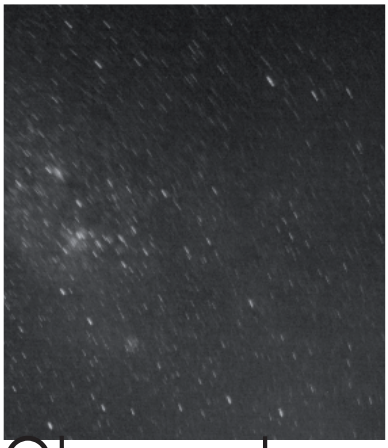

Anglo-Australian Observatory

Annual Report of the
Anglo-Australian Telescope Board
1 July 2008 - 30 June 2009

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Cover Photo: Anglo-Australian Telescope and dark sky. The scene in this photo was extremely dark, with the dome being lit by a small amount of moonlight coming through some clouds, and some light from the nearby workshops. To get enough detail, multiple photos were taken and added together, one on top of the other. The stars are blurred because they have moved over the course of the 20 odd exposures. Photo: Barnaby Norris

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Picture Credits: Shaun Amy, Jurek Brzeski, Paul Curnow, Michael Drinkwater, Kristin Fiegert, Gemini Observatory/K. Pu'uohau-Pummill, Jeroen Heijmans, Steve Keough, Steve Lee, Andrew McGrath, Stan Miziarski, Barnaby Norris, Stuart Ryder, John Sarkissian, Helen Sim, Mark Sims, Swinburne University, Chris Walsh

Senator The Honourable Kim Carr, MP

Minister for Innovation, Industry, Science and Research

Government of the Commonwealth of Australia

Lord Drayson

Minister of State for Science and Innovation

Government of the United Kingdom of Great Britain

and Northern Ireland

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 2008 to 30 June 2009. The report summarises the operations of the Board for the period under review and includes financial statements and statements of estimated expenditure in accordance with the provisions of the Agreement.

Professor Warrick Couch
Chair
Anglo-Australian Telescope Board

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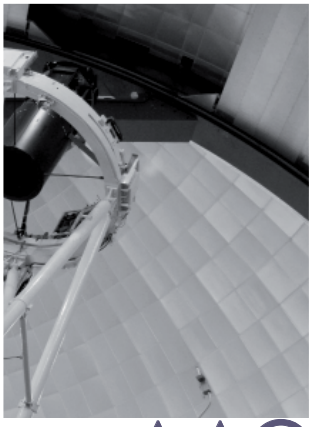
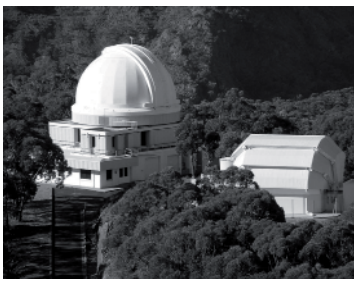


1 About the AAO

Statement of purpose

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.



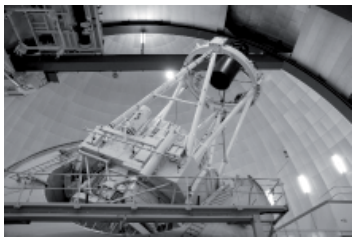
Top: Anglo-Australian Telescope (Photo: Barnaby Norris)
Bottom: UK Schmidt Telescope (Photo: Kristin Fiegert)

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).



Top: Anglo-Australian Telescope (Photo: Barnaby Norris)
Bottom: UK Schmidt Telescope (Photo: Shaun Amy)

The United Kingdom government has indicated its intention to withdraw from the AAT Agreement with effect from 1 July 2010. Arrangements to carry out this withdrawal and related matters came into effect in the form of a treaty amendment, the Anglo-Australian Agreement Amendment Act 2006. This notice period allows for a phased withdrawal by the UK Government and sufficient time for the Australian Government to plan for the future of the AAO.

The Australian Government, as part of its May 2009 Budget announcements, has agreed to taking over the AAO as a fully Australian owned entity from July 2010 and has agreed to meet its ongoing operational requirements. The AAO is to become part of the Department of Innovation, Industry, Science and Research (DIISR) and is in discussion with DIISR on the details of the transition and governance arrangements.

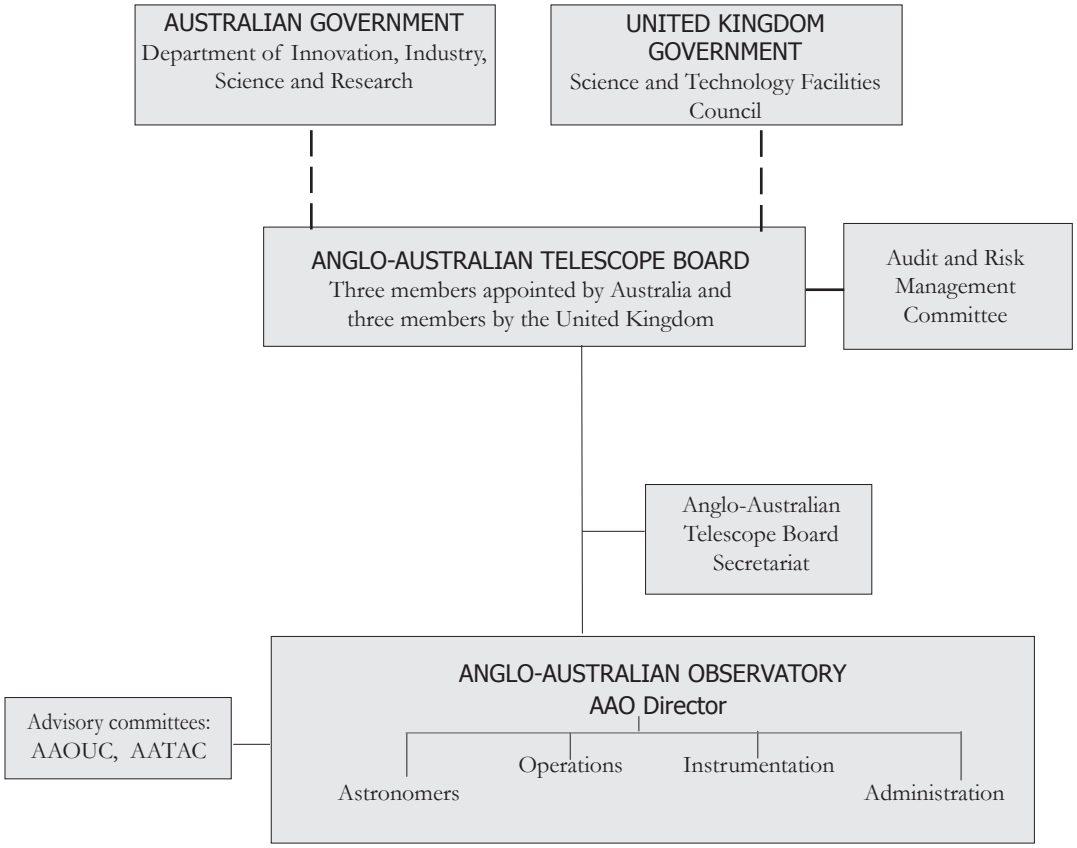
From Leftt: The Hon Maxine McKew, Mr Neville Legg, Executive Officer, AAO, Senator the Hon. Kim Carr and Professor Matthew Colless, Director, AAO at the offices of Enterprise Connect in June 2009. (Photo: DIISR)

Ministers responsible

The Minister responsible in Australia is Senator Kim Carr, MP, Minister for Innovation, Industry, Science and Research.

The Minister responsible in the United Kingdom for the Research Councils, and through them the AATB, is Minister of State for Science and Innovation, Lord Paul Drayson of Kensington.

Figure 1.1 General structure of the AAO



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 oversees 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 and an Adjunct Professor at the School of Physics, University of Sydney.

In April 2009, an Honorary Fellowship of the Royal Astronomical Society (RAS) was conferred on Professor Colless in recognition of his leadership role in Australian astronomy.

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

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 is allocated by a single bi-national panel, the Anglo-Australian Time Allocation Committee (AATAC), details of which are included in Appendix E.

2 The year in review

Top left: The Hon. Maxine McKew during a visit to the AAO's Eastwood Laboratory in August 2008 (Photo: Jurek Brzeski)
Centre: Senator the Hon. Kim Carr (Photo: DIISR)
Top: From Left: The Hon Maxine McKew; Rolf Muller, AAO Electronics technician; Professor Matthew Colless, AAO Director; Dr Andrew McGrath, AAO Instrument Scientist discussing the Echidna instrument (Photo: Jurek Brzeski)

Review by the Director

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, leading Australia's participation in the preeminent facilities of the next generation. These activities underpin the AAO's future as Australia's national observatory for optical and infrared astronomy.

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 north-

western NSW. In 1988 the AAO also took over responsibility for the 1.2-metre UK Schmidt Telescope (UKST) at Siding Spring. In 2006 the AAO began to provide support for Australian access to the twin Magellan 6.5-metre telescopes, located in northern Chile. Most recently, in 2008, the AAO became the host for the Australian Gemini Office, which supports Australia's involvement as a partner in the two Gemini 8.1-metre telescopes, one of which is located in Hawaii and the other in Chile.

On 30 June 2010, the UK's involvement in the AAO, which has been gradually ramping down over the past five years, will come to an end, and the AAO will become a wholly Australian organisation. With this milestone approaching, the AAO's role has evolved from supporting a single telescope for Australian and UK astronomers towards becoming the national observatory supporting all of Australia's major optical astronomy facilities. The past year has seen major strides being taken to effect this transition.

The new AAO

The Australian Government has now taken the fundamental decisions that will shape the AAO's future beyond the end of the AAT Agreement. From 1 July 2010, the Anglo-Australian Observatory will become the **Australian Astronomical Observatory**, operating under the Department of Innovation, Industry, Science & Research (DIISR). Funding for the final year of the old AAO (2009-10) and the first three years of the new AAO (2010-13) was provided in the Australian Government Budget released in May 2009. The funding for the new AAO will allow the Observatory to maintain the level of services and support that it currently provides for Australian users of the AAT, Gemini and Magellan, together with its world-renowned programs of astronomical research and instrumentation. This brings to an end several years of uncertainty over the future of the organization and provides a degree of funding stability that will allow the AAO to plan more effectively for the future.

This 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 $88.4M to pay for a 10% share in the construction of the Giant Magellan Telescope (GMT) and enhance Australian involvement in the telescope and instrument contracts.

Science highlights

Both the AAT and the UKST continue to enable excellent research by the AAO's own astronomy group and by the hundreds of users from Australia, the UK and around the world. The AAT has maintained a remarkable track record of scientific productivity and impact over its whole history. The most recent comprehensive study of the astronomical literature (Trimble & Ceja, 2008, Astron. Nachr., 329, 632) examined the productivity (number of papers) and impact (number of citations) of all major telescopes based on publications over the three years 2001 to 2003. The study shows that the AAT is the #1-ranked 4-metre optical telescope in the world in both productivity and impact, achieving more than twice as many citations as its nearest competitor. Furthermore, amongst optical telescopes of any size, on the ground or in space, the AAT is ranked #5 in productivity and also #5 in impact. It is only surpassed by the Hubble Space Telescope, the Keck 10-metre and VLT 8-metre telescopes, and two major imaging/spectroscopy surveys (2MASS and SDSS). This is an extraordinary achievement for a 4-metre ground-based telescope.

