF) facility for the AAT is officially opened.
1996		The Taurus tunable filter uses a unique system to enable astronomers to tune into very narrow parts of the spectrum. This is particularly helpful for observing objects that emit their light at a specific wavelength rather than across a broad range.

Year	Scientific advances	Technological advances
1997	Observations at the AAT detect the first isolated brown dwarf in our galaxy. Brown dwarfs are star-like objects which are not massive enough to burn nuclear fuel and so are extremely faint and difficult to detect.	
1998	Australian telescopes including the AAT help make the link between an exploding star, SN1998bw, and a powerful burst of gamma-rays from the same region of space. This is the first good evidence that gamma-ray bursters are in fact exploding stars. The Anglo-Australian Planet Search starts. It monitors 24 bright, nearby Sun-like stars, and looks for tiny wobbling motions in the star that reveal the presence of a planet. By 2010, the search has found 32 planets.	The AAO is recognised as world leader in optical fibres for astronomy when the European Southern Observatory contracts it to build a fibre positioner for the Very Large Telescope (VLT) in Chile.
1999	The 2dF system is in regular use. By 1999, it has measured more galaxy and quasar redshifts than any other instrument in the world.	
2000	Astronomers finish three years of observations to map the magnetic fields on the surfaces of stars other than the Sun—the first time such images have been made.	
2001	Analysis of early results from the 2dF Galaxy Redshift Survey shows that dark matter is distributed in the Universe in the same way as normal matter, and that there is not enough of it to stop the Universe expanding forever.	
2002	Observations are completed for the 2dF Galaxy Redshift survey. The survey measures the redshifts of 220 000 galaxy—effectively, their distances—and from it is produced the biggest 3D map to that time of galaxies in space, out to three billion light-years from Earth. From subtle patterns in the map astronomers make the most precise estimates to date of the proportions of normal matter, dark matter and dark energy in the Universe.	IRIS2 is a combined infrared imager and spectrograph built by the AAO for the AAT. In 2002, it takes out the JJC Bradfield Award for engineering excellence from the Institution of Engineers Australia (Sydney Division)—just as its predecessor, IRIS, did in 1993.
2003	The Anglo-Australian Planet Search finds a planet about twice the mass of Jupiter orbiting a Sun-like star. Of the hundred-odd planetary systems that are known at the time, this is the one most similar to our Solar System.	
2004	Astronomers using the AAT discover more than 40 previously unknown miniature galaxies, now called ultra-compact dwarfs.	

Year	Scientific advances	Technological advances
2005	The AAT and a large telescope in Chile are used together to listen to a star that rings like a bell. Churning gas in the star Alpha Centauri B create low frequency sound waves that make the star pulse in and out. These are the most precise and detailed measurements of such a star vibrating.	
2006	Astronomers start WiggleZ—a huge survey of distant galaxies that will help determine the nature of the mysterious dark energy.	The AAO installs a powerful new spectrograph, AAOmega, on the AAT. It is the world's best instrument for wide-field spectroscopic surveys.
2007	Astronomers used the AAT with a visitor instrument, SEMELPOL, to study magnetic fields on the surfaces of young stars, which are much stronger than those on the Sun. Magnetic fields affect, for instance, how active a star is and how fast its spin slows down.	Commissioning of the automated fibre positioner for the Subaru Faint Multi Object Spectrograph, begins at Mauan Kea in Hawaii.
2008	Astronomers begin the GAMA (Galaxy And Mass Assembly) project, to help build a better picture of how galaxies form and evolve.	The first trials take place on the AAT of OH-suppression optical fibres for astronomy. These make the sky look darker and clearer at infrared wavelengths, allowing astronomers to detect fainter objects in space.
2009	Astronomers make a detailed picture of the cloud patterns in the thin gas in the space between the stars (the interstellar medium). To do this, they use the AAOmega spectrograph to study the pattern of wavelengths absorbed from light shining through the gas from a background source (a globular cluster of stars).	
2010	The Anglo-Australian Planet Search team announces the discovery of three 'Super-Earths', rocky planets like our own.	

4 Performance

Strategies

The AAO consults with the astronomical community, and especially users of its facilities, to assess and anticipate their needs. There are several avenues available for this: the AAT Time Assignment Committee, the AAO Users' Committee, and user feedback forms. All have a strong influence on the strategic directions of the AAO.

ABC Western Plains visited the AAO Symposium from Dubbo. Pictured is AAO staff member Bob Dean being interviewed. Photo: Justin Huntsdale

The AAO aims to stay abreast of world best practice for observatories, and AAO staff are frequently successful in competing for valuable observing time at major telescopes overseas. Participation in conferences, workshops and colloquia are also important ways of staying in touch and promoting the science conducted at the AAT and by AAO staff.

Another vital strategy is to ensure that the needs of users are met through a range of measures: maintaining and improving existing instrumentation and associated software; keeping on-line documentation up to date; providing excellent support in setting up the instruments; liaising with telescope operations staff and observers; soliciting users' feedback; providing input to the design of the next generation of innovative new instrumentation; and achieving ever-greater efficiency in operating the telescopes.

AAT Performance

There were 71 proposals for AAT time across the past year, spread over two semesters. The 2009B semester was the last in which the UK had formal involvement with the telescope. Under the terms of their withdrawal from the Joint Agreement, the fractional allocation of AAT time in 2009B and 2010A was set at 71.2 per cent for Australian proposals, 8.8 per cent for those from the UK, and 20 per cent from all other countries.

Figure 4.1 shows the level of AAT demand in terms of its marginal oversubscription over the past few years. This allows for existing allocations to long term programs (running over several semesters), then the rate is around 2.3. In contrast to the overall rate, this is more heavily skewed towards dark time, reflecting the higher demand on dark time by the larger Long Term Programs. Long Term Programs used 25 and 50 per cent in Semesters 2009B 2010A respectively. Three of the five existing Long Term Programs ended during the period and two new ones began.

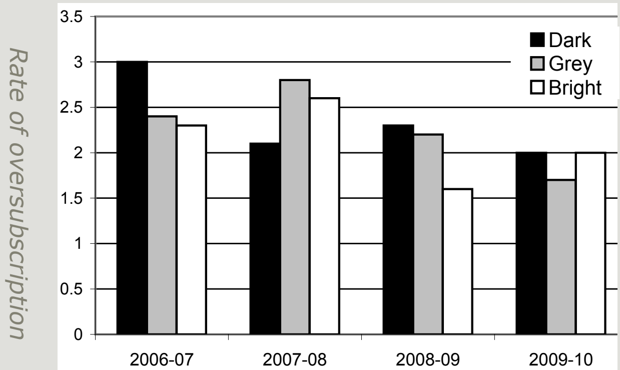


Figure 4.1 Oversubscription rates for the AAT over the last four years.

Figure 4.2 shows the use of AAT time over 2009-10. Losses due to weather (36.5 per cent) are slightly higher than the long term average and account for the lower than average observing time (60.5 per cent). Equipment failure has stayed constant (3 per cent). AAOmega and the 2dF top-end are used for nearly two-thirds of all telescope time, and the Observatory has endeavoured to secure periods of off-telescope maintenance of the ageing 2dF robot to improve its reliability further. Figure 4.3 shows AAT usage trends over the longer term.

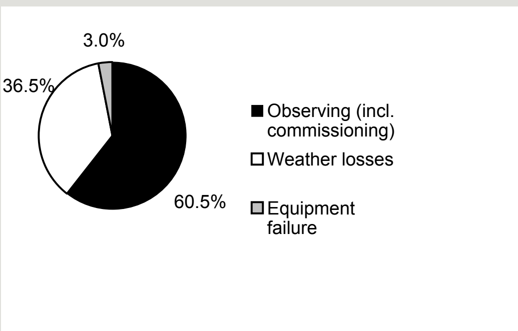


Figure 4.2 The use of observing time at the AAT in 2009-10.

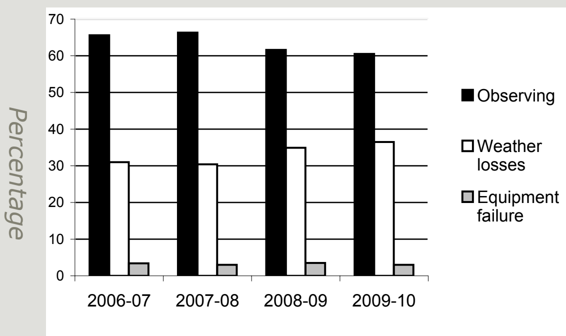


Figure 4.3 The use of observing time at the AAT over the last four years.

User Feedback

AAT observers are encouraged to complete the web feedback form, which asks how well the AAO has fulfilled its obligations under its client service charter. The responses are ranked in five steps ranging from well below (1) to well above (5) acceptable. Users are also asked to flag key items and to comment on any issues of concern.

For the past two semesters, 2009B and 2010A, 20 feedback forms were returned from the 30 programs not led (or observed) by AAO staff, giving a return rate of 66 per cent (historical average is a return rate of 50-70 per cent). Although 27 separate observing sessions were scheduled, many of these were part of multi-epoch runs for large programs, or smaller programs split up for scientific or scheduling reasons, and for which only a single report was returned. This number also excludes AAO-staff led programs where the observer typically provides feedback directly. All grades of three or lower are explored by querying them explicitly with the observer to identify problem areas for follow-up.

Table 4.1 Average user feedback ranking at the AAT (1= well below acceptable 5 = well above acceptable)

	2007-08	2008-09	2009-10
Night Assistant Support	4.6	4.6	4.6
Staff astronomer before run	4.6	4.6	4.5
Staff astronomer during	4.8	4.5	4.6
Other technical support	4.6	4.6	4.4
Instrumentation & software	4.3	3.9	3.9
General computing	4.3	4.1	4.1
Working environment	4.2	4.0	4.2
Web based accommodation & travel support information	-	3.7	4.2
Data reduction software	4.0	3.9	4.0
Instrument manuals	4.1	3.9	4.0
AAO WWW pages	4.0	3.9	3.8

The AAO's performance target is a minimum level of 3.75 in all categories. In 2009-10, all key areas exceeded this. The working environment grade, which had dipped is now high, and the general impression of the refurbished control room seems strongly positive. Staff astronomer support, technical support, and night assistant support continue to receive excellent ratings from almost all observers (average grades above 4). All comments, both positive and negative, are followed up through appropriate channels, and all observer feedback forms are acknowledged by the Head of AAT Science. Average scores for the past 12 months and two previous years are presented in table 4.1.

UKST Performance

The UKST is currently used exclusively for the RAVE survey of galactic stars. RAVE (RAdial Velocity Experiment) is a nine-nation collaboration headed by Prof. Matthias Steinmetz of the Astrophysical Institute in Potsdam (AIP). RAVE aims to generate an archive of stellar radial velocities and atmospheric parameters for more than half a million stars using the UKST. From its commencement on 11 April 2003 until 31 July 2005, the project utilised seven bright nights per lunation, funded incrementally by the international RAVE consortium. Since 1 August 2005, RAVE has been the sole user of the UKST and has provided the operational funding, although the telescope itself continues to be managed by the AAO.

Weather and downtime statistics are shown below:

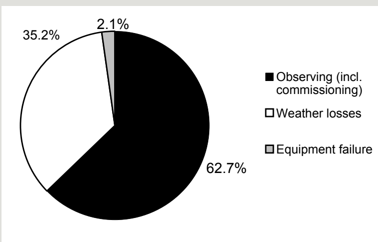


Figure 4.4 The use of observing time at the UKST in 2009-10.

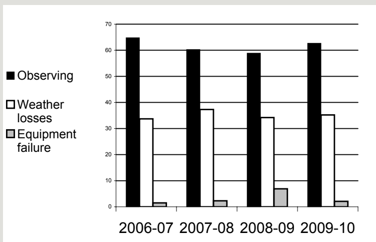


Figure 4.5 The use of observing time at the UKST over the past four years.

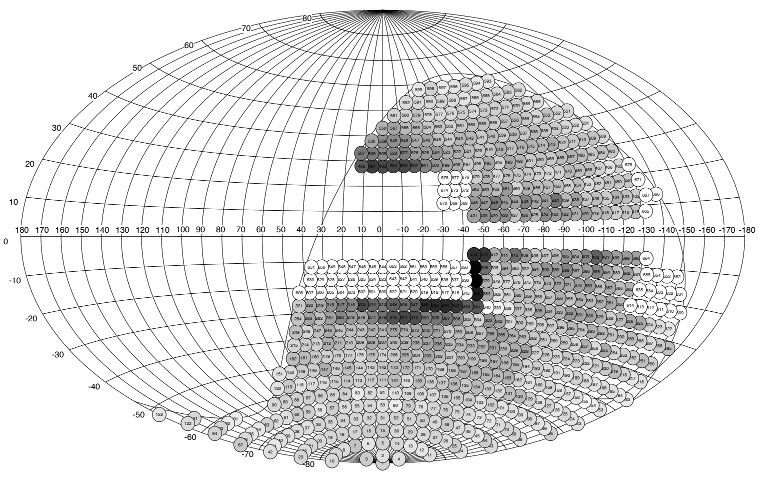
By the end of 2009-10, a total of 5 289 RAVE fields (telescope pointings) had been observed. These are detailed in Table 4.2. By 2 July 2010, a total of 440,316 spectra had been amassed on 363 779 unique objects. The total number of spectra obtained during the year was 84 059, the highest in a 12-month period since 2006. This performance was largely a consequence of the introduction of the new third field plate (FP3) in March 2009.

Table 4.2 Numbers of 6dF fields observed

Program	2004-05	2005-06	2006-07	2007-08*	2008-09	2009-10
6dF Galaxy Survey fields	383	94	-	-	-	-
RAVE Survey	407	726	798	926	1022	936
Non-survey fields	112	2	-	-	5	1
Total fields	902	822	798	926	1027	937

**Incomplete semester due to AAO OH&S Remedial Works Programme*

The status of the observations is shown in Figure 4.6. The grey scale represents the density of observations in each 5° field, with white indicating zero observations, and black a maximum density of 2 055 stars per field.



AAO/UKST 6df-RAVE Survey: Observation Density: 02-07-2010 Total Observations = 313,198(Imax=2055)

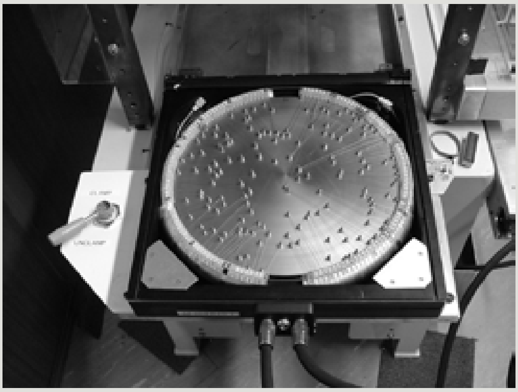
Figure 4.6 Total observations since start of RAVE (as at 2 July 2010).