Demand for AAT time continues to be strong; the over-subscription rate has been a factor of two or more since AAOmega came on-line in January 2006. The productivity of the AAT likewise maintains a very high level: observational data obtained with the telescope has led to between 80 and 110 papers in each of the last seven years.

In addition to developing new instrumentation, the AAO also fosters its special strength in survey astronomy by supporting ambitious large observing programs. These programs may use any of the AAT instruments to compellingly address major scientific questions with allocations of telescope time ranging from fifty nights to hundreds of nights over several semesters. At least 25% of the time on the AAT is given over to large programs, and the AAO encourages ambitious proposals by not setting an upper limit

on the fraction of time awarded to such projects. During 2008-09, the active large programs were the WiggleZ dark energy survey (mapping distant galaxies to understand the nature of the mysterious 'dark energy' that is accelerating the expansion of the universe), the GAMA redshift survey (studying the assembly of mass and stars in nearby galaxies), and the Anglo-Australian Planet Search (discovering planets around other stars using precise Doppler measurements).

Telescopes and instruments

As emphasised by the conclusions of the independent international review by the Astronomy NCRIS Strategic Options Committee (ANSOC), the AAT can maintain its current high levels of productivity and impact for another decade with appropriate investment in telescope infrastructure and new instruments. The NCRIS program has provided $4 million to refurbish the telescope and ensure that it can operate reliably and efficiently for another ten years, and more than $6 million for a major new instrument, the 400-fibre HERMES high-resolution spectrograph.

Figure 2.1 A design model of the HERMES spectrograph (Image: Andrew McGrath)

The AAT refurbishment project is proceeding well, with replacement and upgrading of several major telescope systems, 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 the safety of the telescope environment for staff and users.

The HERMES instrument will be a versatile general-purpose facility enabling survey-style astronomy at high spectral

resolutions. The primary science drivers are massive 'Galactic Archaeology' surveys that will unravel the formation history of the Milky Way by measuring the motions and chemical compositions of millions of stars. Extragalactic surveys using the existing AAOmega spectrograph and Galactic surveys using the new HERMES spectrograph will be the flagship science carried out on the AAT over the next 5-10 years. AAOmega and HERMES, together with upgrades to existing instruments, will provide astronomers with powerful tools that will enable them to do competitive, high-impact research using the AAT throughout the coming decade. HERMES passed its conceptual design review in September 2008 and its configuration review in June 2009; it is expected to reach the preliminary design review milestone in late 2009. Construction of HERMES will begin in 2010, and the instrument is expected to begin science operations on the AAT in 2012.

Other projects either underway or seeking funding include the CYCLOPS fibre feed for the UCLES high-resolution spectrograph, expected to be commissioned and available for shared-risk observing in early 2010; an OH-suppression fibre feed system called GNOSIS, initially intended for the AAT and potentially thereafter for Gemini; the NG1dF concept for a prime focus multislit spectrograph with a 1 degree field of view on the AAT; and a proposed facility fibre feed system for GMT called MANIFEST.

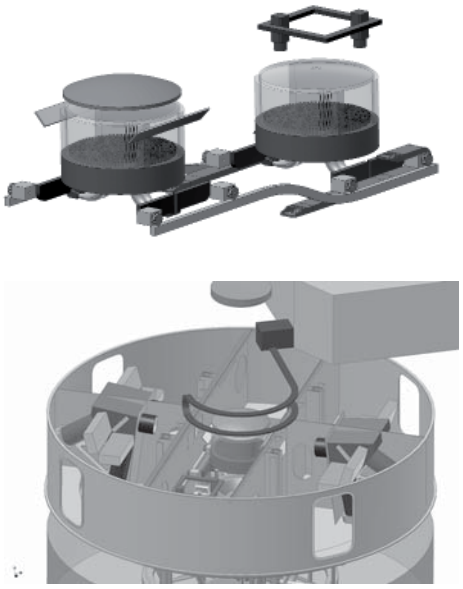


Fig 2.2 Top: MANIFEST Starbug field plate assembly shown in observing and storage position.
Bottom: The MANIFEST fibre positioner concept for the GMT. (Models: Jurek Brzeski)

Innovative technology

A significant element in the long-term success of the AAO's instrumentation program, and consequent scientific productivity, is the development of new technologies for astronomical instrumentation. A particular focus at present is the application of innovative photonic materials and devices to astronomy, a far-reaching program carried out in collaboration with researchers from universities and companies both in Australia and internationally.

In December 2008 the AAO and collaborators from the University of Sydney carried out the first on-sky demonstration of 'sky-suppression' optical fibres, which remove the OH airglow emission at near-infrared wavelengths using photonic structures embedded in each fibre. This technology is capable of reducing this unwanted atmospheric background by a factor of more than 20. The scientific potential of this technology is immense – applications include observations of the Universe at the time the first stars and galaxies were formed. The AAO and collaborators hope that by 2011 this technology will be available to users of the AAT through the proposed GNOSIS upgrade for the existing IRIS2 infrared spectrograph.

An even more ambitious goal of the AAO's R&D program is an integrated photonic spectrograph, in which all the components of a normal astronomical spectrograph are miniaturised and replicated within a solid-state optical device – a 'spectrograph on a chip'. The AAO is collaborating with Australian and overseas institutions to develop this revolutionary technology as part of its long-term goal of remaining at the forefront of astronomical instrumentation technology and competing for future instrumentation contracts on next-generation facilities such as GMT.

People

The main strength of an organization like the AAO is its people. This was emphasised in 2008-09 by the AAO's celebration of 35 years of service by Bob Dean and 30 years of service by Helen Davies. These two staff members have given long, loyal and valuable service to the Observatory. There were also some

significant changes during 2008-09, with the retirement of long-time staff members and some new appointments and re-structuring in the astronomy, operations and instrumentation areas.

The AAO now has two astronomy groups, one supporting the two telescopes operated by the AAO (the AAT and the UKST) and the other supporting Australian access to the international Gemini and Magellan telescopes. The new Head of the AAT Science group is Dr Andrew Hopkins, a QEII Fellow previously at the University of Sydney, while AAO staff astronomer Dr Stuart Ryder leads the Australian Gemini Office (which also supports Magellan). This new structure makes explicit and visible the fact that the AAO supports all of Australia's national optical/infrared facilities, not just the AAT and UKST.

Above: Bob Dean much earlier in his long career at the AAO

A re-organisation has also taken place in the operations group, following the retirement of Chris McCowage as AAT Operations Manager. Chris has been an outstanding contributor to the effective performance of the AAT over his 29 years of service, and his superb technical understanding of the telescope and its systems will be greatly missed. Doug Gray, who previously managed the AAT refurbishment project, has been appointed as the new Operations Manager. Because this role has been redefined and expanded, Bob Dean has been moved into the new position of telescope Systems Manager, responsible for the technical operation of the telescope, dome and instruments.

Chris McCowage says farewell to the AAO after 29 years (Photo: Steve Lee)

Another organisational change was the appointment of William Rambold as Instrumentation Group Manager, in one of the first steps towards re-structuring the instrumentation group. The group's capabilities were further

bolstered by the hiring of two new project managers, Ian Saunders and Anthony Heng, while the instrument science group was brought back nearer to full complement with the hiring of Dr Stuart Barnes and Dr Michael Goodwin.

Another welcome development has been the extension of the successful program of joint appointments between the AAO and neighbouring Macquarie University. Two new joint positions were filled by Dr Jon Lawrence, an instrument scientist with a particular focus on photonics and a continuing interest in Antarctic astronomy, and Dr Daniel Zucker, an astronomer whose field is the structure of the Milky Way, M31, and other nearby galaxies.

Outlook

Now that the future of the AAO is mapped out in terms of its funding and its governance model, the coming year (2009-10) will focus on the detailed arrangements for the transition of the AAO from the Anglo-Australian Observatory to the Australian Astronomical Observatory. Although this will require much work and great care, it is exciting to look forward at last with certainty to developing the AAO as Australia's national optical observatory.

Review by the Chairman of the Board

This last year has been a momentous one in the life of the AAO, and a highly challenging one for the AAT Board. The year commenced with continued uncertainty as to the future of the AAO beyond the middle of 2010, when the UK withdrawal becomes complete and the Observatory becomes a wholly Australian organisation. Here the 2009 Australian Federal Budget represented the last major opportunity to put in place the necessary funding and governance arrangements to ensure the continuance of the AAO beyond this point. In addition, the AAO was required to cost and determine the conditions under which it would lead the construction of the ambitious Wide Field Multi-Object Spectrograph (WFMOS) instrument for the 8-metre Subaru telescope, as part of the requirements for the concept design study it undertook for Gemini. This presented a significant challenge to the Board in how to deal with the financial risks and contractual complexities associated with such a large and expensive instrument, made even more difficult by the unknown future of the AAO.

Professor Warrick Couch, Chair, AATB (Photo: Mark Sims)

In developing the New Policy Proposal to the Australian government for the continued funding of the AAO in the early part of the year, a timely reminder of the critical importance in keeping the AAO operating was provided by the Astronomy NCRIS Strategic Options Committee (ANSOC). This committee, which included some of the world's most eminent

astronomers from the US and UK, was tasked with evaluating the scientific contributions the AAT would make over the next decade in the broad context of optical and radio astronomy, where it would be operating in an environment with an increasing number of newer and bigger facilities (such as the 8-metre class Gemini telescopes and the Australian Square Kilometre Array Pathfinder). It was significant that ANSOC was unequivocal in its support for the on-going operation of the AAT – based on its potential to conduct competitive and world-leading survey science for at least another decade – and recommended that funding of the AAO be maintained at its present level over this period.

The announcement by the Australian government in its May 2009 budget of the very positive decisions it had taken in securing the future of the AAO is one that is warmly welcomed by the Board and the astronomy community at large, and will I am sure be recorded as one of the most significant events in the lifetime of the Observatory. At last there is now certainty over both the future funding and governance of the new AAO, which will be called the "Australian Astronomical Observatory". The provision of new funding that will keep the AAO's total budget at an appropriate level for at least the next four years, thereby allowing it to continue to provide the level of services and support that it currently offers its users, as well as maintain its world-renowned astronomical instrumentation and research programs, is an excellent outcome. The decision to make the new AAO a unit within the Department of Innovation, Industry, Science and Research, based on the same model used for the Australian National Measurement Institute, should place it in a solid and stable operating environment and, most importantly, allow it to retain its identity and strong brand name. With these important foundations being laid, the challenge now is in the implementation, working through the multitude of detailed issues that need to be resolved to ensure a smooth and seamless transition from the old AAO to the new.

With the AAO's future now assured, it is possible for it to be much more forward-looking in terms of its vision and what it might achieve as Australia's national optical observatory.