In order to alleviate a lack of winter bright-time targets (caused by the need to avoid the galactic bulge region), the survey has now been extended towards the galactic equator with the addition of a new input catalogue. When incorporated into the RAVE tiling scheme, the new catalogue produces the additional low-latitude fields clearly visible in Figure 4.6. The asymmetry around the bulge is due to asymmetric reddening in the northern and southern galactic hemispheres.

The new fields are most effective in bridging the gap due to the bulge, significantly reducing the problems experienced in bright time. Observations using the new catalogue began on 2 July 2010.

Instrumentation and Upgrades

The addition of FP3 in March 2009 produced a significant increase in the data rate. FP3 was delivered with 139 active fibres, and low-level attrition had reduced availability to 125 fibres by March 2010. Unfortunately, on 17 April, there was an accident to FP3 that resulted in the breakage of 45 fibres within the fibre cable and at the slit end. Breakage within these areas cannot be repaired, owing to the cemented-slit construction of the 6dF fibre feeds.



Above: The third field plate (FP3) in the 6dF robot will soon get new fibre sub-bundles.

It is planned to replace the FP3 cable using new fibre sub-bundles, to be manufactured by AIP. The heavily armoured cable (which may have been a contributor to the accident) will also be replaced by a lighter version. Currently, FP3 is operating with 71 available fibres, and FP1 with 84. These relatively low fibre numbers have had a smaller effect on the data rate than might be expected, due to the faster turn-round time in the robot.

The status of FP2's long-awaited refurbishment is that the last 16 replacement fibres were delivered from AIP in mid-July, allowing the completion of the new fibre feed. It is expected that FP2 will be recommissioned with a full complement of 150 fibres in September 2010. Once that has taken place, fibre repair work can begin on the damaged FP3 fibre feed.

RAVE Progress

The first tranche of RAVE data was publicly released in 2006, and the release of the second year's data took place in mid-2008. Besides radial velocities, this also includes stellar parameters, and was accompanied by the publication of a data release paper in *Astrophysical Journal*. The third data-release was originally scheduled for mid-2009, but has been delayed by several months to verify a calibration issue in the stellar parameter pipeline. An additional data release providing distance estimates based on isochrones has been published in MNRAS.

Furthermore, additional data releases featuring detailed abundances and stellar rotational velocities are currently in preparation. The 12th international RAVE Collaboration Meeting was held in Groningen on 14 and 15 June 2010, and the 13th will be in Coonabarabran on 24 and 25 June 2011. RAVE funds exist to support these operations until mid-2011, and discussions are in progress with AAO and other stakeholders with a view to extending the operational phase of the project to the end of 2011 or beyond.

RAVE Science

Members of the RAVE collaboration are now producing significant numbers of science papers covering a very wide range of galactic topics. Recent submissions include contributions on stellar distance determinations (three papers), thick disc formation mechanisms, metal-poor stars in the thick disc, an extended stellar flow in the local disc, the eccentricity distribution of stars in the thick disc, and new stellar streams. There also appears to be an increasing engagement with RAVE by members of the GAIA consortium, which may eventually result in a more formal collaboration.

Australian Gemini Office

Australia has a 6.2 per cent share of time on the twin 8.1-metre telescopes on Mauna Kea in Hawaii and Cerro Pachon in Chile operated by the Gemini Observatory, an international partnership that also includes the USA, UK, Canada, Argentina, Brazil, and Chile. Australian membership of the Gemini Observatory is funded jointly by the Australian Research Council and the National Collaborative Research Infrastructure Strategy (NCRIS). The Australian Gemini Office (AusGO) within the AAO coordinates Australia's usage of Gemini time by issuing calls for proposals; acting as first point of contact for prospective Australian applicants; technically assessing proposals on behalf of the Australian Time Assignment Committee; assisting successful Australian Principal Investigators with preparing their queue-scheduled observing programs; providing guidance in how to reduce and analyse new and archival data from Gemini; and helping promote Australian science from Gemini to the media and general public. AusGO also manages Australia's purchase of 15 nights per year on the twin 6.5-metre Magellan telescopes at the Las Campanas Observatory in Chile, also funded by NCRIS.

The AAO operates AusGO under contract to Astronomy Australia Limited (AAL) from funds provided by NCRIS. AusGO now comprises seven astronomers: the Australian Gemini Scientist Dr Stuart Ryder, and Deputy Gemini Scientist Dr Simon O'Toole, both based at the AAO; Deputy Gemini Scientist Dr Christopher Onken based at ANU; and four Magellan Fellows. Dr Francesco Di Mille and Dr Shane Walsh are based in Chile, and after two years each conducting research with and providing operational support to the Magellan telescopes, will spend a third year of research at an Australian institution of their choice. They replaced Dr David Floyd and Dr Ricardo Covarrubias, who have now joined their Australian host institutions (University of Melbourne and AAO, respectively).

AusGO coordinates the Australian Gemini Undergraduate Summer Studentship (AGUSS) program sponsored by AAL. Under this scheme, up to three Australian undergraduate students spend 10 weeks working at the Gemini South headquarters in La Serena, Chile on a research project supervised by Gemini staff. Besides having its own website hosted by the AAO servers (http://ausgo.aao.gov.au), AusGO utilises the bi-annual AAO Newsletter to publish Gemini news and items with a more specific Australian focus. As its contribution to the International Year of Astronomy, AusGO launched an annual contest for Australian high school students to win one hour of time on the Gemini South telescope to observe an object nominated by them for scientific and aesthetic reasons.

Above: The winner of the 2009 International Year of Astronomy Gemini School Astronomy Contest, PAL College Year 10 student Daniel Tran (right), his classmates, and teacher David Lee (left) are presented with their Gemini telescope image of the planetary nebula NGC 6751 by Deputy Gemini Scientist Dr Christopher Onken (centre). Photo: David Marshall Photography.

Research performance

The total number of AAT observing programs for the past five years is shown in Figure 4.7. The number of scheduled programs per year on the AAT did not decline as strongly as in past years, suggesting that we may be starting to see things stabilise following the completion of the UK withdrawal, alongside a similar stabilisation in the number of large survey-style programs that contribute to the high scientific impact of the AAT. The decline in the programs led by UK astronomers, reflecting the declining UK share, is seen in Figure 4.8 which shows the distribution of AAT observing programs by the location of the Principal Investigator. This decline is being balanced in part by increases in Australian-led programs, although in recent years those submitted by astronomers at Other (non-Australian and non-UK) institutions has also been declining. We are addressing this decline by advertising the availability of the AAT more widely to the international community, in particular in Europe through the OPTICON scheme, and to the US community through the AAS newsletter.

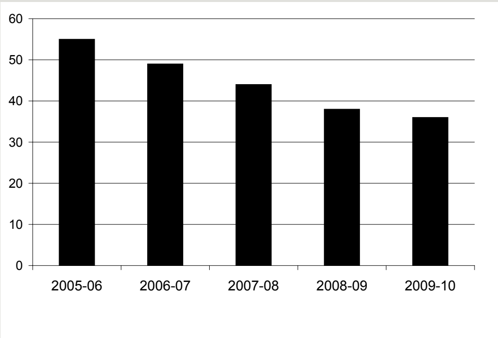


Figure 4.7 Total number of scheduled AAT observing programs. Note that long-term proposals are counted for each semester they are scheduled.

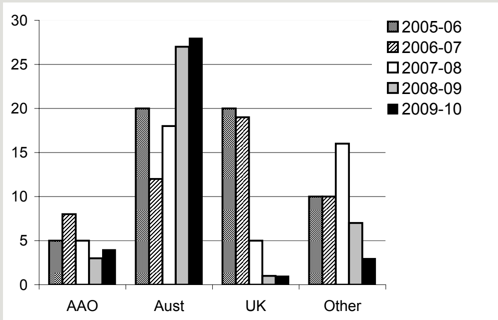


Figure 4.8 Number of scheduled AAT observing programs by location of Principal Investigator.

Figure 4.9 shows the total number of research papers published in refereed journals and conference proceedings using data from the AAT and UKST. Also shown are the total number of papers published by AAO staff, students, and visitors. The number of publications has indeed increased as predicted in last year's Annual Report, in part as a consequence of the growing size of the Astronomy group at the AAO and associated increase in productivity, but also with the completion of the WiggleZ and GAMA Large Programs, publications from which are beginning to make an impact.

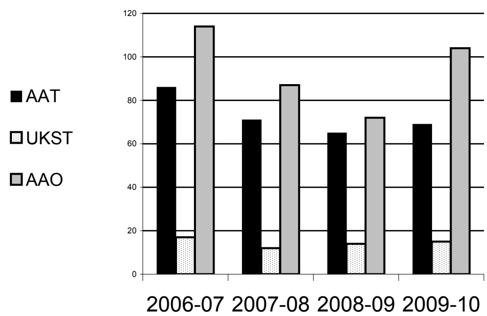


Figure 4.9 Total number of publications using AAT and UKST data, and AAO publications.

The distribution of publications in refereed journals by location of the first author is shown in Figures 4.10 and 4.11 for papers using AAT and UKST data, respectively.

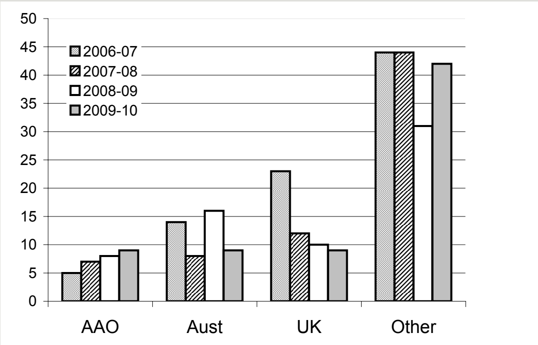


Figure 4.10 Research papers published using AAT data by location of first author.

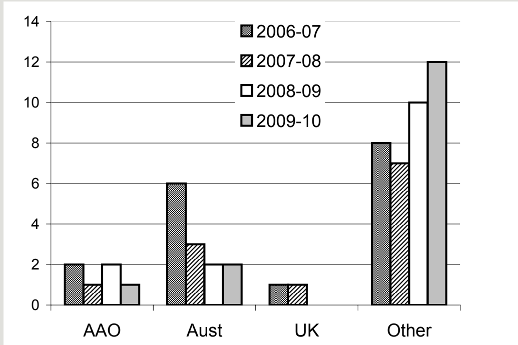


Figure 4.11 Research papers published using UKST data by location of first author.

The number of UK-led publications using AAT data has declined marginally, while those from the AAO and other institutions have increased. The decline in papers by first authors from Australian institutions compared to last year is indicative of the oscillation seen in earlier years, and is likely to be a reflection of the numbers of programs allocated time on the telescope. First authors from outside the UK and Australia continue to dominate the publication rates, and have risen again to the pleasingly high level of earlier years. Figure 4.12 shows that publication rates by AAO staff, utilising data from the AAT and UKST and from facilities worldwide (the 'Other' column) have increased to a particularly strong level. The publication rate for papers using AAT data per AAT observing program has increased even compared to the healthy level seen in recent years (Figure 4.13).

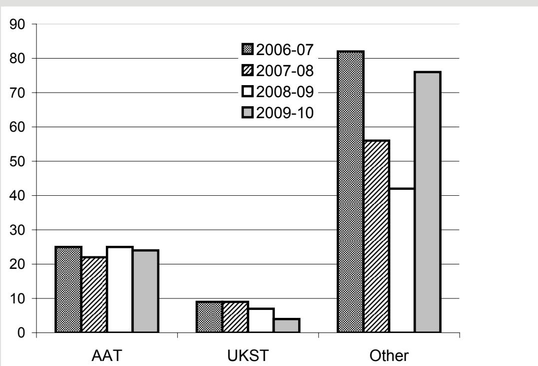


Figure 4.12 AAO publications by AAO staff, students & visitors.

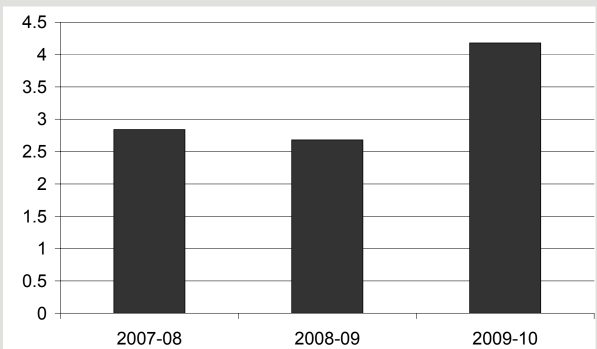


Figure 4.13 Publications per AAT observing program.

Astronomy Students and Postdoctoral Fellows

The AAO plays host to a healthy number of postgraduate research students, who are jointly supervised by AAO staff. Currently, AAO staff co-supervise 28 PhD, Masters and Honours students, with the bulk of these being PhD students. The AAO continues to provide a PhD top-up scholarship scheme for graduate students enrolled at Australian universities whose research is substantially co-supervised by staff at the AAO. We were able to offer three top-up scholarships this year, two recipients of which were university medal winners at Macquarie and Sydney Universities, bringing our total of AAO funded PhD students to six.

The AAO was successful in being awarded four Super Science Postdoctoral Fellowships by the ARC, with one Fellowship to begin in 2010, and the other three to begin in 2011. These are three-year research fellowships, and will focus on science with the GAMA survey on the AAT and the proposed TAIPAN survey on the UKST, building from experience with the 6dF Galaxy Survey.

In addition, Macquarie University was successful in being awarded four Super Science Fellowships as well, three of which are to work on science related to the HERMES instrument currently being built by the AAO. These fellows will spend up to one year of their three-year fellowships hosted by the AAO, collaborating with both AAO and Macquarie researchers.

Attending the Super Science Fellowship announcement in April are (left to right): Professor Elaine Sadler (U. Sydney), Professor Richard Coleman (ARC), Professor Matthew Colless (Director, AAO). Photo: Chris Taylor

AAO Distinguished Visitor Scheme

This year the AAO instituted a new distinguished visitor scheme that provides support for long-term visits (four weeks to six months) by high-profile international researchers. The distinguished visitors will strengthen and enhance the AAO's visibility both locally and internationally, and will provide opportunities for AAO staff to benefit from longer term collaborative visits by eminent international colleagues. The intent of the program is to support one or two distinguished visitors annually. Details of the program are given on the

AAO's website. To celebrate the inaugural round of the distinguished visitor scheme, and to promote the new scheme, the AAO has awarded four visitorships to occur during 2010.

The Distinguished Visitors for 2010 were:

Associate Professor Andrew Connolly, (University of Washington), who worked with AAO staff on new techniques for the classification of spectra using spectroscopic survey data, and the creation of a simulation framework for designing future photometric and spectroscopic surveys.

Professor Richard Ellis, (Caltech), who engaged with AAO staff in a program of identifying which multiwavelength photometric and spectroscopic observables most strongly constrain the shape of the stellar initial mass function for star clusters, galaxies, and galaxy populations.

Professor David Koo, (UCO Lick Observatory, and UC Santa Cruz), who is a leader of the AEGIS multiwavelength survey, and worked with AAO staff (Hopkins, Brough) and students (Gunawardhana) in comparing measurements from the AEGIS survey with those from the GAMA survey on the AAT, to explore evolutionary trends in galaxies spanning more than half the age of the Universe.

Assistant Professor Kim-Vy Tran, (Texas A&M University), who collaborated with AAO staff (Brough) on a project to spatially map the kinematics and stellar populations of Brightest Cluster Galaxies in the nearby Universe.

Left to right: Former Director Russell Cannon, Fellows Max Spolaor and Chris Springob, and Australian Deputy Gemini scientist Simon O'Toole, are pictured enjoying lunch in the grounds at the Sydney Laboratory. Photo: Stuart Ryder

Instrumentation

Table 4.3 shows that AAOmega+2dF used 49 per cent of the total nights allocated on the AAT over the past two semesters. The science undertaken with this instrument was largely the WiggleZ and GAMA surveys. UCLES, used for 32 per cent of the allocated nights, was largely used for the Anglo-Australian Planet Search.

Table 4.3 Use of the AAT instruments for the last three years (% of nights allocated).*

Instrument	2007-08	2008-09	2009-10
2dF/AAOmega Wide-field multi-object spectrograph	61.5	49.0	49.0
SPIRAL/AAOmega Integral field spectrograph	7.5	9.5	3.5
UCLES/UHRF Coude echelle spectrographs	15.0	32.0	32.0
IRIS2 Infrared imager and spectrograph	9.0	3.0	5.0
Visitor instruments Instru-ments supplied by users	7.0	7.5	7.5

** Years indicated are not financial years, but two AAO Semesters running from 1 February to 31 July (A) and 1 August to 31 January (B).*

Instrumentation Projects

HERMES

The HERMES (High Efficiency and Resolution Multi-Element Spectrograph) passed its Preliminary Design Review in February. The project is now in the final design phase and is on track to deliver a facility capable of observing up to 400 simultaneous targets in the two-degree field of the AAT at relatively high spectral resolution and wavelength coverage. The primary science objective is a one-million star survey of our Milky Way galaxy to untangle the formation history through chemical and kinematic tagging of the stars. This instrument and survey will be a valuable complement to the European GAIA satellite. Science commissioning is anticipated to take place in early 2013.

Electronics Technician Rolf Muller working on the video board for HERMES. Photo: A Heng

CYCLOPS

CYCLOPS is a fibre array feed for the UCLES spectrograph. Such an array will allow more light to be collected from the star. This comes about by ensuring that all the light enters the slit of the spectrograph and thus avoids the two mirrors otherwise required to direct light to the instrument. The resolving power of the instrument can also be improved since the slit does not need to be widened to collect the star light. The array was commissioned in late June. Other than a few issues that will require some rework of the mounts and array, the array is delivering performance levels consistent with expectations.

GNOSIS

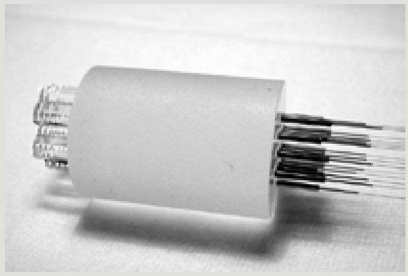
A Linkage, Infrastructure, Equipment and Facilities, (LIEF) bid was successful in securing funds to build an H-band OH suppression integral field unit for use with the IRIS-2 spectrograph on the AAT. This capability will serve as an on-sky demonstrator of the cutting edge OH suppression technology developed by the AAO in collaboration with the University of Sydney. The device will be made available for some trial scientific applications. A follow-on effort will be proposed next year to fund an extension of the OH suppression into the J-band and explore implementation of the array on the Gemini telescopes for use with the Gemini Near-IR Spectrograph (GNIRS).

MANIFEST

The GMT has accepted a proposal to perform a Feasibility Study of a facility multi-object fibre system (MANIFEST). The funding arrangements were agreed upon this year with the study starting early in the new fiscal year. The effort will focus on a Starbugs positioner with a glass substrate holding the probes in alignment with the focal plane, as well as defining the critical interfaces to the telescope and instruments.

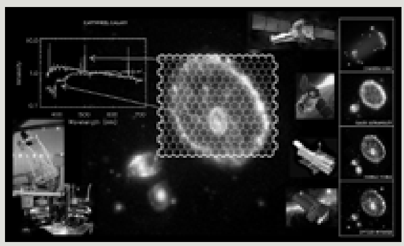
KOALA

KOALA (Kilo-fibre Optical AAT Lenslet Array) is a proposed integral field unit to replace the SPIRAL IFU. KOALA will provide twice the areal coverage and will feed the AAOmega spectrograph. A proposal was generated and submitted for LIEF funds. If funded, the array will be build in 2011 with on-telescope implementation in early 2012.



Above: CYCLOPS. The completed microlens array after removal from the fibre alignment/gluing jig. Photo: Anthony Horton

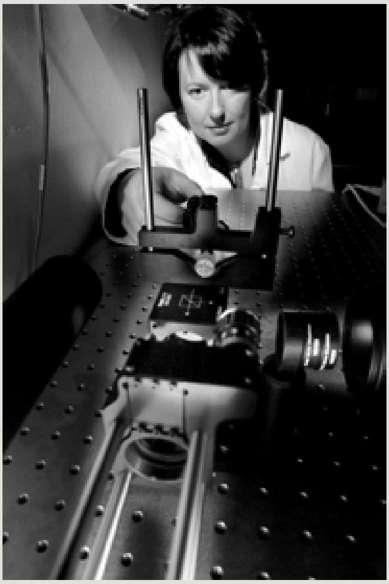
*Above: AAO staff member Anthony Horton assembling a micro-lens array for CYCLOPS.
Photo: Tim Wheeler*

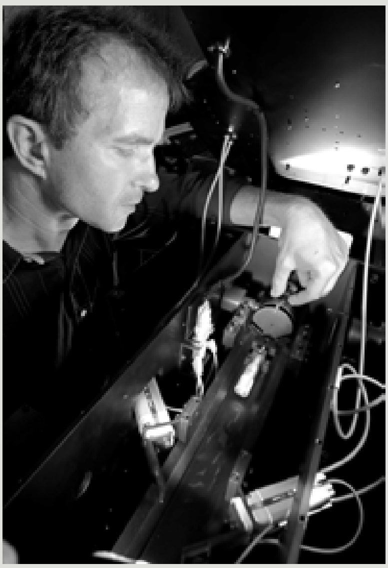


Above: Combining the proposed KOALA fibre feed with the AAOmega spectrograph, users will determine the life histories of nearby galaxies by interpreting differences in the spectroscopic fingerprints from every different part of the galaxy in a single observation. Image: Robert Sharp

Instrument Science

The Instrument Science Group is tasked with research and development of new instrument concepts and new enabling technologies for existing and future telescopes. In order to achieve this, The group works closely with the Astronomy and Instrumentation groups and maintains strong links with key universities and industrial partners. In support of instrumentation projects, the group develops new instrument concepts and provides instrument science and systems engineering support from the project initialisation stage through to project completion.





Top: AAO student Dionne Haynes testing fibres; Bottom: Staff member Jurek Brzeski adjusting the optical assembly for CYCLOPS. Photos: Tim Wheeler

The last twelve months have seen a number of staff movements. The former Head of the group, Roger Haynes, departed the AAO in late November. Jon Lawrence has been acting Head of the Instrument Science group since then, and has now taken on the role formally. Other departures from the group in late 2009 included Stuart Barnes and Dionne Haynes. We are now expanding the group, with Nemanja Jovanovic commencing a joint appointment with Macquarie University in late 2009, and two new Instrument Scientists, Simon Ellis and Jessica Zheng, set to join us in late 2010. Additionally, a second joint AAO/MQ appointment is expected later in the year. These new additions join group members Anthony Horton and Michael Goodwin, and part-time member Will Saunders.

Research and Development

The instrument science technology research and development program is undertaken in close collaboration with local and international university and industrial partners, in particular: the Astrophotonics Groups at the University of Sydney and at Macquarie University, and the InnoFSPEC research centre at the Astrophysikalisches Institut Potsdam (AIP) in Germany. These groups collaborate under the Consortium for Australian Astrophotonics (CAA) and the Astrophotonics Instrument Consortium (ASPIC) agreements. The Instrument Science group is also a key member of Astrophotonica Europa, a European-based consortium of 20 institutions, led by Durham University, formed to investigate photonic applications in astronomy.

Research highlights

Highlights in the past year included:

OH suppression: An investigation into the key components required for fibre-based astronomical atmospheric OH suppression systems (fibre Bragg gratings and photonic lanterns). This research, in collaboration with U. Sydney, AIP, and industry, is the key technology that underpins the GNOSIS instrument funded through ARC LIEF (led by Joss Bland-Hawthorn).

Integrated Photonic Spectrograph: the publication of the first on-sky acquisition of an infrared sky spectrum using an arrayed-waveguide grating device coupled to the IRIS2 near-infrared spectrograph at Siding Spring.

Fibre technologies: An investigation into the performance of telecommunications-based fibre connectors and fibre ribbon cables for astronomical applications.

Starbugs: A laboratory demonstration of the closed-loop position control of a discrete-step robotic fibre positioning "Starbug" to within several microns, well within the specification required for future ELT instruments.

Laser calibration: The coupling of a laser frequency comb into the UHRF instrument at the AAT site, in collaboration with Swinburne University of Technology and the University of Western Australia, to investigate intra-pixel sensitivity variations in extremely high resolution spectrographs.

Antarctic astronomy: The development of designs for telescopes and automated instrumentation, in close collaboration with the University of New South Wales, that are specifically engineered to take advantage of the unique atmospheric conditions found at high Antarctic plateau sites.

Three views of a Starbug prototype for the parallel positioning of optical fibres on telescope focal planes. (top) the contact surface or 'feet'; (middle) walking underneath a glass plate coupled by sliding 'donut' magnet; (bottom) alternatively, walking in an upright position over a metal plate. Photo: James Gilbert

The Instrument Science group has also provided significant support to AAO Instrumentation group projects CYCLOPS, HERMES, GNOSIS, MANIFEST, and KOALA.

Publications, workshops and conferences

The Instrument Science group produced over 40 publications last year. All members of the group attended the SPIE Astronomical Telescopes and Instrumentation conference in San Diego in June 2010. This is the key international conference on astronomical instrumentation research and development, and the AAO Instrument Science group had a noticeable presence, with over 20 papers presented on a variety of R&D topics. Group members also attended the GMT Workshop in Melbourne and the AAO Symposium in Coonabarabran, both in June 2010.

Students

A number of university students and graduates have been co-supervised by Instrument Science staff at the AAO during the last 12 months:

Nick Cvetojevic (PhD student, Macquarie University) is working with Jon Lawrence on the characterisation of array waveguide grating spectrographs for astronomy.

Marc Etherington (MSc student, Durham University) completed a three-month AAO Student Scholarship project, supervised by Jon Lawrence and Roger Haynes, on characterising photonic crystal fibres for astronomy.

Jamie Gilbert (MSc graduate, Bath University) completed a three-month AAO internship project, supervised by Michael Goodwin, on Starbugs control systems.

Dionne Haynes (MPhil student, Macquarie University) completed a large fraction of a thesis looking at light loss mechanisms and propagation in multimode optical fibres under the supervision of the Instrument Science group (AAO) and Mick Withford (MQ).

Talini Jayawardena (MEng student, University of Bath) completed a three-month AAO Student Scholarship project supervised by Michael Goodwin investigating a closed-loop control system for Starbugs.

Geraldine Marien (PhD student, Macquarie University) is working with Jon Lawrence on the development of fibre Bragg gratings for temporal spectral astronomy.

Anna Perejma (BSc student, University of Adelaide) completed an AAO Student Scholarship project, supervised by Jon Lawrence and Anthony Horton, on the experimental characterisation of photonic lanterns.

Resources

Human Resources

The AAO strives to provide challenging work combined with good employment conditions and work-life balance. The AAO is an equal employment opportunity employer and has a strong commitment to occupational health and safety.

Staff numbers

The AAO employs research scientists, technical staff, software engineers, electronics engineers, optical and mechanical engineers, computing, administrative and library staff. Staff members are located at both the Sydney Laboratory and at the Siding Spring Observatory. Table 4.4 shows staff numbers by tenure.

Table 4.4 Staff Numbers by tenure at 30 June 2010

Fixed Term Positions	**No. of Full Time**	**No. of Part-Time**	**FTE Part-Time**	**Total FTE***
Director	1	-	-	1.0
Technology - Instrument Science	3	-	-	3.0
Technology - Instrumentation	7	-	-	7.0
Astronomy	12	2	1	13.0
Operations	4	5	2.1	6.1
Corporate/Information Technology	3	1	0.4	3.4
Sub total	30	8	3.5	33.5

Indefinite Term Positions	**No. of Full Time**	**No. of Part-Time**	**FTE Part-Time**	**Total FTE**
Technology - Instrumentation	12	2	1.5	13.5
Astronomy	1	-	-	1.0
Operations	18	-	-	18.0
Corporate/Information Technology	7	-	-	7.0
Sub total	38	2	1.5	39.5
Total Staff	**68**	**10**	**5**	**73.0**

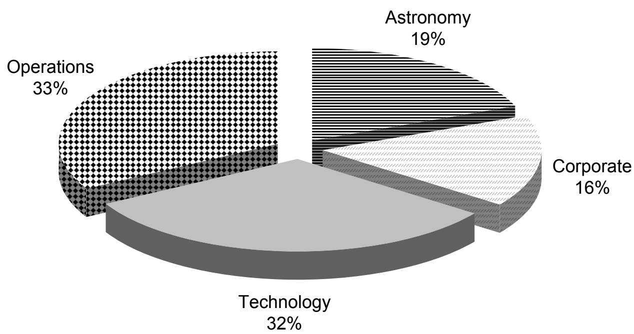
** FTE: Full time equivalent*

Staff by function

The functional areas of the AAO are:

- Astronomy, which includes on staff astronomers, visiting astronomers, research fellows, and visiting students;
- Operations, which is responsible for the running of the AAT and UKST at Siding Spring;
- Technology - Instrumentation, which builds instruments for the AAO telescopes and external clients;
- Technology - Instrumentation Science, which develops new technology; and
- Corporate, which includes accounting, library, information technology and other support services.