The past year has seen a number of important scientific and instrumentation developments for the AAO that indicate there is much to look forward to in the coming years. A number of the scientific highlights presented in Chapter 3 of this report continue to emphasise the key role the AAT's AAOmega survey spectrograph is playing, and will continue to play, in keeping the AAO at the forefront of astronomical research. The exploitation

Above: Members of the Board along with some members of the AAO Executive in April 2009 at the University of Hertfordshire (from top left) Dr Ian Chessell, Mr Neville Legg (Executive Officer), Professor Bryan Gaensler, Dr Colin Vincent, (from bottom left) Professor Sean Ryan, Professor Warrick Couch (Chair AAT Board), Professor Matthew Colless (Director AAO) and Dr Stephen Warren (Photo: Mark Sims)

of this instrument to reveal for the first time the intricate structure of the interstellar medium in the direction of the ω-Centauri cluster and to spatially resolve and measure the star formation activity within distant galaxies illustrates its versatility and potency in conducting fundamental astrophysical research. The first major scientific results now emerging from the WiggleZ

dark energy survey are also a reminder of the important mission of the AAOmega facility in enabling large survey programs that uniquely address big questions such as the nature of dark energy. In this context, the wide field, large-multiplex spectroscopic capability of the AAT will be significantly enhanced by the new NCRIS-funded HERMES instrument – a high-resolution spectrograph fed by the 400 fibres from the 2dF positioner. Significant strides were taken this year towards the realisation of this instrument, with the finalisation of its design – it is now the AAO's top-priority project. Once HERMES is completed in 2012, it, together with AAOmega, will further cement the AAT's world-leading position as a Galactic and extra-galactic survey science facility, and should keep it there for most of the next decade.

The AAO's reputation for excellence in astronomical instrumentation is also built upon a successful track record in instrument design and construction for other telescopes, as well as the research and development of new instrument technologies that will be so crucial for next-generation instruments and telescope facilities. While the decision by the Gemini Board in May 2009 to cancel the WFMOS instrument was a major disappointment for the AAO, the year saw other promising prospects in these two areas emerge. The AAO's in-house developed OH-suppression fibre technology, where the OH airglow emission at near-infrared wavelengths is removed by photonic devices built into optical fibres, was successfully demonstrated on the AAT. This now opens the way for a fuller and more mature implementation of this technology, first via a fibre-feed system for the IRIS2 infrared spectrograph on the AAT, and then hopefully for the GNIRS instrument on Gemini. Another significant development is the potential uptake of the AAO's fibre feed technology for the next generation 25-metre Giant Magellan Telescope (GMT), with the Observatory being requested to submit a proposal to develop the MANIFEST concept, which will feed a number of the GMT spectrographs.

In May this year the AAO welcomed the Governor of NSW, Professor Marie Bashir AC, QVO to the AAT. Governor Bashir was shown an instrument change on the AAT as well as other aspects of the AAT's operations.

This year, Prof. Brian Schmidt's term as an Australian Board member came to an end. The energy and enthusiasm he brought to the Board, combined with his sound scientific and political judgment, were

much appreciated and proved invaluable in dealing with the significant challenges that were faced in the last three years. His replacement is Prof. Bryan Gaensler from the University of Sydney, who is a distinguished radio astronomer, but with strong interests and connections in optical and X-ray astronomy. His perspectives will be particularly important given the growing synergy between optical and radio astronomy in Australia, brought about by the development of the wide-field radio survey facilities in Western Australia.

The great benefit the AAO has received from its many long-serving, loyal and highly dedicated staff was further highlighted this year with the retirement of Chris McCowage as AAT Operations Manager, after 29 years of outstanding service, and Bob Dean and Helen Davies having clocked up 35 and 30 years of service, respectively. The Board is highly appreciative of the enormous contributions these staff members have made to the Observatory, as well as the continued dedication and patience of all the staff through the recent period of uncertainty with regards to the AAO's future.

An instrument change on the AAT (full context at inset). Watching are Mr Stephen Patfield, Protocol, Office of the Governor, Mr Bob Dean (AAO), Dr Stefan Keller (MSO), Professor Fred Watson (AAO), Mr Chris McCowage (AAO), Professor Marie Bashir AC, QVO, Governor of NSW and Mr Neville Legg (AAO). (Photo: Steve Lee)

3 Scientific highlights

An illuminating study of the interstellar medium towards ω-Centauri

Interstellar space is a much better vacuum than any created in laboratories on Earth but it is still not completely empty. While the diffuse matter of the interstellar medium (ISM) is most conspicuous in regions of recent star formation, in the form of reflection nebulae and visible light emitted from the recombination of hydrogen and oxygen ions, radio observations reveal that interstellar gas is distributed throughout the Milky Way. Indeed, gas clouds even populate the Galactic Halo, far from the spiral arms that give our Galaxy its characteristic appearance. Absorption of background light by highly-excited atoms is also seen by spacecraft in all directions, even in the voids between interstellar emission.

This diverse collection of observations fits into a picture of a multi-phased ISM, where hot gas (up to millions K) occupies large volumes and cold gas (down to 15 K) defines the smaller, denser clouds. The different phases are determined by the

cooling and the heating of the gas, which in turn depends on the gas density, on the radiation field, and on shock waves that travel through the ISM even without the need for explosions or jets. The result is a myriad intricate structures, from bubbles and shells to cometary clumps, sheets and strings with scales ranging from Galactic, down to that of the Solar System. The ISM is far from a static ensemble of clouds but rather a highly dynamic place where morphological and thermo-dynamical structure is as evanescent as it is elusive.

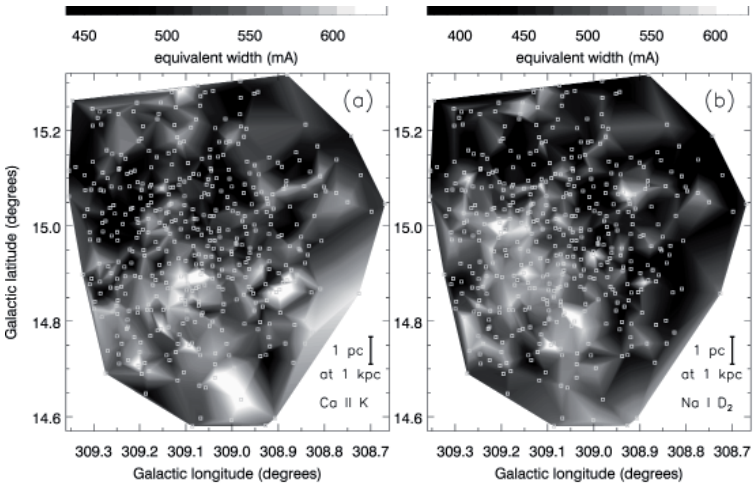


Figure 3.1 The first detailed maps of the Interstellar medium in the direction of ω-Centauri

An international team of scientists led by Jacco van Loon of the University of Keele, UK, have recently performed a detailed study of the spatial and thermodynamic structure of the ISM down to scales of ~1 light year. The astronomers used the Anglo-Australian Telescope and the multi-object spectrograph AAOmega to observe ω Centauri, the most massive and also one

of the closest Galactic globular star clusters in the night sky. ω Centauri is particularly suitable for probing the ISM as it is spread over a sizeable area of the sky, about twice the diameter of the full moon, and its stellar members are bright and well separated. It also has a substantial population of hot (8000-30 000 K) stars with low levels of metals in their atmospheres (BHB stars). The very weak metal absorption lines make it much easier to spot the effects of the interstellar medium superimposed on their spectra. Additionally, the counter-rotating orbit of ω-Centauri around the Galaxy clearly separates absorption lines of material associated with the cluster from those of the Galactic ISM.

By examining the strength of the absorption lines in the spectra of over 450 blue horizontal branch stars from calcium and sodium, van Loon and his team were able to construct the first detailed maps of the ISM in the direction of ω Centauri (Figure 3.1). The sodium maps appear to be dominated by material above the Scutum-Crux spiral arm of the Galaxy at 3000-4500 light years distance, whereas the calcium maps contain a significant component arising in the inner-halo region of the Galaxy situated beyond the spiral arm. Intriguingly, detailed analysis of the shapes of the absorption lines suggests that this gas may be lagging behind the Galaxy's rotation, possibly as a result of friction between the Galaxy's disk and halo. The astronomers speculate that this could excite instabilities which propagate throughout the disk giving rise to the spiral arm pattern.

The astronomers believe that the fluctuations in the maps seen on the smallest scales are due to a combination of variations in the density and in the level of excitation of the interstellar medium in the Galaxy.

2D spectroscopy of star-forming galaxies

Until relatively recently, due to technological limitations, astronomers were only able to spectroscopically observe galaxies in the local and distant Universe with one-dimensional (1D) longslit or single fibre instrument configurations. This is akin to only being able to observe the street where you live by looking out of the letterbox of the house front door. It had thus

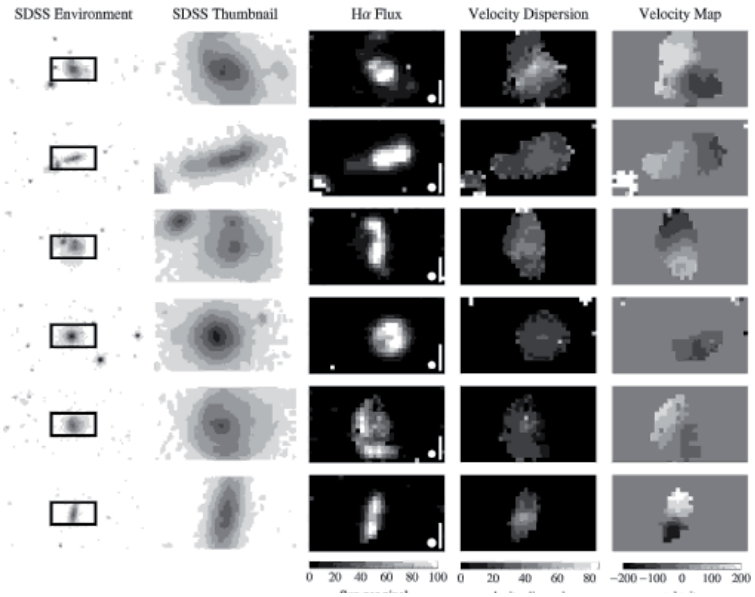


Figure 3.2 Sample of results from the first DYNAMO observing run. The white and the white bar shown in the middle image of each run indicate the image quality during the observation and 15,000 light years at the galaxy's distance respectively.

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been impractical to perform the detailed spectroscopic studies of substantial samples of these objects which are required to build a clearer picture of their formation and evolution. Fortunately, with instruments such as the SPIRAL integral field unit (IFU) on the Anglo-Australian Telescope, which provide astronomers with the capability to perform two-dimensional (2D) spatially resolved spectroscopy, the door is now firmly open for this type of study.