Figure 4.14 shows the breakdown of AAO staff by function



Employment arrangements

The AAO's terms and conditions of employment are set via a collective agreement, the Anglo-Australian Telescope Board Enterprise Agreement 2007-10. In June 2010, staff overwhelmingly voted in favour of a new agreement, the Australian Astronomical Observatory Enterprise Agreement 2010-11, which commences on 1 July 2010. In accordance with the Australian Government's Employment Bargaining Framework, the new agreement must not have an expiry date later than 30 June 2011.

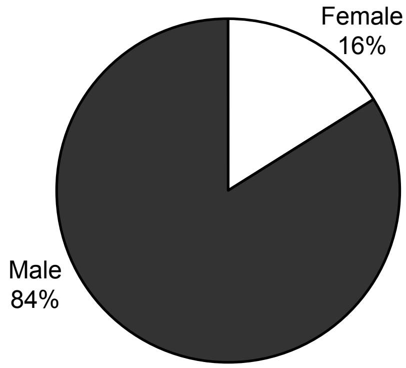
As from 1 July 2010, under the provisions of the *Australian Astronomical Observatory (Transitional Provisions) Act 2010* all AAO staff (formerly AATB employees) will be employed under the *Public Service Act 1999*.

Equal Employment Opportunity (EEO)

The AATB is an equal employment opportunity employer and strongly supports workplace diversity. The chart below shows the ratio of males to females at the AAO and reflects the difficulty of attracting and retaining females in science.

During the year the AAO also had ten visiting students. Of this number six (i.e. 60 per cent) were female.

Figure 4.15 Ratio of female to male staff members



Occupational health and safety

The aim of the AAT Board's safety policy is to ensure that employees at every level and working visitors are provided with a safe and healthy working environment. The current Occupational Health and Safety Strategic Plan (1 July 2008 to 30 June 2010) aims to continuously improve the work environment to ensure that it is safe and healthy. The key objectives for the biennium are:

- raising the levels of awareness of OH&S throughout the AAO;
- risk identification and mitigation; and
- completing a program of remedial works at both Siding Spring and Epping sites.

The AAO has two Health and Safety committees – one at each site (Siding Spring and Epping) – which meet quarterly. They comprise staff and management representatives. The Executive Officer is a member of both committees.

The AATB's workers compensation insurer is Comcare - an Australian Government statutory authority responsible for workplace safety, rehabilitation and compensation. The AAO has worked hard to maintain a safe working environment. There have been no notifications of dangerous occurrences for at least the last five years.

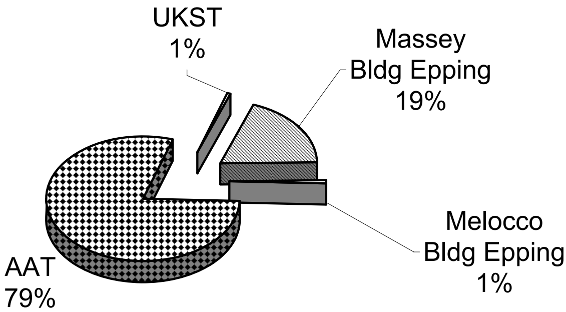
Table 4.5 OH&S Statistics

	2005-06	2006-07	2007-08	2008-09	2009-10
No. of claims	3	4	3	0	4
Payments Made	$15,121	$41,627	$35,000	$ 0	$4,193
Dangerous Occurrences	0	0	0	0	0
Workers Comp Insurance	$33,891	$52,075	$31,665	$42,340	$23,266

The OH&S remedial works program commenced in 2006 and has now been completed. In 2005, the AATB commissioned an external review of its OH&S infrastructure needs. The report identified various remedial works that need to be undertaken at both Head Office and Siding Spring with the bulk of the work to be undertaken at the AAT.

Following an approach by the AATB, the Australian and United Kingdom Governments provided $2.7 million to fund a remedial works program. The AAO Safety Committees were involved in the project.

Figure 4.16 shows infrastructure upgrades by location



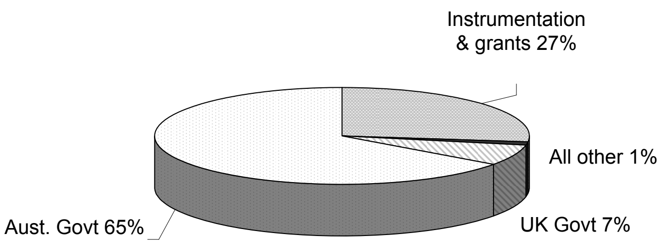
Financial resources

The financial statements in Appendix A outline the AAO's financial position. The Australian National Audit Office (ANAO) has audited the financial statements of the AATB and has again provided a clear audit certificate. The auditor's report is also contained in Appendix A.

The AAO's sources of funds are:

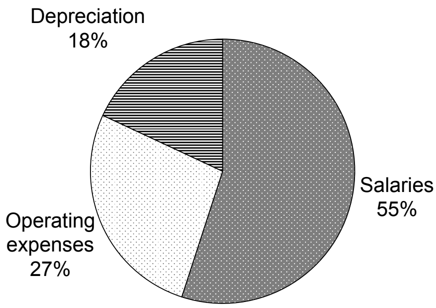
- Government grants provided by Australia and the United Kingdom;
- Contracts for the building of instruments for external clients and for the AAT; and
- All other revenue which includes research grants and fellowships funded via the ARC and STFC, and the RAVE international consortium for survey work on the UKST.

Figure 4.17 Revenue for 2009-2010



The AATB has been funded mostly for recurrent expenditure and has to strike a balance between that expenditure, equipment needs and telescope refurbishment. The Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS) made grants to the AAO for a new instrument for the AAT (HERMES), and for refurbishment of the AAT and related infrastructure. Funding from the Australian Government was made via the Department of Innovation, Industry, Science and Research (DIISR - Outcome 2, Program 2.2).

Figure 4.18 Expenditure for 2009-10



The results for 2009-10 show that the AATB has net assets of $54 million with a small net accounting operating loss. The AAO's longer term funding needs after the treaty ends on 30 June 2010 appear more settled following the Australian Government, as part of its Budget announcements for 2009-10, agreeing to taking over the AAO as a fully Australia-owned entity from July 2010, and agreeing to meet its ongoing operational costs.

Business systems

Major instrumentation projects such as the new AAT instrument (HERMES) demand that systems are adequate to facilitate a high level of project performance, management and control. The AAO has now fully implemented business software that:

- provides a fully integrated solution that allows time recording, project management, project scheduling, project and general accounting, and general ledger functions; and
- is a small-business type solution with low total cost of ownership.

This capability more than satisfies the requirements of managing large projects such as HERMES and those of the GMT. The AAO is working closely with DIISR to ensure that the latter's business systems are able to meet the AAO requirements.

Information Technology

This year brings us to the end of our current three-year IT Strategic plan. All major milestones of the plan have been met. A major achievement for this year has been the successful implementation of the Docushare document management system. This system will not only enable the AAO to better maintain its documentation library, but will also facilitate the collaborative development of new capabilities, especially within the project teams.

The second half of this year has been dominated by the preparations for the AAO's integration into the Department of Innovation, Industry Science and Research (DIISR). The main goal was to find a way of providing AAO staff with the access they need to departmental applications while causing the minimum of disruption to the daily working life of AAO Staff, students and visitors.

Looking to the future, the IT facilities of the AAO will be enhanced by the opportunities presented to us by joining DIISR. As part of a much larger organisation the AAO will have significantly more resources available to call upon, especially with regard to administration systems. This will allow the AAO's IT team to focus more toward supporting the science side of our business.

Environmental Issues

Changes to the NSW planning codes to include self-certified building developments were foreshadowed in the last Annual Report. The Regional Environmental Plan (REP) Revision Working Group has contributed to a model Development Control Plan intended to ensure that these do not threaten Siding Spring's dark skies. The plan is still in the draft stage, but will go on public exhibition later in 2010.

The decision by three NSW energy companies to pursue the development of a new open-cut coalmine at Cobbora near Dunedoo has resulted in considerable activity by the REP Revision Working Group. If it goes ahead, the mine will be within 100km of the Observatory, and is expected to be the second largest open-cut coalmine in the southern hemisphere. It will provide low-grade coal for domestic power generation, with the operational phase beginning in 2012-13.

The combined light-spill and dust emission from the mine would pose a considerable threat to the observatory without special conditions being applied, and representatives of the initial project management group have visited Siding Spring in order to discuss these. Further negotiations cannot take place until a mining company has been identified and awarded the contract to proceed. This is expected to take place later in 2010, and the REP Revision Working Group will continue to engage with the project.

The Regional Environmental Plan Revision Working Group works to ensure light pollution does not threaten Siding Spring's dark skies.
Photo: Fred Kamphues

External Communications

The AAO stakeholders are the astronomy community, responsible Ministers, funding agencies, the Board and its advisory committees, the staff and the general public. Most of the visitors to the AAO's website are attracted by the images page, which now support a total of about 220 photographs. A newsletter is published twice a year on the web, and distributed as a hardcopy to over 1,000 subscribers and institutions. It caters to a wide readership, including professional astronomers, instrument scientists, users of the observatory and local AAO staff. The science web page has the aim of attracting students towards collaborative work at the AAO either through vacation positions or thesis study.

Publicity and Outreach

This year, AAO staff had more opportunities than usual to engage with the media and the public: 2009 was the International Year of Astronomy, and the second half of the year also saw the 35th anniversary of the AAT, while June 2010 saw the symposium celebrating the AAO's past, present and future. Seven media releases were issued during the year. Staff gave at least 224 radio interviews, 18 television interviews, and 33 interviews to print and online outlets. Print and online items from Australian sources that mentioned the AAO or AAT ran to at least 108 this year, and the number from overseas sources was at least 185. AAO staff wrote 12 articles for general, non-specialist readers.

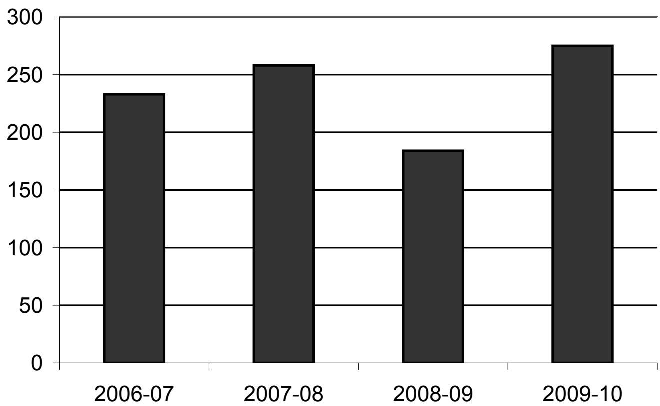


Figure 4.19 Media interviews over the past four years.

Staff also gave 69 talks to audiences other than professional astronomers. These talks were complemented by the two annual lectures organised by the AAO: the Bok lecture, given in Coonabarabran in memory of ANU astronomer Bart Bok; and the Allison-Levick memorial lecture, funded by a bequest from Melbourne psychiatrist Mr Jack Allison-Levick. The 2009 Bok lecture was given by Professor Bryan Gaensler of the University of Sydney, on the topic of cosmic magnetism. The 2009 Allison-Levick lecture was given by Robert Kirshner, Clowes Professor of Science at Harvard University, who spoke at Sydney's Powerhouse Museum in November

June 2010: A symposium celebrating the AAO's past, present and future.
Photo: Liz Cutts, Coonabarabran Times

AAO astronomer Paul Dobbie mentoring Year 5/6 students in the MyScience program. Photo: Bonita Mendis

on Exploding stars and the accelerating cosmos: Einstein's blunder undone.

Outreach to students and teachers was very much to the fore this year. Daniel Zucker talked to several Sydney high schools simultaneously, via a video linkup organised by the NSW Department of Education and Training. Andrew Hopkins gave a keynote address at the NSW Science Teachers' Association's annual conference. Stuart Ryder and Fred Watson took part in a workshop, "Astrophysics for Physics Teachers" (organised by CSIRO) designed to increase the skills and confidence of high-school teachers to teach astronomy. In his capacity as head of the Australian Gemini Office, Stuart Ryder helped to organise the inaugural Australian Gemini Schools Imaging Contest, begun as an activity for the International Year of Astronomy. Stuart also sat as a judge for a re-creation of the trial of Galileo by the students of PAL College, a secondary school in Cabramatta, NSW.

Andrew Hopkins, Simon O'Toole and Matthew Colless continued their involvement in the national Scientists in Schools program this year. The program is designed to create long-term partnerships between scientists and engineers and teachers in primary and secondary schools. The scientists visit schools to talk about their science, but they can also get involved in other activities, such as mentoring students doing science projects or running science fairs. Several staff—Andrew Hopkins, Simon O'Toole, Paul Dobbie, Sarah Brough, Chris Lidman and Heath Jones—made three visits to a local school under the NSW MyScience program, a primary school program that aims to spark children's natural curiosity about the world around them. Visiting scientists develop an ongoing relationship with teachers and their classes, and help the children design experiments.

AAO astronomer Andrew Hopkins (front centre) with other "Living Books" at the "Living Library" event coordinated by Julie Just of Ryde Library. Photo: Julie Just

The Public Education Foundation is a not-for-profit charitable organisation set up in 2008 to support student education in NSW, and the AAO's Fred Watson is one of its directors. In 2009, the International Year of Astronomy, the Foundation announced that it would offer Stellar Astronomy Scholarships valued at up to $4 000 each to support and encourage girls studying physics in Years 11 and 12 in public schools. More than 100 applications were received and Fred headed the selection committee that had the difficult task of choosing twelve winners from an excellent field. The awards were presented by Her Excellency the Governor-General, Ms Quentin Bryce AC, in March 2010.

AAO staff participated in two unusual, perhaps unique, events this year. In September 2009, Andrew Hopkins took part in the City of Ryde's Living Library program, in which people were borrowed as talking books. In October, Fred Watson took the starring role of Galileo in a re-trial of Galileo created by the University of NSW. Hosted by former ABC personality Julie McCrossin, the event featured leading lawyers Anna Katzman and Julian Burnside, Charley Lineweaver as the astronomical authority of the day, and former NSW Premier Bob Carr as Cosimo de' Medici. The re-trial was staged for a live audience of more than 800 people and was also filmed for broadcast by the ABC in May 2010.

Above: The Re-Trial of Galileo, UNSW. Here we see defence counsel Julian Burnside QC quizzing Paul Collins (in the character of Pope Urban VIII), while eminent Galileo scholar Maurice Finocchiaro (University of Nevada) and Fred Watson look on in the foreground, with members of the jury behind them. Photo: Grant Turner, Medikoo

Appendix A
Financial Statements

Statement by the AAO Director

In accordance with sections 13 and 15 of the *Australian Astronomical Observatory (Transitional Provisions) Act 2010*, I am the responsible financial officer, responsible for preparing the attached financial statements.

In my opinion, the attached financial statements of the former Anglo Australian Telescope Board for the year ended 30 June 2010 are based on properly maintained financial records and give a true and fair view of the matters required by the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997* as amended, and section 13 of the *Australian Astronomical Observatory (Transitional Provisions) Act 2010*.

Matthew Colless

Professor Matthew Colless FAA FRAS

21 October 2010

Australian National
Audit Office

INDEPENDENT AUDITOR'S REPORT

To the Minister for Innovation, Industry, Science and Research

Scope

I have audited the accompanying financial statements of the Anglo-Australian Telescope Board (AATB) for the year ended 30 June 2010. They comprise: a Statement by the Australian Astronomical Observatory Director; Statement of Comprehensive Income; Balance Sheet; Statement of Changes in Equity; Cash Flow Statement; Schedule of Commitments; Schedule of Contingencies; Schedule of Asset Additions; and Notes To and Forming Part of the Financial Statements, including a Summary of Objective and Significant Accounting Policies.

The Responsibility of the Director for the Financial Statements

The Director of the Australian Astronomical Observatory, in accordance with the *Australian Astronomical Observatory (Transitional Provisions) Act 2010*, is responsible for the preparation and fair presentation of the financial statements in accordance with Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997,* including Australian Accounting Standards, which include Australian Accounting Interpretations. This responsibility includes establishing and maintaining internal controls relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error; selecting and applying appropriate accounting policies; and making accounting estimates that are reasonable in the circumstances.

Auditor's Responsibility

My responsibility is to express an opinion on the financial statements based on my audit. I have conducted my audit in accordance with Australian National Audit Office Auditing Standards, which incorporate Australian Auditing Standards. These auditing standards require that I comply with relevant ethical requirements relating to audit engagements and plan and perform the audit to obtain reasonable assurance whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgement, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making these risk assessments, the auditor considers internal controls relevant to the AATB's preparation and fair presentation of the financial statements to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the AATB's internal control. An audit also includes evaluating the appropriateness of accounting policies used

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and the reasonableness of accounting estimates made by the Director, as well as evaluating the overall presentation of the financial statements.

I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my audit opinion.

Independence
In conducting the audit, I have followed the independence requirements of the Australian National Audit Office, which incorporate the requirements of the Australian accounting profession.

Auditor's Opinion

In accordance with subsection 19(1) of the *Anglo-Australian Telescope Agreement Act 1970,* I now report that the financial statements are in agreement with the accounts and records of the Anglo-Australian Telescope Board, and in my opinion:

(i) the financial statements are based on proper accounts and records;
(ii) the financial statements give a true and fair view of the matters required by the Finance Minister's Orders including the Anglo-Australian Telescope Board's financial position as at 30 June 2010, and its financial performance and cash flows for the year then ended;
(iii) the receipt, expenditure and investment of moneys, and the acquisition and disposal of assets, by the Board during the year have been in accordance with the *Anglo-Australian Telescope Agreement Act 1970*; and
(iv) the financial statements have been prepared in accordance with the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997* including Australian Accounting Standards.

Australian National Audit Office

Graham Johnson
Senior Director
Delegate of the Auditor-General

Sydney
22 October 2010

ANGLO-AUSTRALIAN TELESCOPE BOARD
STATEMENT OF COMPREHENSIVE INCOME
for the year ended 30 June 2010

	Notes	2010 $'000	2009 $'000
EXPENSES			
Employee benefits	3A	**8,401**	7,274
Supplier expenses	3B	**3,698**	5,890
Depreciation and amortisation	3C	**2,640**	2,998
Write-down and impairment of assets	3D	**176**	-
TOTAL EXPENSES		**14,915**	16,162
LESS:			
OWN-SOURCE INCOME			
Own-source revenue			
Sale of goods and rendering of services	4A	**3,318**	9,583
Interest	4B	**159**	211
Other	4C	**513**	1,256
Total own-source revenue		**3,990**	11,050
Gains			
Sale of Assets	4D	**2**	-
Other	4E, 12	**38**	36
Total gains		**40**	36
TOTAL OWN-SOURCE INCOME		**4,030**	11,086
Net cost of (contribution by) services		**10,885**	5,076
Revenue from Government	4F	**10,039**	5,546
Surplus (Deficit)		**(846)**	470
OTHER COMPREHENSIVE INCOME			
Changes in asset revaluation reserve		**7,995**	-
Total other comprehensive income		**7,995**	-
TOTAL COMPREHENSIVE INCOME		**7,149**	470

ANGLO-AUSTRALIAN TELESCOPE BOARD
BALANCE SHEET
as at 30 June 2010

	Notes	**2010 $'000**	2009 $'000
ASSETS			
Financial Assets			
Cash and cash equivalents	5A	**7,580**	3,988
Trade and other receivables	5B	**147**	522
Total financial assets		**7,727**	4,510
Non-Financial Assets			
Land and buildings	6A,6C	**14,066**	19,050
Property, plant and equipment	6B,6C	**31,233**	21,126
Other	6D	**3,317**	1,835
Total non-financial assets		**48,616**	42,011
TOTAL ASSETS		**56,343**	46,521
LIABILITIES			
Payables			
Suppliers	7A	**302**	357
Other	7B	**2,628**	194
Total payables		**2,930**	551
Provisions			
Employee provisions	8A	**2,312**	2,017
Total provisions		**2,312**	2,017
TOTAL LIABILITIES		**5,242**	2,568
NET ASSETS		**51,101**	43,953
EQUITY			
Parent Entity Interest			
Reserves		**48,298**	40,303
Retained surplus (accumulated deficit)		**2,803**	3,650
TOTAL EQUITY		**51,101**	43,953

ANGLO-AUSTRALIAN TELESCOPE BOARD
STATEMENT OF CHANGES IN EQUITY
for the year ended 30 June 2010

	Retained earnings		**Asset revaluation reserve**		**Total equity**	
	2010	2009	**2010**	2009	**2010**	2009
	$'000	$'000	**$'000**	$'000	**$'000**	$'000
Opening balance						
Balance carried forward from previous period	**3,650**	3,180	**40,303**	40,303	**43,953**	43,483
Adjusted opening balance	**3,650**	3,180	**40,303**	40,303	**43,953**	43,483
Comprehensive income						
Other comprehensive income	**-**	-	**7,995**	-	**7,995**	-
Surplus (Deficit) for the period	**(846)**	470	**-**	-	**(846)**	470
Total comprehensive income	**(846)**	470	**7,995**	-	**7,149**	470
Closing balance as at 30 June	**2,803**	3,650	**48,298**	40,303	**51,102**	43,953

ANGLO-AUSTRALIAN TELESCOPE BOARD
CASH FLOW STATEMENT
for the year ended 30 June 2010

	Notes	2010 $'000	2009 $'000
OPERATING ACTIVITIES			
Cash received			
Goods and services		**7,115**	6,767
Receipts from Government		**10,039**	5,551
Interest		**159**	228
Other		**1,327**	761
Total cash received		**18,640**	13,307
Cash used			
Employees		**7,658**	6,338
Suppliers		**6,989**	7,819
Net GST paid		**374**	425
Total cash used		**15,021**	14,582
Net cash from (used by) operating activities	9	**3,619**	(1,275)
INVESTING ACTIVITIES			
Cash used			
Purchase of property, plant and equipment		**27**	36
Total cash used		**27**	36
Net cash from (used by) investing activities		**(27)**	(36)
Net increase (decrease) in cash held		**3,592**	(1,311)
Cash and cash equivalents at the beginning of the reporting period		**3,988**	5,299
Cash and cash equivalents at the end of the reporting period	9	**7,580**	3,988

ANGLO-AUSTRALIAN TELESCOPE BOARD
SCHEDULE OF COMMITMENTS
as at 30 June 2010

	2010	2009
	$'000	$'000
BY TYPE		
Other commitments		
Operating leases	130	115
Total other commitments	130	115
BY MATURITY		
Operating lease commitments		
One year or less	100	93
From one to five years	30	22
Total operating lease commitments	130	115
Net Commitments by maturity	130	115

ANGLO-AUSTRALIAN TELESCOPE BOARD
SCHEDULE OF CONTINGENCIES
as at 30 June 2010

There were no contingencies to be disclosed for the year ended 30 June 2010 (2008/09: Nil)

ANGLO-AUSTRALIAN TELESCOPE BOARD
SCHEDULE OF ASSET ADDITIONS
for the period ended 30 June 2010

The following non-financial non-current assets were added in 2009-10:

	Other property, plant & equipment	**Total**
	$'000	**$'000**
By purchase - other	**27**	**27**
Total additions	**27**	**27**

The following non-financial non-current assets were added in 2008-09:

	Other property, plant & equipment	Total
	$'000	$'000
By purchase - other	31	31
Total additions	31	31

NOTE 1. SUMMARY OF OBJECTIVE AND SIGNIFICANT ACCOUNTING POLICIES

1.1 Objective of the Anglo-Australian Telescope Board (AATB)

The AATB is a bi-national authority established by the Anglo-Australian Telescope Agreement between the Australian Government and the Government of the United Kingdom of Great Britain and Northern Ireland for the purposes of establishing and operating an optical telescope at Siding Spring Mountain in New South Wales.

The AATB contributes to Outcome 2 of the Innovation, Industry, Science and Research Portfolio Budget Statements: *The generation, utilisation and awareness of science and research knowledge through investment in research, research training and infrastructure, science communication, skill development and collaboration with industry, universities and research institutes domestically and internationally.*

The AATB ceased to exist on 30 June 2010 being replaced by the Australian Astronomical Observatory – see note 2.

1.2 Basis of Accounting

The financial statements are required by subsection 19(1) of the *Anglo-Australian Telescope Agreement Act 1970* and are a general purpose financial report.

The financial statements have been prepared in accordance with:

- Finance Minister's Orders (or FMO) for reporting periods ending on or after 1 July 2009; and
- Australian Accounting Standards and Interpretations issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The financial statements have been prepared on an accrual basis and in accordance with historical cost convention, except for certain assets and liabilities at fair value. Except where stated, no allowance is made for the effect of changing prices on the results or the financial position.

The financial statements are presented in Australian dollars and values are rounded to the nearest thousand dollars unless otherwise specified.

Unless an alternative treatment is specifically required by an accounting standard or the FMO, assets and liabilities are recognised in the balance sheet when and only when it is probable that future economic benefits will flow to the entity or a future sacrifice of economic benefits will be required and the amounts of the assets or liabilities can be reliably measured. However, assets and liabilities arising under Agreements Equally Proportionately Unperformed are not recognised unless required by an accounting standard. Liabilities and assets that are unrecognised are reported in the schedule of commitments or the schedule of contingencies.

Unless alternative treatment is specifically required by an accounting standard, income and expenses are recognised in the statement of comprehensive income when, and only when, the flow, consumption or loss of economic benefits has occurred and can be reliably measured.

1.3 Significant Accounting Judgments and Estimates

In the process of applying the accounting policies listed in this note, the Anglo-Australian Telescope Board has made the following judgment:

"The fair value of land and buildings has been taken to be the market value of similar properties as determined by an independent valuer. The Anglo-Australian Telescope Board buildings are purpose-built and may in fact realise more or less in the market."

No accounting assumptions or estimates have been identified that have a significant risk of causing a material adjustment to carrying amounts of assets and liabilities within the next accounting period.

1.4 Statement of Compliance

Adoption of new Australian Accounting Standards requirements

No accounting standard has been adopted earlier than the application date as stated in the standard. No new accounting standards, amendments to standards and interpretations issued by the Australian Accounting Standards Board that are applicable in the current period have had a material financial affect on the AATB.

1.5 Revenue

The Government of Australia provided revenue to the AATB via a parliamentary appropriation to the Department of Innovation, Industry, Science and Research (DIISR). United Kingdom (UK) funds were via its Science and Technology Facilities Council (STFC). Contributions receivable from the Governments are recognised at their nominal amounts.

The AATB also builds astronomical instrumentation for other observatories and institutions and attempts to recover at least the full economic cost of so doing.

Revenue from rendering of services is recognised by reference to the stage of completion of contracts at the reporting date. The revenue is recognised when:

- the amount of revenue, stage of completion and transaction costs incurred can be reliably measured; and
- the probable economic benefits associated with the transaction will flow to the AATB.

The stage of completion of contracts at the reporting date is determined by reference to the proportion that costs incurred to date bear to the estimated total costs of the transaction.

Receivables for goods and services, which have 30-day terms, are recognised at the nominal amounts due less any provision for bad and doubtful debts.

Collectability of debts is reviewed at balance date. Provisions are made when collection of the debt is no longer probable.

Research grants received from the Australian Research Council (ARC) and the STFC are recognised as revenue on receipt.

1.6 Resources Received Free of Charge

Services received free of charge are recognised as income when and only when a fair value can be reliably determined and the services would have been purchased if they had not been donated. Use of those resources is recognised as an expense.

Contributions of assets at no cost of acquisition or for nominal consideration are recognised at their fair value when the asset qualifies for recognition.

The following resources are received free of charge at fair value:
Services provided by the Auditor-General for auditing of the financial statements for the reporting period.

The following resources are received free of charge and without a reliable fair value estimate being made*:*

(i) Use of land at Siding Spring Observatory

At Siding Spring Observatory in north-western New South Wales, the 3.9-metre Anglo-Australian Telescope (AAT) building and the 1.2-metre UK Schmidt Telescope (UKST) building are on land owned by the Australian National University (ANU).