A multi-national collaboration of astronomers led by Karl Glazebrook of Swinburne University is undertaking a survey of local and distant emission-line galaxies in a bid to resolve a number of puzzles relating to their formation and evolution. For example, it remains unclear as to whether very distant galaxies at high redshift grow predominantly through mergers or as a result of rapid star formation in embryonic disks. Previous IFU observations have shown that large galactic disks existed a mere 3 billion years after the Big Bang, albeit with structures that appear to be quite different from those observed in the present-day Universe. Additionally, studies of distant starburst galaxies (z>2) have revealed these objects to have complex natures. Fewer than half appear to harbour disk structures, yet in the local Universe (z<~0.1) star formation is generally indicative of the presence of a disk.

Glazebrook and his collaborators are employing IFU instruments fed by adaptive optics systems on the 8-metre Gemini and Keck telescopes to target a sample of galaxies in the redshift range z~1-2 and SPIRAL on the Anglo-Australian Telescope to study a selection of objects at z~0.1. Little previous work has been undertaken on the spatially resolved motions of the local galaxy population, including efforts to classify them according to their kinematic state. Therefore these new SPIRAL observations are crucial for the interpretation of the Gemini and Keck data. By artificially redshifting local objects to simulate more distant galaxies, the astronomers are able to check that the techniques employed to interpret the z~1-2 observations are robust.

Moreover, with their new IFU data the team are able to compare the spatial distribution of H-alpha light (a marker of star formation) to the broadband light (showing older stars) to investigate the location of recent star birth within each galaxy (see Figure 3.2). The H-alpha light maps reveal the level of disorder within each system, allowing the astronomers to better understand the recent history of galaxy merger events. The new data also aid in eliminating small complications traditionally associated with measurements of the rotation of galaxy disks. These are a substantial source of scatter within the Tully-Fisher relation, which can be used to obtain distances to galaxies, independent of redshift measurements. Finally, these IFU data are being used to provide dynamical mass estimates for the galaxies. By comparing these to mass estimates based on modeling the stellar light distribution, the astronomers are investigating the distribution of dark matter within galaxy halos.

IRIS2 reveals an excellent candidate for a leading-arm spiral galaxy

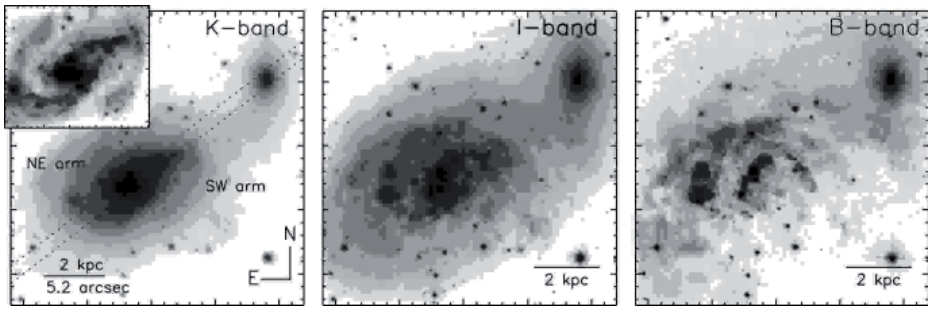


Figure 3.3 The galaxy IRAS18293-3413 imaged in the near-infrared (left), red-optical (middle) and blue-optical (right). The inset in the left-hand image has been specially processed to highlight the spiral arms. The dashed lines indicate the section of galaxy observed with IRIS2.

As little as half a century ago, astronomers were still vigorously debating whether all spiral galaxies had "trailing arms" consistent with differential rotation in their inner parts, or if in fact some galaxies had "leading arms" which curve in the opposite sense to the rotation of their disk. In theory at least, determining whether spiral arms are leading or trailing ought to be simple enough. A spectrum across the broadest dimension of the inclined galactic disk will give an unambiguous indication of which side of the galaxy is approaching and which side is receding. However, determining the viewing geometry of a galactic disk is less straightforward, the most intuitive method being to examine the obscuring effect of dust lanes in galaxies which are highly inclined to the line of sight. High quality images of objects such as the famous Sombrero galaxy or NGC7331 suggest that the side of the disk most silhouetted by dust lanes is the closest.

A team of astronomers including Stuart Ryder of the Anglo-Australian Observatory, Petri Väisänen of the South African

Astronomical Observatory, Seppo Mattila and Jari Kotilainen of the University of Turku, Finland have recently made an interesting serendipitous discovery about the luminous infrared galaxy IRAS 18293-3413 while searching it for supernovae. Their high resolution near-infrared images obtained with the European Southern Observatory's Very Large Telescope have revealed IRAS 18293-3413 to have a possible companion galaxy 15" to the northwest and "grand design" spiral arms which were not apparent in earlier optical images obtained with the Hubble Space Telescope (Figure 3.3).

The team obtained follow-up near-infrarad spectroscopy of both galaxies with the Anglo-Australian Telescope and the IRIS2 instrument, which has shown the velocity of the adjacent galaxy to be some 500 km/s greater than that of IRAS 18293-3413. This means that if it is a true companion, it must be undergoing a high-speed encounter in a sense opposite to the direction of the main galaxy's rotation (a retrograde encounter). Based on measurements of the galaxy's rotation derived from the IRIS2 data and the arguments outlined above suggesting the more heavily dust-obscured side of the disk is in the foreground, the astronomers have concluded that the spiral arms of IRAS 18293-3413 revealed in the near-infrared images are leading spiral arms. Numerical modeling predicts that retrograde encounters with small companions can result in long-lived leading-arm features but only when the dark matter envelope of a galaxy outweighs the spiral itself. As retrograde encounters ought to be just as frequent as prograde encounters, the astronomers suggest that the extreme rarity of a double leading arm system like IRAS 18293-3413 may indicate that such massive dark matter envelopes are uncommon.

Early results from the WiggleZ survey

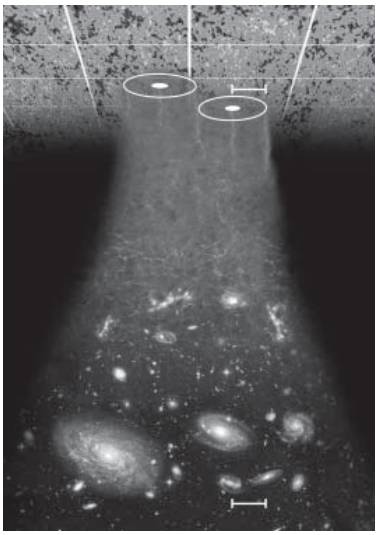
In the early 1990's it became clear to astronomers that while the cosmos was geometrically flat, the density of matter was well below the critical value separating a gravitationally bound universe from an unbound universe. This implied an additional large contribution from a non-zero cosmological constant term as first suggested by Einstein. This was confirmed in the late 1990's by studies of distant supernovae which revealed that the expansion rate of the Universe is accelerating. To explain this acceleration, new physics are needed — either gravity is fundamentally different from the vision put forward by Einstein, or the cosmic energy budget is dominated by a new form of matter with a negative pressure, ``dark energy''.

Several large, high-redshift galaxy surveys have been proposed to test models of dark energy. The first of these to commence was the WiggleZ Dark Energy Survey, a large project on the AAT led by Michael Drinkwater of the University of Queensland, and Warrick Couch of Swinburne University, aimed at measuring the scale of baryon acoustic oscillations (BAO) imprinted on the spatial distribution of the galaxies. The BAO scale is a standard ruler that can be used to measure cosmic distances. Ultimately, when WiggleZ is completed, this measurement will be accurate to 2% and allow stringent constraints to be placed on theories of dark energy. Observations are not scheduled to finish until mid-2010, but some interesting early results have emerged from the survey during the last year.

Above: WiggleZ makes a name for itself on the AAT (Photo: Michael Drinkwater)

Drinkwater, Couch and collaborators have counted the number of pairs of close neighbours within their sample as a function of separation, to investigate the clumpiness of the local environments of

WiggleZ galaxies. They have determined that the characteristic length of this clumpiness is substantially larger than the value found in earlier AAT surveys indicating that the WiggleZ galaxies inhabit somewhat denser environments than local star-forming galaxies. This is consistent with the suggestion that these are 'starburst' objects produced by galaxy mergers or interactions within denser galaxy groups at high redshifts. However, the clustering length for WiggleZ galaxies is significantly lower than that found for luminous red galaxies or for galaxy clusters. This is unsurprising because star formation activity is believed to be suppressed in the densest environments by mechanisms which remove the gas supply from galaxies.



WiggleZ measures the imprint on the galaxy distribution of structures formed in the early universe.
(Image: Swinburne University)

The team has also performed a preliminary analysis of 'redshift-space distortions' within their target sample. Galaxies possess 'peculiar velocities' through space in addition to their overall motion in the expanding universe. Outside the cores of clusters, these peculiar velocities are produced by the flow of galaxies into clusters through the action of gravity. Galaxies lying in front of clusters are falling away from the observer into the cluster (which increases their redshifts), whereas galaxies lying behind clusters are falling towards the observer into the cluster which (decreases their redshifts).

A plot examining the apparent separations of WiggleZ galaxies parallel and perpendicular to the line-of-sight clearly reveals the signature of this effect. The measurement is found to be consistent with the value predicted by prevailing cosmological models. Ultimately, with the entire WiggleZ sample in hand, redshift-space distortions will be used to understand the rate of growth of cosmic structure and provide the team with another powerful test of models of dark energy.

Finding hidden supernovae with Gemini

If the rates of star birth within the class of Luminous Infrared Galaxies (LIRGs) implied by their brightness at infrared wavelengths are to be believed, then the most massive of these new stars should end their lives as core-collapse supernovae at the rate of 1 or 2 a year. However, barely a handful of the 4500 supernovae known have been found in LIRGs, due to their high dust content and clumpy nature. Spotting a new point source like a supernova inside a LIRG is therefore hopeless at optical wavelengths but is ideally suited to near-infrared adaptive optics (AO) techniques. The Gemini North telescope uses a laser to create an artificial optical star in the upper atmosphere, which enables images at infrared wavelengths to be corrected for the distortions introduced by the atmosphere and deliver images as sharp as (but deeper than) those obtained from the Hubble Space Telescope.

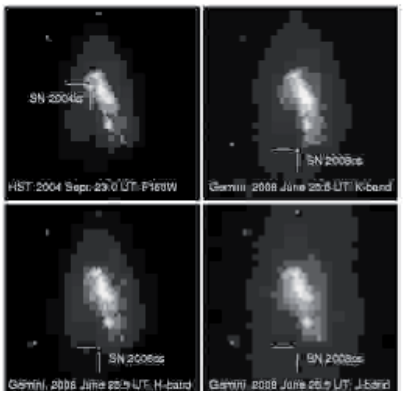


Figure 3.4 Images of the LIRG IRAS 17138-1017 obtained from the Hubble Space Telescope (top left) in 2004, and with Gemini's laser guide star AO system in 2008. The previously unreported SN 2004iq and newly-discovered SN 2008cs are marked

A collaboration led by Seppo Mattila (University of Turku, Finland) and Stuart Ryder (AAO) has been using near-IR AO systems on the VLT and Gemini to hunt for these 'missing' supernovae. They are now halfway through a 5-semester program using the laser guide star system on Gemini North to monitor 8 LIRGs for new supernovae. They had their first success in mid-2008, when PhD student Erkki Kankare compared Gemini imaging of the galaxy IRAS 17138-1017 with a NICMOS image from 2004, and found not just one new supernova (SN 2008cs), but also one "historical" supernova (SN 2004iq) that had gone unnoticed at the time (Kankare et al. 2008, ApJL, 689, L97). By measuring the changing colours of SN 2008cs as it faded, they showed that it suffers the most obscuration by dust of any supernova known, with fewer than one in a million optical photons able to escape the dust unhindered. It is little wonder therefore that such heavily-obscured objects have gone unnoticed previously. This first-ever discovery of a supernova using laser guide star AO was featured in the Sydney Morning Herald on 5 Jan 2009, as well as the May/June 2009 issue of Australian Sky & Telescope.