For the AAT, the ANU has regarded itself as being bound by Article 4 of the AAT Agreement (*Anglo-Australian Telescope Agreement Act 1970)* to make arrangements with the AATB 'as will ensure that the Board has proper enjoyment of the present site for all its agreed purposes'. In light of that Agreement, the ANU decided that it was not necessary to enter into a lease for the site. However, as a result of the end of the Agreement, the ANU and the Commonwealth of Australia intend entering into a new lease arrangement for the AAT.

The UKST is owned by the STFC and operated by the AATB. The UK Government through its agencies entered into a permissive occupancy agreement with the ANU for the UKST at Siding Spring at a rental of one dollar per year if and when demanded. The term of the lease is for not less than forty years from 1 July 1971. The STFC has given formal notice to the ANU of its intention to terminate the lease in light of the end of the Anglo-Australian Telescope Agreement. The STFC has made a formal offer to willingly 'release occupancy and ownership of the buildings and land to the ANU'. The parties are in discussion on the matter. In turn, it is expected that the ANU and the Commonwealth will enter into a leasing arrangement to allow the AAO to continue operating the UKST.

(ii) Use of land in Sydney

At Eastwood, New South Wales, the AATB's buildings are on the site of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) with which the AATB has entered into a permissive occupancy agreement for the site. A rental of 10 cents a year is payable on demand and the term of this agreement is until the AAT Agreement ceases, or if terminated by agreement of the parties - whichever is earlier. As the Agreement has now terminated, the CSIRO is in discussion with the Commonwealth to enter into a new leasing arrangement for the AAO.

1.7 Employee Benefits

(a) Benefits

Liabilities for services rendered by employees are recognised at the reporting date to the extent that they have not been settled.

Liabilities for 'short-term employee benefits' (as defined in AASB 119) and termination benefits due within twelve months are measured at their nominal amounts. The nominal amount is calculated with regard to the rates expected to be paid on settlement of the liability.

All other employee benefit liabilities are measured as the present value of the estimated future cash outflows to be made in respect of services provided by employees up to the reporting date.

(b) Leave

The liability for employee benefits includes provision for annual leave and long service leave. No provision has been made for sick leave as all sick leave is non-vesting and the average sick leave taken in future years by employees of the AATB is estimated to be less than the annual entitlement for sick leave.

The leave liabilities are calculated on the basis of employees' remuneration, including the AATB's employer superannuation contribution rates, to the extent that the leave is likely to be taken during service rather than paid out on termination.

The estimate of the present value of the liability takes into account attrition rates and pay increases through promotion and inflation.

(c) Superannuation

Staff of the AATB are members of the Commonwealth Superannuation Scheme (CSS), the Public Sector Superannuation Scheme (PSS), the PSS accumulation plan (PSSap) or other superannuation funds held outside the Commonwealth. The CSS and PSS are defined benefit schemes for the Australian Government. The PSSap is a defined contribution scheme. The liability for defined benefits is recognised in the financial statements of the Australian Government and is settled by the Australian Government in due course. This liability is reported by the Department of Finance and Deregulation as an administered item. The AATB makes employer contributions to the Commonwealth employee superannuation schemes at rates determined by an actuary to be sufficient to meet the cost to the Government of the superannuation entitlements of the AATB's employees.

The liability for superannuation recognised as at 30 June represents outstanding contributions for the relevant portion of the final fortnight of the year.

1.8 Leases

A distinction is made between finance leases and operating leases. Finance leases effectively transfer from the lessor to the lessee substantially all the risks and rewards incidental to ownership of leased non-current assets. An operating lease is a lease that is not a finance lease. In operating leases, the lessor effectively retains substantially all such risks and benefits. The AATB has no finance leases.

Operating lease payments are expensed on a straight line basis which is representative of the pattern of benefits derived from the leased assets.

1.9 Cash

Cash and cash equivalents includes cash on hand and demand deposits in bank accounts with an original maturity of 3 months or less that are readily convertible to known amounts of cash and subject to insignificant risk of changes in value. Cash is recognised at its nominal amount.

1.10 Trade Creditors

Trade creditors and accruals are recognised at their nominal amounts, being the amounts at which the liabilities will be settled. Liabilities are recognised to the extent that the goods or services have been received irrespective of having been invoiced.

1.11 Acquisition of Assets

Assets are recorded at cost on acquisition except as stated below. The cost of acquisition includes the fair value of assets transferred in exchange and liabilities undertaken. Financial assets are initially measured at their fair value plus transaction costs where appropriate.

Assets acquired at no cost, or for nominal consideration, are initially recognised as assets and revenues at their fair value at the date of acquisition unless acquired as a consequence of restructuring of administrative arrangements. In the latter case, assets are initially recognised as contributions by owners at the amounts at which they were recognised in the transferor authority's accounts immediately prior to the restructuring.

1.12 Property, Plant and Equipment

Asset Recognition Threshold

Purchases of property, plant and equipment are recognised initially at cost in the Balance Sheet, except for purchases costing less than $3,000, which are expensed in the year of acquisition (other than where they form part of a group of similar items which are significant in total).

Revaluations

(i) Basis

Land, buildings, plant and equipment are carried at fair value, being revalued with sufficient frequency such that the carrying amount of each asset is not materially different, at reporting date, from its fair value. Valuations undertaken in each year are as at 30 June.

Fair values for each class of asset are determined as shown below:

Asset class	***Fair value measured by:***
Land	Market appraisal
Eastwood buildings	Market appraisal
Domes	Depreciated replacement cost
Telescope and ancillary equipment	Depreciated replacement cost
Telescope instrumentation	Depreciated replacement cost
Plant and equipment	Market appraisal

Under fair value, assets that are surplus to requirements are measured at their net realisable value. At 30 June 2010, the AATB held no surplus assets. (30 June 2009: $0)

(ii) Frequency

Following initial recognition at cost, valuations are conducted with sufficient frequency to ensure that the carrying amounts of assets do approximate the assets' fair values as at the reporting date. The regularity of independent valuations depends upon the volatility of movements in market values for the relevant assets.

(iii) *Conduct*

Valuations of land, buildings and plant and equipment (other than telescopes and instrumentation) are conducted by an independent qualified valuer. Valuations of telescopes and instrumentation are conducted in-house.

(iv) Depreciation

Depreciable property, plant and equipment assets are written off to their estimated residual values over their estimated useful lives using the straight line method of depreciation.

Depreciation rates (useful lives) and methods are reviewed at each reporting date and necessary adjustments are recognised in the current, or current and future, reporting periods, as appropriate. Residual values are re-estimated for a change in prices only when assets are revalued.

Useful lives are used when applying rates to each class of depreciable assets as follows:

Asset class	***2010***	***2009***
Buildings and Domes	**50 years**	50 years
Telescope and Ancillary Equipment	**50 years**	50 years
Telescope Instrumentation	**20 years**	20 years
Personal Computers	**3 years**	3 years
Other Computers	**5 years**	5 years
Other Plant and Equipment	**20 years**	20 years

The aggregate amount of depreciation by class of asset during the reporting period is disclosed in Note 4C.

1.13 Taxation

The AATB is exempt from taxation except for GST and FBT. Employees are liable for FBT on salary packaging. Revenues, expenses and assets are recognised net of GST except:

- where the amounts of the GST incurred are not recoverable from the Australian Taxation Office; and
- for receivables and payables.

1.14 Foreign Currency

The contributions from the United Kingdom are converted to Australian dollars at the selling rate quoted by the Bank of England at the time each contribution is made. All other transactions denominated in a foreign currency are converted at the exchange rate at the date of the transaction. Foreign currency receivables and payables are translated at the exchange rates current as at balance date. Associated currency gains and losses are not material.

1.15 Agreements

Under an agreement between the AATB and the STFC (through its predecessors), the Board is responsible for the management, care and maintenance, operation and development of the UK Schmidt Telescope (UKST). The revenues, expenses and asset values of the UKST form part of the financial statements. See also note 1.6 relating to use of land.

1.16 Comparative Figures

Where necessary, comparative figures have been adjusted to conform to changes in presentation in the financial statements.

NOTE 2. THE FUTURE OF THE AAO

The Anglo-Australian Telescope Board ceased operating on 30 June 2010. The Board was established by the *Anglo-Australian Telescope Agreement Act* 1970 and operated as the Anglo-Australian Observatory (AAO). It has depended heavily on the revenue provided by the Governments of Australia and the United Kingdom. The United Kingdom government indicated its intention to withdraw from the Agreement with effect from 1 July 2010. The Australian Government, as part of its May 2009 Budget announcements for 2009-10, agreed to taking over the AAO as a fully Australia-owned entity from July 2010 and has agreed to meet its ongoing operational costs. Legislation to give effect to this change received Royal Assent in March 2010:

- *The Australian Astronomical Observatory Act 2010* commenced on 1 July 2010 and establishes the new AAO - the *Australian Astronomical Observatory*, the Statutory Office of Director of the AAO, and lists the functions of the AAO.
- *The Australian Astronomical Observatory (Transitional Provisions) Act 2010* deals with the transfer of staff to being employed under the *Public Service Act*, the transfer of AATB assets and liabilities to the Commonwealth of Australia, and the repeal of the *Anglo-Australian Telescope Agreement Act 1970.*

The Anglo-Australian Observatory has now become the Australian Astronomical Observatory whose functions include the following:

(a) *to operate, construct, develop and maintain national optical astronomy facilities;*
(b) *to support optical astronomy facilities;*
(c) *to consult and co-operate with other persons, organisations and governments on matters relating to optical astronomy;*
(d) *to facilitate access to optical astronomy facilities;*
(e) *to develop, manufacture and provide instrumentation for optical astronomy facilities;*
(f) *to support the development, manufacture and provision of instrumentation for optical astronomy facilities;*
(g) *to support, encourage, conduct and evaluate research about matters relating to optical astronomy;*
(h) *to support, encourage, conduct and evaluate educational, promotional and community awareness programs that are relevant to optical astronomy;*
(i) *to publish (whether on the internet or otherwise) reports, papers and information relating to optical astronomy;*
(j) *to advise the Minister about matters relating to optical astronomy;*
(k) *to implement Australia's international obligations in relation to optical astronomy;*
(l) *such other functions (if any) as are specified in the regulations;*
(m) *to do anything incidental to or conducive to the performance of any of the above functions.*

This is in line with an Australian Government review in 2006 which recommended that the AAT continue operating, and that the AAO evolve into the national optical observatory supporting not just the AAT, but also Australia's involvement in the Gemini and Magellan telescopes and future facilities such as the Giant Magellan Telescope (GMT).

The AAO became part of the Department of Innovation, Industry, Science and Research (DIISR) from I July 2010.

NOTE 3. EXPENSES

	2010 $'000	2009 $'000
Note 3A: Employee Benefits		
Wages and salaries	**6,194**	5,669
Superannuation:		
Defined contribution plans	**899**	872
Leave and other entitlements	**1,308**	733
Total employee benefits	**8,401**	7,274
Note 3B: Suppliers		
Goods and services		
Materials	**2,346**	3,361
Contractors	**1,134**	2,276
Travel Expenses	**65**	98
Total goods and services	**3,545**	5,735
Goods and services are made up of:		
Provision of goods – related entities	**-**	-
Provision of goods – external parties	**2,346**	3,361
Rendering of services – related entities	**-**	-
Rendering of services – external parties	**1,199**	2,374
Other supplier expenses		
Operating lease rentals – external parties:		
Minimum lease payments	**130**	118
Workers compensation expenses	**23**	37
Total other supplier expenses	**153**	155
Total supplier expenses	**3,698**	5,890
Note 3C: Depreciation		
Depreciation:		
Buildings & Dome	**1,118**	1,118
Telescopes	**805**	805
Instruments	**610**	859
Plant & Equipment	**107**	216
Total depreciation	**2,640**	2,998
Note 3D: Write-Down and Impairment of Assets		
Asset write-downs and impairments from:		
Impairment of property, plant and equipment	**176**	-
Total write-down and impairment of assets	**176**	-

NOTE 4. INCOME

	2010	2009
OWN SOURCE REVENUE	**$'000**	$'000
Note 4A: Sale of Goods and Rendering of Services		
Provision of goods - external parties	**1,857**	4,643
Rendering of services - external parties	**1,461**	4,940
Total sale of goods and rendering of services	**3,318**	9,583
Note 4B: Interest		
Deposits	**159**	211
Total interest	**159**	211
Note 4C: Other Revenue		
Grants revenue including fellowships	**505**	1,205
Other	**8**	51
Total other revenue	**513**	1,256
Note 4D: Sale of Assets		
Infrastructure, Plant and equipment:		
Proceeds from sale	**60**	-
Carrying value of assets sold	**(58)**	-
Net gain from sale of assets	**2**	-
Note 4E: Other Gains		
Resources received free of charge	**38**	36
Total other gains	**38**	36
REVENUE FROM GOVERNMENT		
Note 4F: Revenue from Government		
Australian Government	**9,114**	5,546
UK Government	**925**	-
Total revenue from Government	**10,039**	5,546

NOTE 5. FINANCIAL ASSETS

	2010	2009
	$'000	$'000
Note 5A: Cash and Cash Equivalents		
Cash on hand or on deposit	**7,580**	3,988
Total cash and cash equivalents	**7,580**	3,988
Note 5B: Trade and Other Receivables		
Good and Services:		
Goods and services - external parties	**147**	378
Total receivables for goods and services	**147**	378
Other receivables:		
GST receivable from the Australian Taxation Office	**-**	144
Total other receivables	**-**	144
Total trade and other receivables (gross)	**147**	522
Total trade and other receivables (net)	**147**	522
Receivables are expected to be recovered in no more than 12 months		
Receivables are aged as follows:		
Not overdue	**119**	144
Overdue by:		
0 to 30 days	**15**	-
31 to 60 days	**-**	126
61 to 90 days	**-**	252
More than 90 days	**13**	-
Total receivables (gross)	**147**	522

NOTE 6. NON-FINANCIAL ASSETS

	2010	2009
Note 6A: Land and Buildings		
Land at fair value	**-**	2,950
Buildings on freehold land:		
Fair value	**14,066**	55,897
Accumulated depreciation	**-**	(39,797)
Total buildings on freehold land	**14,066**	19,050

No indicators of impairment were found for land and buildings.
No land or buildings are expected to be sold or disposed of within the next 12 months.

Note 6B: Property, Plant and Equipment	**2010 $'000**	2009 $'000
Other property, plant and equipment:		
Fair value	**31,233**	63,685
Accumulated depreciation	**-**	(42,559)
Total other property, plant and equipment	**31,233**	21,126
Total property, plant and equipment	**31,233**	21,126

The Department of Innovation, Industry, Science and Research (DIISR) engaged an external valuation service to undertake a single purpose valuation Financial Reporting under AASB 116 for all asset classes covering Plant & Equipment and Land & Buildings. The purpose of the valuation was to provide DIISR with estimated values for proposed financial reporting purposes on the AAO. The valuation was provided on the basis of 'Fair Value for financial reporting under AASB 116'. The effective date of the valuation is 30th June 2010. As a result of that report, the value of Buildings decreased slightly while the value of Infrastructure Plant & equipment increased – as shown in the table below.

No indicators of impairment were found for property, plant and equipment.

Land has been written down to reflect the termination of the lease agreement with CSIRO and the AATB on 30 June 2010 - which terminated when the AATB ceased operation. Consequently, there is no value in the lease as of 30 June 2010.
Reflecting the revised valuations, the value of Buildings decreased, by $916,000 in 2010 while the value of Other property, plant and equipment increased by $11,861,000 for 2010.

Note 6C: Reconciliation of the Opening and Closing Balances of Property, Plant and Equipment (2009-10)

	Land $'000	**Buildings $'000**	**Total land and buildings $'000**	**Other property, plant & equipment $'000**	**Total $'000**
As at 1 July 2009					
Gross book value	**2,950**	**55,897**	**58,847**	**63,685**	**122,532**
Accumulated depreciation/amortisation and impairment	**-**	**(39,797)**	**(39,797)**	**(42,559)**	**(82,356)**
Net book value 1 July 2009	**2,950**	**16,100**	**19,050**	**21,126**	**40,176**
Additions:					
By purchase	**-**	**-**	**-**	**27**	**27**
Revaluations and impairments recognised in other comprehensive income	**(2,950)**	**(916)**	**(3,866)**	**11,861**	**7,955**
Depreciation/amortisation expense	**-**	**(1,118)**	**(1,118)**	**(1,522)**	**(2,640)**
Disposals:					
From disposal of entities or operations (including restructuring)	**-**	**-**	**-**	**(259)**	**(259)**
Net book value 30 June 2010	**-**	**14,066**	**14,066**	**31,233**	**45,299**

Note 6C: Reconciliation of the Opening and Closing Balances of Property, Plant and Equipment (2008-09)

	Land	Buildings	Total land and buildings	Other property, plant & equipment	Total
	$'000	$'000	$'000	$'000	$'000
As at 1 July 2008					
Gross book value	2,950	55,897	58,847	63,655	122,502
Accumulated depreciation/amortisation and impairment	-	38,679	38,679	40,680	79,359
Net book value 1 July 2008	2,950	17,218	20,168	22,975	43,143
Additions:					
By purchase	-	-	-	31	31
Depreciation/amortisation expense	-	1,118	1,118	1,880	2,998
Net book value 30 June 2009	2,950	16,100	19,050	21,126	40,176
Net book value as of 30 June 2009 represented by:					
Gross book value	2,950	55,897	58,847	63,685	122,532
Accumulated depreciation/amortisation	-	(39,797)	(39,797)	(42,559)	(82,356)
	2,950	16,100	19,050	21,126	40,176

	2010	2009
	$'000	$'000
Note 6D: Other Non-Financial Assets		
Prepayments	**-**	219
Work-In-Progress	**3,317**	1,616
Total Other Non-Financial Assets	**3,317**	1,835
Total Other Non-Financial Assets are expected to be recovered in:		
No more than 12 months	**944**	1,194
More than 12 months	**2,373**	641

NOTE 7. PAYABLES

	2010	2009
Note 7A: Suppliers		
Trade creditors and accruals	**302**	357
Total supplier payables	**302**	357
Total supplier payables are expected to be settled within 12 months:		
Note 7B: Other Payables		
Salaries and wages	**187**	194
GST Payable to ATO	**218**	-
Unearned Revenue	**2,223**	-
Total other payables	**2,628**	194
Total other payables are expected to be settled within 12 months:		

NOTE 8. PROVISIONS

	2010 $'000	2009 $'000
Note 8A: Employee Provisions		
Leave	**2,312**	2,017
Total employee provisions	**2,312**	2,017
Employee provisions are expected to be settled in:		
No more than 12 months	**257**	1,784
More than 12 months	**2,055**	233

NOTE 9. CASH FLOW RECONCILIATION

Reconciliation of cash and cash equivalents as per Balance Sheet to Cash Flow Statement

	2010	2009
Cash and cash equivalents as per:		
Cash flow statement	**7,580**	3,988
Balance sheet	**7,580**	3,988
Difference	**-**	-

Reconciliation of net cost of services to net cash from operating activities:

	2010	2009
Net cost of services	**10,885**	5,076
Add revenue from Government	**10,039**	5,546
Adjustments for non-cash items		
Depreciation / amortisation	**2,640**	2,998
Net write down of non-financial assets	**176**	-
Changes in assets / liabilities		
(Increase) / decrease in net receivables	**375**	14
(Increase) / decrease in other non-financial assets	**(1,400)**	-
Increase / (decrease) in prepayments received	**-**	(952)
Increase / (decrease) in employee provisions	**295**	259
Increase / (decrease) in supplier payables	**(55)**	82
Increase / (decrease) in other payable	**2,434**	(4,146)
Net cash from (used by) operating activities	**3,619**	(1,275)

NOTE 10. RELATED PARTY DISCLOSURES

Members of the Board at 30 June 2010 were:

Australia - Professor W Couch (Chair), Professor B Gaensler and Dr I Chessell.
UK - Professor S Warren (Deputy Chair), Professor S Ryan and Dr C Vincent.

Dr Chessell is entitled to Category 3 fees as specified in the Remuneration Tribunal Determination 2006/12. Remaining Directors do not receive remuneration for service on the AATB or its Audit and Risk Management Committee.

Professor Couch and Dr Vincent are members of the Gemini Observatory Finance Committee. Dr Vincent is a member of the Gemini Observatory Board of Directors.

Professor Couch is a member of the Board of Astronomy Australia Ltd.

NOTE 11. EXECUTIVE REMUNERATION

Note 11A: Actual Remuneration Paid to Senior Officers

	2010	2009
The number of senior officers who received:		
less than $145,000*	**4**	3
$160,000 to $174,999	**2**	3
$205,000 to $219,999	**1**	1
Total	**7**	7

* Excluding acting arrangements and part-year service.

Total expense recognised in relation to Senior Officer employment

	$	$
Short-term employee benefits:		
Salary (including annual leave taken)	**690,370**	750,854
Changes in annual leave provisions fill in	**35,812**	28,956
Other[1]	**22,100**	52,388
Total Short-term employee benefits	**748,282**	832,198
Superannuation (post-employment benefits)fill in	**134,593**	151,416
Total	**882,875**	983,614

[1]. "Other" includes motor vehicle allowances and other allowances.

Note 11B: Salary Packages for Senior Officers
Average annualised remuneration packages for substantive Senior Officers

	As at 30 June 2010		As at 30 June 2009	
	No.	**Total remuneration package ($)**	No.	Total remuneration package ($)
Total remuneration[2]:				
less than $145,000*	**4**	**88,130**	6	133,936
$160,000 to $174,999	**2**	**168,064**	-	-
$205,000 to $219,999	**1**	**194,227**	1	179,999
Total	**7**	**450,421**	7	313,935

NOTE 12. REMUNERATION OF AUDITORS

	2010 $'000	2009 $'000
Fair value of Financial Statement audit services provided by Australian National Audit Office:	**38**	**36**
	38	36

No other services were provided by the Auditor-General.

Note 13A: Categories of Financial Instruments	**2010 $'000**	2009 $'000
Financial Assets		
Loans and receivables:		
Cash and cash equivalents	**7,580**	3,988
Receivables	**147**	378
Total	**7,727**	4,366
Carrying amount of financial assets	**7,727**	4,366
Financial Liabilities		
Suppliers at amortised cost	**302**	357
Total	**302**	357
Carrying amount of financial liabilities	**302**	357

Note 13B: Net Income and Expense from Financial Assets

Loans and receivables		
Interest revenue	**159**	211
Net gain/(loss) loans and receivables	**159**	211
Net gain/(loss) from financial assets	**159**	211

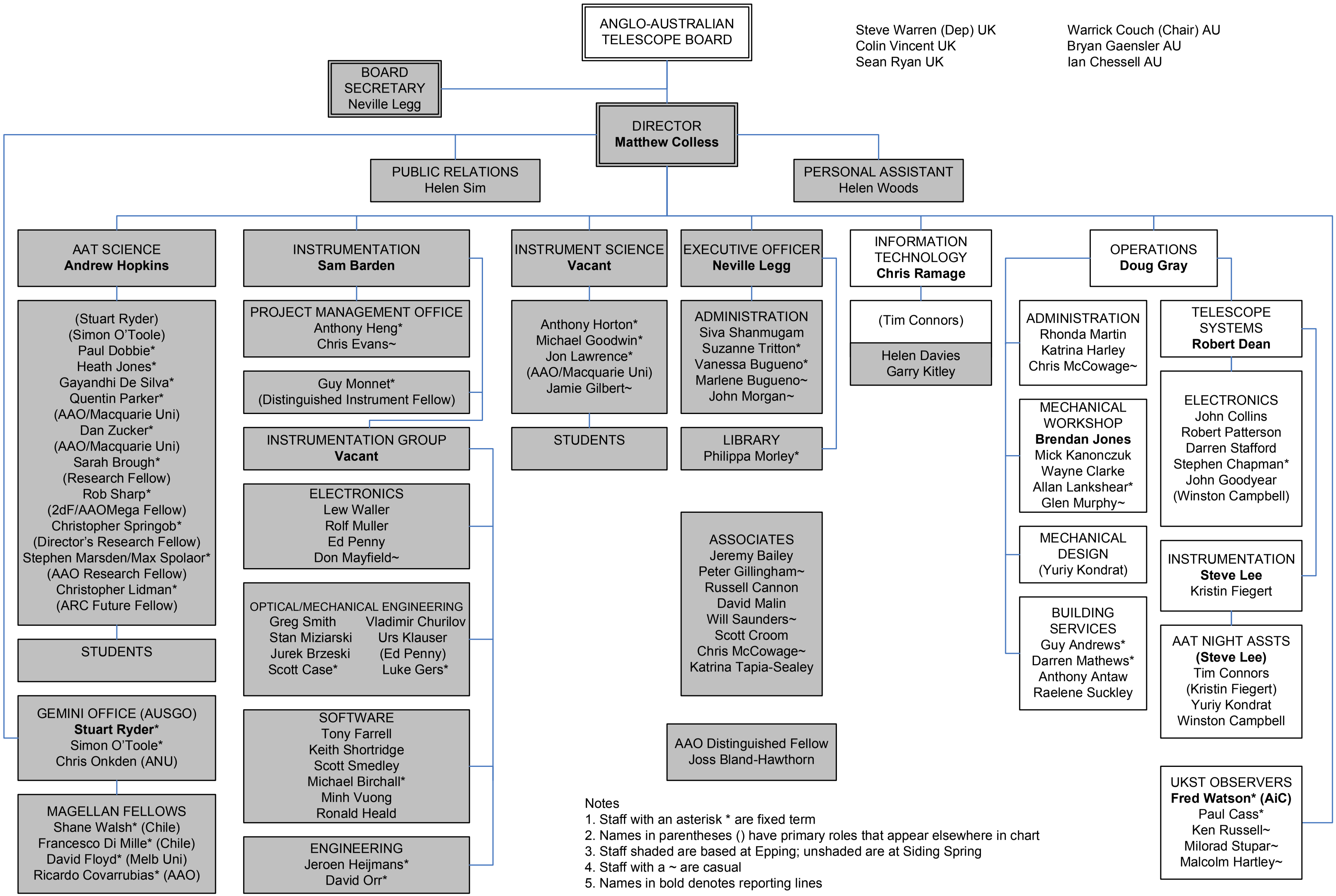
Appendix B Staff

Staff at 30 June 2010

Director	M M Colless, PhD, FAA, FRAS
Executive Officer & AAT Board Secretary	N. Legg, BA(Ec) MBA, FAIM
Head of AAT Science	A Hopkins, PhD
Head of Australian Gemini Office	S D Ryder, PhD
Head of Instrumentation	S C Barden, PhD
Head of Instrument Science	J Lawrence, PhD (Acting)
Operations Manager	D Gray
Astronomer-in-Charge	F G Watson, PhD, AM
Head of Information Technology	C Ramage, MEngSc
Astronomy	S Brough, PhD; G De Silva, PhD; P Dobbie, PhD; D H Jones, PhD; C Lidman, PhD; S Marsden, PhD; Q A Parker, PhD; R Sharp, PhD; M Spolaor, PhD; C Springob, PhD; D Zucker, PhD
AusGO	S J O'Toole, PhD
Instrument Science	M Goodwin, PhD; A J Horton, PhD
Magellan Fellows	R Covarrubias, PhD; D Floyd, PhD
Project Office	S Case, BSc; L Gers, MScE; J Heijmans, MSc; A Heng; D Orr, BE, BSc
Administration	V Bugueno; K Harley; R L Martin; S Shanmugam, B Comm; S Tritton, Ad Cert HR; H M Woods, MLitt
Information Management	P Morley, BInfoStud(Lib)
Software Development	M N Birchall, PhD; T J Farrell, BSc; R Heald, BSc; K Shortridge, PhD; S Smedley, B App Sc; M Vuong, BE, B App Sc
Information Technology	H Davies, MEngSc: G J Kitley
Telescope Systems Manager	R G Dean
Electronics Group	S Chapman; J A Collins, DipEE; J Goodyear; R Muller; R G Patterson; E J Penny; D J Stafford; L G Waller, BE
Optical and Mechanical	J K Brzeski, BE; V Churilov, MSc; M M Kanonczuk; U Klauser; S Miziarski, DipME; G A Smith, BE, BSc
Telescope Operations and Maintenance	UKST: C J P Cass; M Hartley, BSc; K S Russell; M Stupar, PhD; AAT: W Campbell; W T Clarke; T Connors, PhD; K Fiegert; B Jones; Y Kondrat; S Lee
Public Relations	H Sim, MSciSoc
Building Services	G Andrews; T Antaw; D Matthews; R Suckley
AAO Honorary Associates	J A Bailey, PhD; J Bland-Hawthorn, PhD; S Croom, Phd; R D Cannon PhD; R Gillingham, BE, DSc; D F Malin, DSc; C McCowage; W Orchiston, PhD; W Saunders, PhD; C G Tinney, PhD

ANGLO-AUSTRALIAN OBSERVATORY

Organisation Chart 30 June 2010



Notes
1. Staff with an asterisk * are fixed term
2. Names in parentheses () have primary roles that appear elsewhere in chart
3. Staff shaded are based at Epping; unshaded are at Siding Spring
4. Staff with a ~ are casual
5. Names in bold denotes reporting lines

Appendix C Client Service Charter

What you can expect from us

Courtesy

- We will be helpful and courteous in our dealings with you.