Resolving microarcsecond structure around quasars with Magellan

Gravitational microlensing occurs when the gravity of a foreground galaxy acts to focus and magnify light from an even more distant galaxy behind it to produce one or more amplified images. This phenomenon enables astronomers to study the lensed galaxy at a level of detail not normally possible. Observations of gravitational microlensing in multiply-imaged quasars currently provide the only direct probe of the accretion disk of hot gas being drawn into the super-massive black hole at scales of less than 1 microarcsecond, i.e. 100,000 times smaller than can normally be achieved with a ground-based telescope. Previous analyses used microlensing variability over several years of the lensed images. A team from the University of Melbourne, involving Magellan Fellow David Floyd, has demonstrated a technique for constraining the size of the quasar's accretion disk by imaging the lensed quasar in several colours within the one night (Bate et al. 2008, MNRAS, 391, 1955). They obtained images of the lensed quasar MG 0414+0534 in five wavelength bands using the IMACS optical and PANIC infrared cameras on the Magellan 6.5m Baade telescope. These data, in combination with two existing images from the Hubble Space Telescope, were used to model the size and temperature profile of the accretion disk in the quasar MG 0414+0534, finding it to be consistent with a standard Shakura–Sunyaev turbulent thin-disk model.

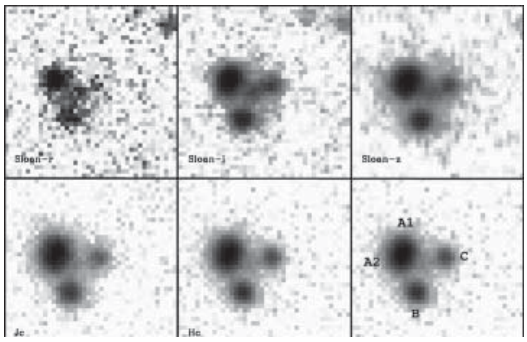
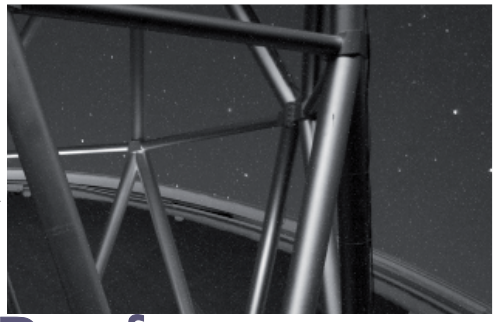


Figure 3.5 Magellan IMACS and PANIC imaging of the multiply-lensed quasar MG 0414+0534, taken on 3 Nov 2007. The change in flux ratios of each component (labeled A1, A2, B, and C in the lower-right image) with wavelength is primarily due to microlensing, and can be used to constrain the nature of the quasar's accretion disk.



4 Performance

The Gemini South primary mirror (Photo: Gemini Observatory/K. Pu'uohau-Pummill)

Strategies

The AAO is committed to listening to the astronomical community, and especially users of its facilities, to assess and anticipate its needs. There are several avenues available for this: the AAT Time Assignment Committee, the AAO Users' Committee, and the AATB. All have a strong influence on the strategic directions of the AAO.

The AAO aims to stay abreast of world best practice, 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, which is achieved 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 observing; 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

The AAT attracts around 40 proposals per semester from Australia and abroad. Under the terms of the Joint Agreement, the AATB set the relative shares of Australian and UK time to 85.5%-14.5% respectively 2008-09. Once a 20% share to non-Australian/non-UK proposals is incorporated, the final division of AAT time in 2008-09 was 68.4% Australian, 11.6% UK, and 20% Other nations (with Australia and UK accessing the other share once their share is used). In Semester 2008B a previous imbalance of 5.65 nights in the UK's favour was paid back to Australia evenly across dark, grey, and bright time. Figure 4.1 shows the over-subscription rates for the AAT over the past four years for Dark, Grey and Bright time. Overall levels of over-subscription have remained consistently around 2 and are shared fairly evenly across lunations in more recent times. Large Program requests are responsible for between 30% and 40% of the overall demand on AAT time, and thus the marginal over-subscription rates on the remaining time are higher, especially for Dark time, which is around 4. Figure 4.2 shows use of the AAT over the past year. Time lost due to weather in 2008-09 (34.9%) was very close to the long-term average, while technical downtime (3.5%) was within the target range. AAOmega remains the instrument of choice and utilises around two-thirds of AAT time. Despite this heavy workload, its reliability is comparable with that of the other instruments. Figure 4.3 shows this breakdown of AAT time over the past four years. The amount of time lost due to system failures has remained consistantly low.

Fig 4.1 Oversubscription rates for the AAT over the last four years

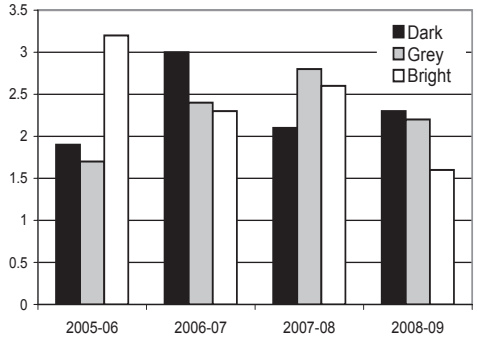
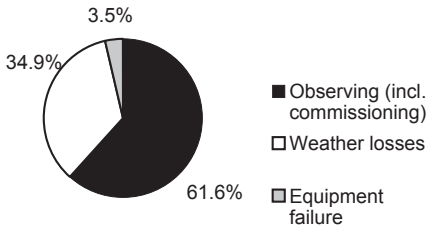


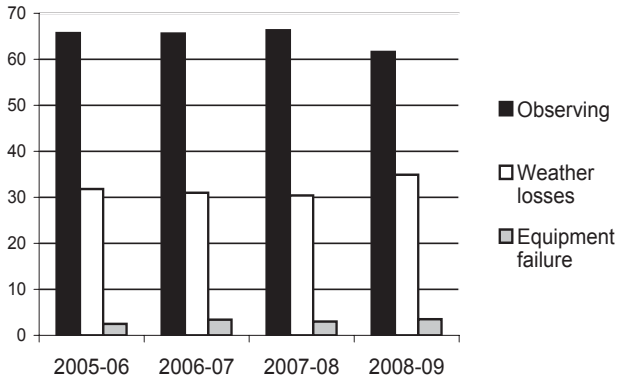
Figure 4.2 The use of observing time at the AAT in 2008-09



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.

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



Users are also asked to flag key items and to comment on any issues of concern.

For the past two semesters, 2008B and 2009A, we had 33 feedback forms returned from the 44 programs executed. This return rate of 75% compares well with the historical average of 50-70%, and we continue to remind observers to fill in the Observer Report Form if we don't receive one shortly after a scheduled run finishes.

The AAO's performance target is a minimum score of 3.75 in all categories. In this semester, all key areas exceeded this, with the exception of "Web-based accommodation and travel information." We have now streamlined the web booking process by removing the duplication of effort involved in completing both the AAO and ANU web forms, and anticipate that this will improve feedback in this area. Staff astronomer support, technical support, and night assistant support continue to

receive excellent ratings from almost all observers (average grades well above 4).

Table 4.1 User Feedback at the AAT

	2006-07	2007-08	2008-09
Night Assistant Support	4.8	4.6	4.6
Staff astronomer before	4.6	4.6	4.6
Staff astronomer during	4.9	4.8	4.5
Other technical support	4.7	4.6	4.6
Instrumentation & software	3.7	4.3	39.
General computing	3.7	4.3	4.1
Working environment	4.0	4.2	4.0
Web based accommodation & travel	4.0	--*	3.7
Data reduction software	3.9	4.0	3.9
Instrument manuals	3.9	4.1	3.9
AAO WWW pages	3.7	4.0	3.9

User Feedback is ranked on a scale of well below (1) to well above (5) acceptable.
**Previously Travel & Admin support; asterisked entry was for the semester after this facility changed, but before the wording of the question was updated.*

UKST Performance

The UKST is currently used exclusively for the RAVE survey of stars in the Galaxy. RAVE (RAdial Velocity Experiment) is a 10-nation collaboration headed by Prof Matthais Steinmetz at the Astrophysical Institute in Potsdam (AIP). RAVE aims to

generate an archive of radial velocities and metallicities for up to a million stars using the UKST. From is commencement on 11 April 2003 until 31 July 2005, the project utilized 7 bright nights per lunation, funded incrementally by the international RAVE consortium. Since 1 August 2005, RAVE has been the single user of the UKST and has provided the operational funding although the telescope itself continues to be operated by the AAO.

Weather and downtime statistics are summarised in Figures 4.4 and 4.5. Figure 4.4 shows the use of UKST observing time during the period 1 July 2008 to 30 June 2009. The poor system loss statistics were because of an unusually high number of complete nights lost during the period. Two faults were primarily responsible - a plateholder elevator fault and a fault in the robot. Table 4.2 summarises the data obtained for the principal observing campaigns since 6dF operations began.

A contributor to the variation from year to year is the availability of fibres. This issue has been of continuing concern to the RAVE collaboration since the beginning of full-time operations in 2005 and was noted in last year's Annual Report. Since then, the new third field plate (FP3) has been introduced and has had

Figure 4.4 The use of observing time at the UKST in 2008-09

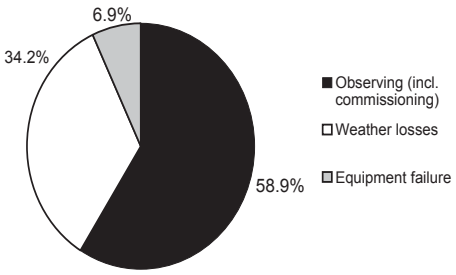
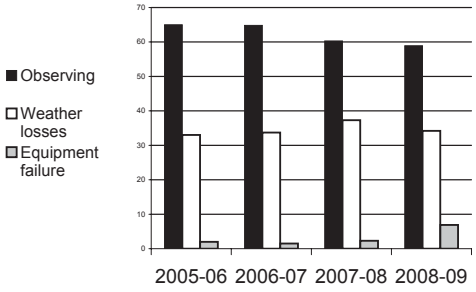


Figure 4.5 The use of observing time at the UKST



a positive effect. Various observing programs using the 6dF fibre spectrograph have occupied all UKST observing time since the beginning of 2003.