Telescope Operations

- The AAT and UKST will be fully operational at the start of each night.
- A technician will be on duty during the first part of the night to respond immediately to any technical problems.
- At other times there will be a two-hour response time by the afternoon shift technician.
- An AAT night assistant will be on duty all night and will operate the telescope. If there are any problems during the night, the night assistant will take immediate action either to fix the problem or arrange for someone else to fix it.

Instrumentation

- An AAO support astronomer will get in touch with you to confirm the details of your observing run at least four weeks prior to the run.
- We will provide the instrumentation at the start of the night that will enable you to undertake your scientific program as specified.
- If requested, a support astronomer will be present for the first night of your run to help you obtain the best possible data.
- If required, we will provide full support for untrained observers on instruments such as AAOmega.
- We will make available full documentation to guide you in carrying out your observations.

Data Exploitation

- We will provide adequate computer hardware and software to allow you to store, access and analyse all data acquired with AAO instrumentation during your observing run.

General Working Environment

- We will provide office space and facilities for each visiting observer.
- We will provide a comfortable and functional control room.
- We will provide library facilities, including access to essential astronomical and technical journals and texts.

Administration

- We will promptly respond to your inquiries.
- We will via our web service assist you arranging accommodation at the Siding Spring Observatory Lodge.
- We will via our web service assist you with arranging transport between Sydney and Coonabarabran.

What we would like you to do

- Advise the AAO of your arrival date for your observing run through the appropriate form on our web pages.
- Advise the SSO Lodge of your arrival date through the appropriate form on our web pages.
- Arrive properly prepared for your observing run.
- Ensure that your computer has up to date virus removal software and is virus-free.
- Make yourself familiar with the safety guidelines and follow them at all times.
- Be thoughtful and considerate in the demands you make of AAO staff.
- Make sure your data is recorded on a suitable backup medium at the end of your observing run.
- Promptly report any problems using the AAO Fault Log.
- Give us constructive feedback on our service using the observer report form. If we do particularly well or if you have suggestions as to how we may improve our service, let us know.

Appendix D Statement on Governance

1. The Anglo-Australian Telescope Board

The AATB oversees the operations of the AAO.

A. *Functions, capacities and powers*

The functions, capacities and powers of the AATB are contained in section 8 of the *Anglo-Australian Telescope Agreement Act 1970*:

The Board has the functions specified in Article 8 of the Agreement, and the capacities and powers specified in paragraph (1) of Article 6 of the Agreement, and shall perform those functions, and exercise those capacities and powers, in accordance with the Agreement.

The Board has such additional functions as are conferred on it by the regulations.

The Board has power to do all things necessary or convenient to be done in connection with the performance of its additional functions.

Article 6

(1)The Telescope Board to be incorporated under an enactment of the Parliament of the Commonwealth of Australia shall be a body corporate with perpetual succession and a Common Seal and shall have such capacities and powers as are necessary and incidental to the performance of its functions under this Agreement including, without affecting the generality of the foregoing capacities and powers:

(a) to acquire, hold and dispose of real and personal property;

(b) to enter into contracts including contracts for the performance of works and contracts of service and for services;

(c) to employ persons;

(d) to sue and be sued;

(e) to receive gifts;

(f) to do anything incidental to any of its powers.

Article 8

(1) The functions of the Telescope Board shall be to do or arrange or cause to be done, subject to and in accordance with Article 2 of this Agreement, such acts, things and matters as shall provide for or contribute to the manufacture, construction, operation and management of the telescope.

B. Membership

The AATB has six members, three appointed by each country, and the roles of Chair and Deputy Chair alternate between the two countries. At 30 June 2010 the Board members and their terms of office were:

Australia

Professor Warrick Couch (Chair), ARC Professorial Fellow, Swinburne University appointed 5 November 2004 till 30 June 2010

Dr Ian Chessell, South Australia's Chief Scientist; appointed 22 March 2007 till 30 June 2010

Professor Bryan Gaensler, ARC Federation Fellow, University of Sydney; appointed 1 January 2009 till 30 June 2010.

United Kingdom

Professor Stephen Warren, (Deputy Chair), Department of Physics, Imperial College London; appointed 1 March 2006 till 30 June 2010

Professor Sean Ryan, Head, School of Physics, Astronomy and Mathematics, University of Hertfordshire; appointed 1 January 2008 till 30 June 2010

Dr Colin Vincent, Head, Astronomy Division, Science and Technology Facilities Council (STFC); appointed 5 April 2006 till 30 June 2010.

C. Board meeting attendance

Board Member	No of meetings attended
Professor W Couch (Chair)	2/2
Professow S Warren (Deputy chair)	2/2
Dr I Chessell	2/2
Professor S Ryan	2/2
Professor B Gaensler	2/2
Dr C Vincent	2/2

The AATB met twice in 2009-10.

D. *Special responsibilities*

Drs. Chessell and Vincent have been nominated by the Designated Agencies, DIISR and STFC respectively, to represent their agencies on all matters in relation to the operation of the Agreement.

2. Audit and Risk Management Committee

The Audit and Risk Management Committee is a subcommittee of the AAT Board with the following objectives:

- Enhancing the management and internal control framework necessary to manage the AAO's business;
- Ensuring the AAO has appropriate risk identification and management practices in place;
- Improving the objectivity and quality of significant financial information;
- Assisting the Board to comply with all legislative and other obligations.

The Audit and Risk Management Committee currently comprises two non-executive Board members, Dr Vincent and Dr Chessell. Mr Harper, FAICD, FCPA (formerly of the ARC) and Mr John M. Williams B.Ec, FCPA (CSIRO), are independent members.

The committee met twice in 2009-10. Member attendance details are:

Committee member	No. of meetings
Mr G Harper (Chair)	2/2
Dr C Vincent	2/2
Mr J Williams	2/2
Dr I Chessell	2/2

3. Performance Management

The AAO has an active performance management system. Group and individual work plans are prepared annually with a view to providing clarity for staff in their work, identifying training needs, and to provide performance measures to track actual progress. Considerable effort is made to ensure that these plans are consistent with the Corporate Plan. The annual staff appraisals take place in March/April each year.

4. Ethical standards

All staff are required to observe the AAO Code of Conduct which requires AAO Staff to perform their duties and conduct themselves in a manner which ensures that they maintain a reputation for fair dealing. This code is based on the Code of Conduct proposed by the Bowen Committee of Inquiry concerning Public Duty and Private Interest.

In addition, staff have to observe good scientific practice. ARC-funded research must also comply with the Joint NHMRC/AVCC Statement and Guidelines on Research Practice, "Australian Code for the Responsible Conduct of Research". The code provides an outline of the general principles of responsible research and detailed advice on:

- the management of research data and records management;
- authorship;
- publication and dissemination of research findings;
- supervisory responsibilities;
- conflict of inter collaborative research;
- peer review;
- research misconduct; and
- a framework for handling allegations of research misconduct.

Research Councils UK (the umbrella organisation for STFC and the other UK research councils) requires that the AAO report annually on good scientific practice and ensure staff are aware of relevant policies and procedures.

AAO staff who manage scientists or supervise students are also expected to act as mentors, providing advice and guidance on good research practice.

The ATAC Guidelines indicate that when a committee member is included in the list of applicants on a proposal, or otherwise feels they may have a conflict of interest, he/she must excuse themselves from the meeting during discussion and voting on that particular proposal.

Appendix E Advisory Committees

Anglo-Australian Time Allocation Committee

Under Article 5 (1) of the Supplementary Anglo-Australian Telescope Agreement, observing time on the AAT and use of associated facilities is shared between the Contracting Parties in proportion to the value of the contributions to the annual Joint Program of the AAO.

The Board has chosen to exercise its responsibility for the allocation of time on the AAT through arrangements made with the two government agencies responsible for implementing the AAT Agreement and its amendment, namely the Science and Technology Facilities Council (STFC) in the UK, and the Department of Innovation, Industry, Science & Research (DIISR) in Australia.

Under guidelines set by the Board, these agencies operate through a single joint time allocation committee – the Anglo-Australian Time Allocation Committee (AATAC) – which ranks all proposals for observing time on the AAT on the basis of scientific merit, and assigns each one an appropriate number of nights. The first half of 2010 was the first in which all AAT proposals (for semester 2010B) were evaluated by a committee comprising six Australian members and one international member.

At 30 June 2010, membership of ATAC was:

Dr P Wood (RSAA), Chair

Dr S Keller (RSAA)

Dr S Wyithe (Melbourne)

Prof J Lattanzio (Monash)

Dr L Kewley (Hawaii)

Dr G Madsen (Sydney)

Dr T Davis (Queensland)

The AAO Users' Committee

The AAO Users' Committee (AAOUC) consists of six members. As of 30 June 2010, five are from Australia and one is international.

Its terms of reference are:

1. To provide advice to the Director on operational and developmental issues relating to the facilities provided by the AAO. These include the Anglo-Australian Telescope, the UK Schmidt Telescope and all aspects of support provided by the AAO.

2. To make recommendations to the Director that seek to maximise the scientific productivity and maintain the competitiveness of the Observatory, taking into account the likely resources availability.

3. To consult widely with the community, liaising where necessary with national time assignment groups, to establish priorities for both operational and instrumentation initiatives.

4. To interface with the design review panels, commenting on any issues arising from these panels that impact on the delivery of key user science requirements.

5. To provide a written report through the Director for submission to each September meeting of the AAT Board.

At 30 June 2010 the six AAOUC members were:

Dr M Brown (Monash) (Chair)

Dr T Jarrett (Caltech)

Dr B Carter (USQ)

Dr J Bryant (Sydney)

Ms E Wisnioski (Swinburne)

Ms E Wylie de Boer (ANU)

Glossary, abbreviations and acronyms

AAL	Astronomy Australia Ltd
AAO	Anglo-Australian Observatory
AAOmega	An optical spectrograph designed and built by the AAO for the AAT
AAOUC	AAO Users' Committee
AAT	Anglo-Australian Telescope
AATAC	Anglo-Australian Time Allocation Committee
AATB	Anglo-Australian Telescope Board
AIP	Astrophysikalisches Institut, Potsdam, (Germany)
ANSOC	Astronomy NCRIS Strategic Options Committee
ANU	Australian National University
AO	Adaptive Optics
ARC	Australian Research Council
ASA	Astronomical Society of Australia
ATNF	Australia Telescope National Facility
AURA	Association of Universities for Research in Astronomy
AusGO	Australian Gemini Office
CAASTRO	Centre of Excellence for All-sky Astrophysics
CCD	Charge coupled device
CHaMP	Census of High-and Medium-mass Protostars
CSIRO	Commonwealth Scientific and Industrial Research Organisation, Australia
DIISR	Department of Innovation, Industry Science and Research
Echidna	A fibre positioner built for National Astronomical Observatory of Japan by the AAO, for use on the Subaru Telescope
EEO	Equal Employment Opportunity
EIF	Education Investment Fund
ELT	Extremely Large Telescope
ESA	European Space Agency, Germany
ESO	European Southern Observatory
FMOS	Fibre-fed Multi-Object Spectrometer built for the Subaru telescope
FTE	Full-time equivalent
GAMA	Galaxy and Mass Assembly Survey
Gemini	Gemini Telescopes
GMT	Giant Magellan Telescope
GNIRS	Gemini Near Infrared Spectrograph
GNOSIS	OH suppression fibre feed
HST	Hubble Space Telescope
Herts	University of Hertfordshire, UK
HERMES	High resolution multi-object spectrograph for the AAT
IAU	International Astronomical Union
IfA	Institute for Astronomy, Edinburgh, UK
IFU	Integral field unit
IR	Infrared
IRIS2	Infrared imager/spectrograph for the AAT
IT	Information Technology

Keck	Keck Observatory, Hawaii
Kelvin	A scale of measurement the zero point of which is known as absolute zero; equivalent to -273.14C
LIEF	Linkage, Infrastructure, Equipment and Facilities, ARC grant program
MANIFEST	Many-instrument fibre system for GMT
MOS	Multi Object Spectrograph
NAOJ	National Astronomical Observatory of Japan
NCRIS	National Collaborative Research Infrastructure Strategy of the Australian Government
NG1dF	Next Generation 1-degree Field instrument (proposal)
NIFS	Near Infrared Integral Field Spectrograph on Gemini telescopes
NOAO	National Optical Astronomy Observatory, USA
ODC	Optical Detector Controllers
OH	Oxygen+Hydrogen diatomic molecule
OH&S	Occupational Health & Safety
OPTICON	A Europen Framework Program giving access to the AAT and UKST to EU astronomers
OzPoz	A fibre positioner for the VLT built by the AAO
PANIC	Persson's Auxiliary Nasmyth Infrared Camera
Photonics	The science of manipulating light within materials
PI	Principal Investigator
PNe	Planetary Nebulae
PSS	Public Sector Superannuation Scheme
RAVE	RAdial Velocity Experiment on the UKST
RSAA	Research School for Astronomy and Astrophysics, Australian National University
SDSS	Sloan Digital Sky Survey
SEMELPOL	a polarimeter used in conjunction with the UCLES spectrograph on the AAT
SKA	Square Kilometre Array radio telescope
SMF	Single mode fibre
SPIE	Society of Photo-Optical Instrumentation Engineers
SPIRAL	An IFU using fibres to feed the AAOmega spectrograph on the AAT
Starbug	A positioning technology using micro-robotic actuators
STFC	Science and Technology Facilities Council, UK
Subaru	An 8-metre optical infrared telescope owned by the National Astronomical Observatory of Japan, based in Hawaii
TAC	Time assignment committee
TAIPAN	proposed galaxy survey using UKST
UCLES	University College London Echelle Spectrograph
UHRF	Ultra High Resolution Facility (with UCLES)
UKST	UK Schmidt Telescope
VLT	Very Large Telescope
WiggleZ	A survey of high-redshift, star-forming galaxies to study dark energy
WFMOS	Wide-field multi object spectrograph
2dF	2-degree Field positioner on the AAT
6dF	6- degree Field positioner and spectrograph on the UKST

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