Repeat observations have been obtained throughout the project at a level of up to 15% by allowing the star selection software to accept random repeats at this level. This was disabled at the beginning of Semester 2008B to allow a more targeted

Table 4.2 Numbers of 6dF elds observed

Program	2003-04	2004-05	2005-06	2006-07	2007-08*	2008-09
6dF Galaxy Survey fields	392	383	94	-	-	-
RAVE Survey	320	407	726	798	926	1022
Non-survey fields	118	112	2	-	-	5
Total fields	830	902	822	798	926	1027

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

repeat campaign to be carried out, as requested by the RAVE collaboration. These repeat observations were principally carried out using the FP3 field plate working typically at rather less than its full fibre capacity, and resulted in a record number of RAVE fields being achieved over the last Semester. The sky coverage of the RAVE survey to date is shown in Fig 4.6.

Instrumentation and upgrades

The third field plate, FP3, commissioned in March 2009, was delivered with 139 active fibres, and is currently operating with 127 available fibres. The fibre bundles were manufactured by AIP, and completed at AAO. Following a major refurbishment in May 2009, Field Plate 1 (FP1) was reintroduced with 107 available fibres and is now operating with 101. The status of Field Plate 2 (FP2) is that it is currently out of service, awaiting delivery of the remaining fibre-bundles being manufactured by AIP for the new fibre feed. Once these are supplied, FP2 will be

reassembled with a full complement of 150 science fibres. Once FP2 is recommissioned, fibre repair work can begin on the other two field plates. It is also expected that a replacement bundle will be supplied by AIP to be fitted to FP1 in due course.

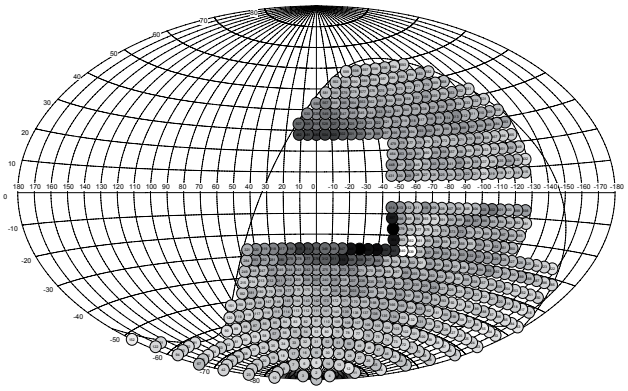
RAVE progress

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 The Astrophysical Journal. The third data-release is expected in late-2009. Furthermore, additional data releases featuring distance estimates, detailed abundances and stellar rotational velocities are currently in preparation. RAVE funds exist to support these operations until the end of the Anglo-Australian Telescope Agreement on 30 June 2010, with a high level of expectation that they will extend into the AAO's new governance regime.

Future prospects for RAVE

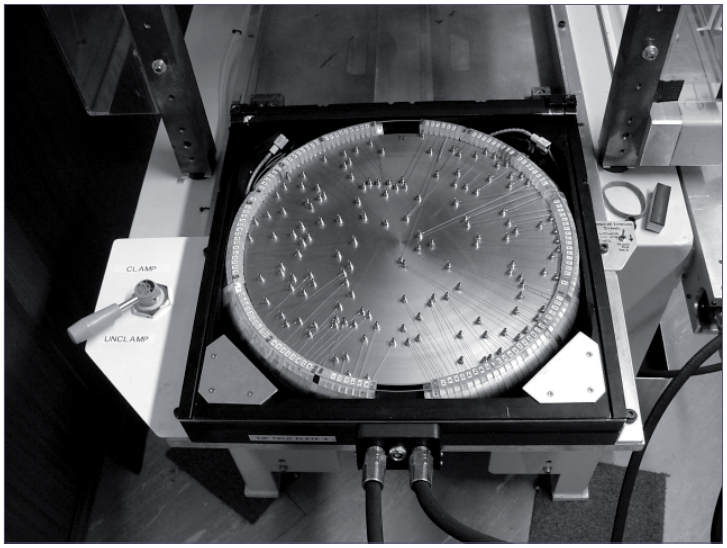
RAVE has provided data of very high quality, substantial quantity, and exciting science is coming out. From scientific aspects, the collaboration sees a strong case for continuing the

Figure 4.6. Total observations since start of project in April 2003 to 30 July 2009



survey towards the goal of 1 million spectra, if technically and financially feasible.

RAVE funding is in place to continue the survey well into the second half of 2010. Two major grants from German and British funding agencies have just been secured, a grant application to the US National Science Foundation is under review. Further fund raising via grants or new partners has been impeded by the uncertainty regarding the future of the UKST. Should this issue be solved, funding could be secured for the continuation of RAVE until the end of 2011 and beyond.



FP3 in the 6dF robot during commissioning

Australian Gemini Office

Australia has a 6.2% 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 which 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 by the National Collaborative Research Infrastructure Strategy (NCRIS). The Australian Gemini Office (AusGO) 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.

The AAO operates AusGO under contract to Astronomy Australia Ltd (AAL) from funds provided by NCRIS. AusGO comprises three astronomers: the Australian Gemini Scientist (Dr Stuart Ryder: 0.65 FTE), one Deputy Gemini Scientist based at the AAO (Dr Simon O'Toole: 0.5 FTE), and one Deputy Gemini Scientist based elsewhere (Dr Christopher Onken at RSAA: 0.5 FTE). 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, funded by NCRIS. It does this primarily by providing 2 Magellan Fellows (Dr David Floyd and Dr Ricardo Covarrubias) who conduct research with and provide operational support to the Magellan telescopes for two years while based in Chile, followed by a third year of research at an Australian institution of their choice.

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 web site hosted by the AAO servers, 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 is running a 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.

Dr Stuart Ryder (far left) and Dr Chris Onken (far right) from AusGO join AGUSS students David Palamara (left centre) and Sophie Underwood (right centre) in the Gemini South control room for a live video link-up with the of cial Australian launch of the International Year of Astronomy at Questacon, 28 Jan 2009.
(Photo: Stuart Ryder)

Research performance

The Astronomy group now includes 11 astronomers (10 FTE). Nine members of the Astronomy group are responsible to greater or lesser degrees for the delivery of astronomical services at the AAT and UKST. The AAO also hosts the Australian Gemini Office (AusGO), with the Australian Gemini Scientist (Dr Stuart Ryder) and one of the two Deputy Gemini Scientists (Dr Simon O'Toole) stationed in Epping.

During 2008-09 there have been a large number of staff movements, with the departure from the AAO of Andy Bunker and Terry Bridges, and the appointment of a new Director's Fellow, Research Fellow and a new AAO/Macquarie Lecturer.

Dr Andrew Hopkins is the new Head of AAT Science at the AAO since November 2008, replacing the former Head of Astronomy. The change in title is to distinguish this role from the Australian Gemini Scientist, while emphasising that the AAO now supports Australian access to more facilities than just the AAT itself. Among a variety of research projects and interests, Dr Hopkins is one of the leadership team in the large AAT project 'Galaxy And Mass Assembly' (GAMA).

Sarah Brough (now AAO) and Chris Blake (Swinburne) doing an interview on Dark Energy at the AAT for the documentary, "400 Years of the Telescope", which was created for PBS television in the USA. (Photo: H. Sim)

Dr Simon O'Toole has replaced Terry Bridges as Deputy Gemini Scientist. Simon was formerly the AAPS Fellow, and continues his involvement in the Anglo-Australian Planet Search.

Dr Chris Springob is the new Director's Fellow, beginning in September 2008. He has taken on the role of service coordinator,

allowing Heath Jones to focus on his AATAC technical secretary duties. Chris is involved in the 6dFGS together with Heath and Matthew Colless.

Dr Daniel Zucker is the new AAO/Macquarie Lecturer, since January 2009. Daniel's research interests include extreme low mass dwarf and satellite galaxies around the Milky Way and Andromeda.

Dr Sarah Brough has just joined the astronomy group as an AAO Research Fellow. Sarah's research background involves work on brightest cluster galaxies, and she is part of the WiggleZ team. Sarah is now also part of the GAMA project and will be investigating environmental dependencies in galaxy evolution.

Delegates to the "Overcoming Great Barriers in Galactic Archaeology" meeting in Palm Cove which explored scienti c and technical issues associated with the new HERMES

The AAO manages the Magellan Fellows program, with two Fellows working at the Magellan Observatory since 2007 and soon to take up their research appointments within Australia. Dr David Floyd will move to the University of Melbourne in August 2009, and Dr Ricardo Covarrubias will be coming to the AAO in December 2009. Two new Magellan Fellows, Dr Francesco Di Mille and Dr Shane Walsh, have recently been appointed and are taking up their positions at the Magellan Observatory in July 2009.

Although not formally part of the Astronomy group, a number of AAO staff including the Director, Dr Fred Watson, and Dr Russell Cannon also make substantial contributions to telescope operations, observing support, and astronomical research. Some members of the Astronomy group also play roles within some of the AAO's projects in addition to their on-going support work. The AAO/Macquarie Lecturers are joint appointments between the AAO and Macquarie University, spending half of their time at each location. The Australian Gemini Scientists have a 50% Gemini support role; their 50% research time falls within the remit of the Astronomy group.

Over the past 12 months the AAO has hosted 32 research students jointly supervised by AAO staff. Six honours students and one PhD student have submitted theses in this period. The AAO also runs a twice-yearly student fellowship program, enabling six undergraduates to gain research experience. The PhD top-up scheme instituted last year continues, with two new PhD scholarships awarded in 2009, including one for an instrumentation-related project.

The AAO astronomy group continues to influence the research direction of the community, with three significant conferences organised this year. Quentin Parker was the primary organiser for "Legacies of the Macquarie/AAO/Strasbourg Hα Planetary Nebula project" held at Macquarie University, in February. Fred Watson organised the "Overcoming Great Barriers in Galactic Archaeology" meeting in Palm Cove in March, to explore scientific and technical issues associated with the new HERMES instrument and related developments. Andrew Hopkins coordinated the 2009 Southern Cross Astrophysics Conference Series meeting, "Galaxy Metabolism", in Darling Harbour in June, with 90 participants from around the world. The AAO jointly coordinated two workshops held at the University of Sydney in late 2008: the GMT instrument workshop, and the Astrophotonics Hexabundle Science workshop. AAO astronomers were also very active in attending meetings, with participation in eight additional conferences worldwide, including meetings in China, Japan, Malaysia, the Netherlands and the UK.

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

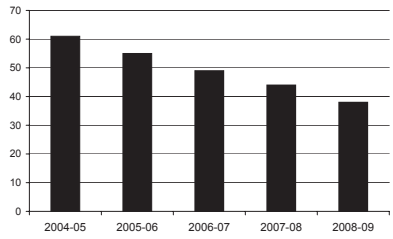
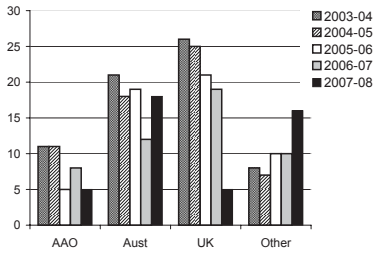


Figure 4.8 Number of scheduled AAT observing programs by location of Principal Investigator



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 is declining due to the continuing growth of large survey-style programs that contribute to the high scientific impact of the AAT. The decline is also due in part to the sharp recent drop in the programs led by UK astronomers, reflecting the reduced UK share, as seen in Figure 4.8 which shows the distribution of AAT observing programs by the location of the Principal Investigator. This trend is being balanced in part by notable increases in Australian-led programs, as well as those by astronomers at Other (non-Australian and non-UK) institutions.

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

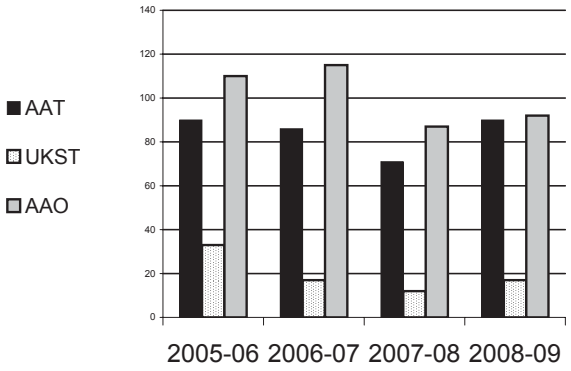


Figure 4.9 shows the total number of research papers published in refereed journals and conference proceedings using data from the AAT and UKST. Also shown are the total number of papers published by AAO staff, students, and visitors. A total of 90 AAT data papers, 17 UKST data papers and 92 AAO papers wer published. As the WiggleZ and GAMA Large Programs come to completion during 2010 this recent upward trend is expected to continue.

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. The number of UK led publications using AAT data has steadied compared to the fall

seen last year, while those from Australia and Other institutions have increased. First authors from outside the UK and Australia continue to dominate the publication rates. Publication rates by AAO staff, utilising data from facilities worldwide, not only the AAT and UKST, continue at a strong level, as seen in Figure 4.12. The publication rate for papers using AAT data per observing program continues at the healthy level seen in recent years at around 3 papers per program (Figure 4.13).

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

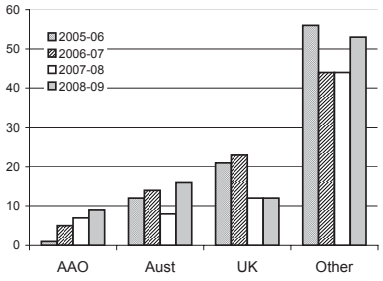


Figure 4.11 Research papers published using UKST data, by location of rst author

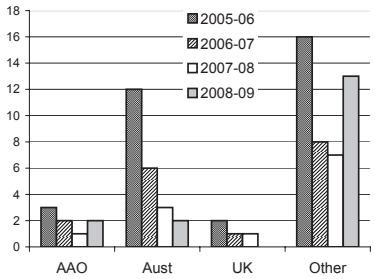


Figure 4.12 AAO publications by AAO staff, students & visitors

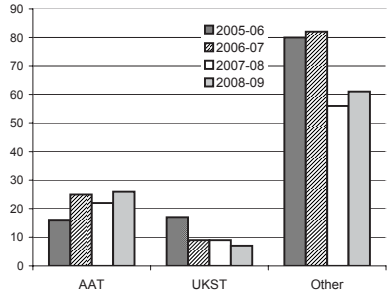
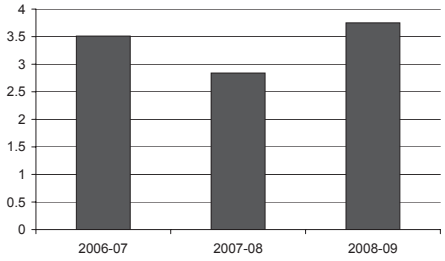


Figure 4.13 Publications per AAT observing program



Instrumentation

AAT instruments

Table 4.3 shows that 2dF/AAOmega used 49% of the total nights allocated on the AAT over the last two semesters. The science undertaken with this instrument was largely dominated by two onging long-term programs: the WiggleZ survey of distant galaxies to probe the nature of dark energy which dominates the Universe and the GAMA survey of nearby galaxies that is

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

Instrument	2006-07	2007-08	2008-09
2dF/AAOmega Wide-field multi-object spectrograph	41.5	61.5	49.0
SPIRAL/AAOmega Integral field spectrograph	5.0	7.5	9.5
UCLES/UHRF Coude echelle spectrographs	42.5	15.0	32.0
IRIS2 Infrared imager and spectrograph	8.5	9.0	3.0
Visitor instruments Instruments supplied by users	2.0	7.0	7.5

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

unrvavelling their mass-assembly and star-formation histories.

The UCL echelle spectrograph (UCLES) continues to perform reliably. Its iodine cell was returned briefly to the United States for re-calibration and has since returned and is back in operation. SPIRAL/AAOmega shows increasing levels of use, but IRIS 2

has a diminished amount of time on the AAT over the past 12 months, as it competes with instruments on the 8-meter class telescopes.

Instrumentation Projects

Telescope Control System (TCS)

The Telescope Control System project to upgrade the AAT's thirty-five-year-old Interdata Model 70 control computer was successfully completed in November 2008. The Interdata was powered down following a verification commissioning run to confirm operation of the new system conducted earlier that month. This followed two earlier commissioning runs in July and August 2008 and a subsequent "trial use" period from August to November. A final "maintenance commissioning" run was conducted in May 2009 to address a number of minor issues. The performance of the new system appears to be at least as good as the system it replaced and will allow the AAT to continue to operate reliably for the foreseeable future. The Interdata computer was removed from the AAT control room in March 2009 and donated to the Powerhouse Museum in Sydney.

2dF Data Reduction (2dFdr) Starlink Removal

The 2dFdr software is the AAO's primary fibre instrument data reduction software package. It was originally developed using now unsupported packages that were developed by the UK Starlink software group. Lack of support for Starlink was threatening the future viability of 2dFdr and hence the flow of science from the AAOmega and Spiral instruments.

The AAO funded a project to remove this dependency and ensure the future viability of this important software package. The project started in August 2007 and was completed successfully in March 2009. The improvement in portability was demonstrated when the software was ported to Mac OS X with only a couple of days of effort. The Mac OS X port was quickly in high demand by users, who have been moving to that platform. 2dFdr is now well positioned to become the foundation of data reduction packages for future fibre instruments such as HERMES.

CYCLOPS

CYCLOPS is a fibre array feed for the UCLES spectrograph. Such an array will allow more light (by nearly a factor of two) to be collected from star, since the fibres are reformatted to ensure that all of the light enters the slit of the spectrograph and because the fibre cable avoids two of the mirrors otherwise required to direct the light to the instrument. The resolving power of the instrument can also be improved since the slit doesn't need to be widened to collect the star light.

The design is now complete and the project is well into the manufacturing phase. It is expected to be completed by early 2010.

GMT Instruments

The call for proposals for first generation instruments has been received from GMT.

The instrument group is currently focused on generating a proposal for a Facility Multi-Object Fibre System (as it is called by GMT), or MANIFEST as the AAO refers to the instrument. The core proposal team currently consists of Ian Saunders (project management and systems engineering), Andrew Hopkins (science case), Will Saunders (instrument concept development), Michael Goodwin (Pick & Place and Starbugs concept development), and Jurek Brzeski (mechanical engineering). The proposal is due 30 October 2009.

The AAO will also explore collaborative efforts between the AAO, ANU and other members of the GMT partnership.

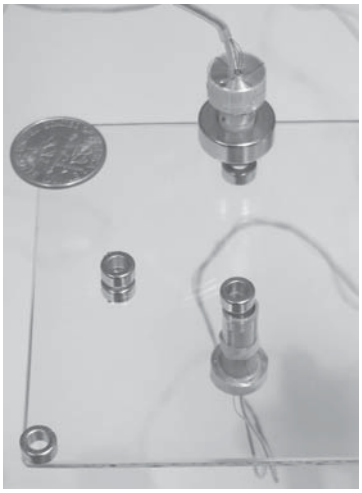


Image of a starbug- bre positioner for use on the proposed MANIFEST instrument for GMT. (Photo: Jeroen Heijmans)

FMOS Echidna

FMOS Echidna is an automated fibre positioner developed by the AAO for the Faint Multi Object Spectrograph instrument on the Subaru telescope at Mauna Kea in Hawaii. Commissioning of this instrument started in early 2008. AAO involvement this year has been primarily limited to remote support of the commissioning effort. Subaru is hoping to start scientific observations in shared risk mode (restricted functionality) in February 2010.

6dF Field Plate

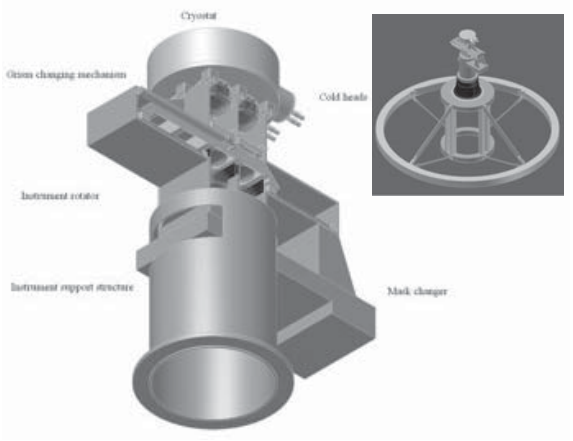
Macquarie University contracted the AAO to fabricate a third fibre field plate for use by the RAVE consortium on the UK Schmidt Telescope 6dF instrument. The project was a joint venture between the AAO, Macquarie University, and Astrophysical Institute Potsdam. AIP manufactured the fibre buttons, attached the fibres and manufactured the slit. AAO manufactured the field plate and retractor bodies and integrated them with the fibres and slit. The field plate was completed in late 2008, software parameter updating and commissioning were completed in March 2009. The third field plate is now in routine use.

HERMES

The HERMES instrument was selected as the next AAT instrument by a Community Review process in 2007. The initial concept of adding high resolution capability to the current AAOmega spectrograph was deemed not to be feasible due to the extended time that AAOmega would be out of service. Over the past year a new concept for a fully stand-alone high-resolution spectrograph suitable for performing an extensive Galactic Archaeology Survey was developed. This revised design was reviewed by an external committee in June and approved for implementation. Testing of various fibre connector options is in progress. The project is nearing the end of the Preliminary Design phase with the final design scheduled to begin in November 2009.

WFMOS

In February 2008 the AAO signed a contract with Gemini to resume the conceptual design study for implementing a Wide Field Multi Object Spectrograph (WFMOS) on the Subaru Telescope. This study was originally commissioned in 2006 but was cancelled by the Gemini Board soon afterwards. The AAO acted as prime contractor for the study, leading a team of seven international institutions. The AAO also contributed designs for the fibre positioner, fibre connector/cable, control systems and overall logistics.



A model of NG1dF Inset: NG1dF mounted on the top end (Image Stan Miziarski)

The final design report was completed and submitted to Gemini in January of 2009, followed by a review meeting in February 2009. Two competing proposals were received by Gemini for this instrument and the AAO team's bid was not selected, although the Gemini WFMOS program itself was cancelled in May, 2009.

WFMOS-A

In 2006, ARC funds were provided to continue studying WFMOS technology and implementation options following the cancellation of the Gemini WFMOS study. The WFMOS-A study explored the feasibility of developing an instrument based on the Echidna technology for the AAT. As a result of the Community Review recommendation to pursue HERMES as the new AAT instrument, and re-engagement with Gemini on the WFMOS study, the WFMOS-A effort was re-focussed to complete the design and prototyping of the Echidna positioner, thereby protecting the AAO's intellectual property in this

critical technology. A full module prototype was successfully constructed and tested. The results of this study were presented at a final project review held in August 2008. The final report was delivered in late 2008.

NG1dF

The AAO undertook a feasibility design and costing estimate for the Next Generation 1-degree Field (NG1dF) instrument. This concept was proposed by Robert Content and Tom Shanks (Durham University) at the November 2007 AAT New Instrument Workshop and was viewed as complementary to HERMES. The NG1dF concept envisages four slit mask based spectrographs mounted on the existing 1-degree Prime Focus top-end in place of the decommissioned Wide Field Imager. This instrument would achieve simultaneous observations on up to 4000 objects, an order of magnitude greater than AAOmega (with 2dF), albeit with considerably lower spectral resolution and wavelength coverage. Work on the feasibility study started in June 2008 and was completed in December 2008 with the publication of the design and costing document. Tom Shanks is currently exploring funding options for NG1dF.

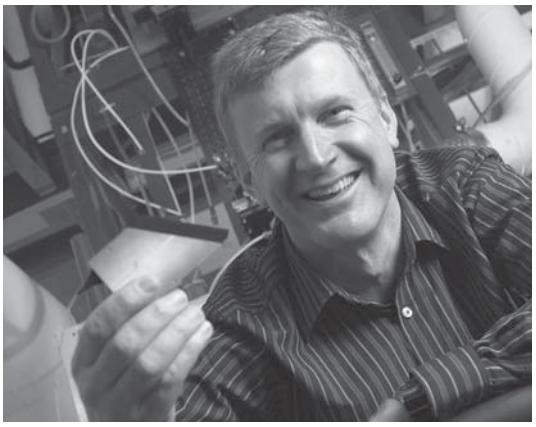
Instrument Science

The Instrument Science group had a productive year, developing instrument enabling technologies and being involved in a number of the AAO's instrumentation projects. Two members of the group have moved on, but the AAO has recruited three new staff members; Dr Jon Lawrence commenced at the AAO in a joint position with Macquarie University in January 2009. Jon has spent the last eight years at the University of New South Wales working on Antarctic astronomy. Dr Michael Goodwin joined us fresh from a PhD at the Australian National University in astronomical instrumentation entitled "Turbulence ranging at Siding Spring and Las Campanas Observatories". Dr Stuart Barnes joined us from a research associate position at McDonald Observatory, the University of Texas at Austin, where he worked on astronomical instrumentation projects.

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 both Sydney and Macquarie universities. These developments are aimed at providing major new photonic and positioning instrument technologies for application in astronomy.

The OH-suppression fibre development (with the University of Sydney and industry partners) passed a major milestone with the first-ever on-sky tests of photonic OH-suppression. This was carried out on the AAT in December 2008, using a 1x7 photonics lantern and gratings tuned to suppress 63 of the brightest OH lines over 1.44 – 1.63 µm. This is the most complex optical filter ever produced. The experiment clearly demonstrated the viability and power of photonic OH suppression and the results are presented in the Feb 2009 AAT newsletter.



Professor Joss Bland-Hawthorn (Sydney University) with a prototype of an integrated photonic spectrograph for astronomy. (Photo: Chris Walsh)

The Instrument Science group is a key member of Astrophotonica Europa (APE), a European-based consortium of 20 institutions formed to investigate photonic applications in astronomy. The kick-off meeting for the integrated photonics spectrograph development (funded by the European FP7 program) will take place in September 2009 at the University of Durham. The AAO has completed characterisation of a feasibility demonstration device with Macquarie and Sydney Universities; the details have been submitted to Optics Express for publication.

The group is about to embark on a significant Astrophotonics collaboration with the Universities of Sydney, Macquarie and Potsdam, together with the Astrophysikalisches Institut Potsdam (AIP), the Potsdam centre for photonics called InnoFSPEC and industry partners.

The year saw the further development of strong national and international links in Astrophotonics. The AAO and the University of Sydney are collaborating under the established Consortium for Australian Astrophotonics (CAA) Memorandum of Understanding.

The group is also undertaking collaborative technology developments in Starbugs positioning devices for cryogenic and ELT applications, multi-mode optical fibre connectors and fibre tapers for the AAO HERMES project, and Hexabundles for the VLT and ELTs.

A LIEF funding proposal, led by Joss Bland-Hawthorn at Sydney University and supported by the AAO was submitted in May 2009 to develop a science demonstration OH-Suppression system for the AAT, called GNOSIS.

The Instrument Science staff are involved in all current AAO projects to some extent.

Publications, workshops and conferences

The Instrument Science group had 45 authorships from publication in the last year. The group attended the "Hexabundle Science" workshop and technical discussions (24-26th November 2008). The program revolved around Australian and European involvement in ERASMUS (E-ELT) and Fireball (VLT) instrument concepts. The group also took part in the "Australian GMT Instrumentation Workshop" on 14th November 2008 in Sydney, organised by Roger Haynes on behalf of Astronomy Australia Limited.

In June 2009 Roger Haynes attended the CLEO Europe photonics conference where he presented his findings in Astrophotonics to the broader photonics community. He also presented the AAO's GMT MANIFEST concept at the GMT High Resolution Spectroscopy workshop, University of Texas in January 2009.

Students

The instrument science group is increasingly playing host to a number of research students being jointly supervised by AAO staff. This is a strong indication of the AAO's focus on research and development across a variety of instrumentation fields and a demonstration of the AAO's commitment to cutting edge research through the supervision of students.

Dionne Haynes is completing her joint AAO/MQ MPhil in Astrophotonics examining light loss mechanisms and propagation in multimode optical fibres. Her role in both the fibre connector and fibre taper developments has been crucial to delivering some of the AAO's project successes to date.

Talini Jayawardena is currently undertaking a three month AAO student fellowship project developing a closed-loop control system for Starbugs. She is a final year student studying Electronics with Space Science and Technology (MEng) at the University of Bath.

Marc Etherington is an AAO summer scholarship student from the University of Durham undertaking the characterisation of photonic crystal fibres for astronomy.

Nick Cvetojevic completed his joint AAO/MQ Honours project on "Tuneable Fibre Bragg Gratings and Applications in Temporal Spectral Astronomy". He has since completed the characterisation of an Array Waveguide Grating based Integrated Photonics Spectrograph under the co-supervision of Jon Lawrence and Roger Haynes, resulting in the submission of a publication to Optics Express.

Allar Saviauk completed an AAO student fellowship in which he successfully identified and developing a solution to the fibre fringing seen with AAOmega. This solution is currently undergoing in-suite testing at the AAT.

The Instrument science group again hosted three Macquarie University Opto-Electronics students undertaking their industrial projects at the AAO working on WFMOS positioner development and fibre characterisation.

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 Epping Laboratory and at the Siding Spring Observatory. Table 4.4 shows staff numbers by tenure.

Staff by function

The functional areas of the AAO are:

- Astronomy, which includes staff astronomers, visiting astronomers, research fellows, and visiting students.
- Operations, which is responsible for the running of the AAT and UKST at Siding Spring.
- Instrumentation, which builds instruments for the AAO telescopes and external clients.
- Instrument Science, which develops new technology.
- Corporate, which includes accounting, library, Board and Audit Committee secretariat and other support services.
- Information technology, which manages systems at both sites.

Figure 4.14 shows the breakdown of AAO staff by function

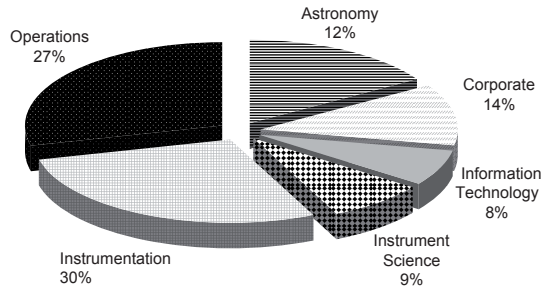


Table 4.4 Staff Numbers by tenure at 30 June 2009

Fixed Term Positions	**No. of Full Time**	**No. of Part-Time**	**FTE Part-Time**	**Total FTE#**
Director*	1			1
Instrument Scientist	2	2	1.3	3.3
Instrumentation	5			5
Astronomy	7	4	2	9
Operations	4	2	0.9	4.9
Corporate/IT	1	1	0.5	1.5
Sub total	20	9	4.7	24.7
Indefinite Term Positions	**No. of Full Time**	**No. of Part-Time**	**FTE Part-Time**	**Total FTE#**
Executive Officer	1			1
Instrument Scientist	1			1
Instrumentation	13	2	1.5	14.5
Astronomy	1			1
Operations	15	3	1.6	16.5
Corporate/ Information Technology	7	3	1.4	8.4
Sub total	38	8	4.5	42.5
Total Staff	58	17	9.2	67.2

**direct Board appointment*
#full time equivalent

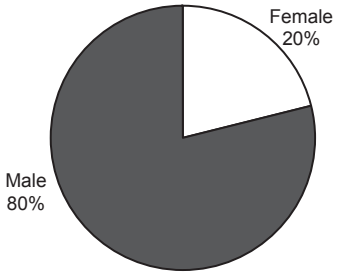
Employment arrangements

The AAO's terms and conditions of employment are set via a collective agreement, the Anglo-Australian Telescope Board Enterprise Agreement 2007-2010.

Equal Employment Opportunity (EEO)

The AATB is an equal employment opportunity employer and supports workplace diversity. Figure 4.15 below shows the ratio of males to females at the AAO and reflects the difficulty of attracting and retaining females in scientific and technical areas. During the year the AAO also had 13 visiting students. Of this number 8 (i.e. 62%) 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 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 names and contact details of committee members and the locations of first aid stations are posted on notice boards, as are emergency evacuation details.

Table 4.5 OH&S Statistics

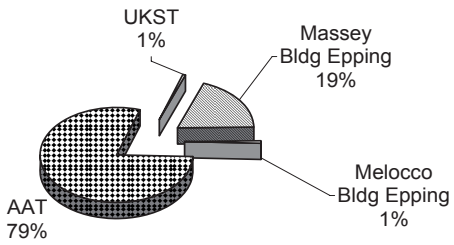
	2004-05	2005-06	2006-07	2007-08	2008-09
No. of claims	2	3	4	3	-
Payments Made	$3,241	$15,121	$41,627	$35,000	$ -
Dangerous Occurrences	-	-	-	-	-
Workers Comp Insurance	$37,309	$33,891	$52,075	$31,665	$42,340

The OH&S plan for the year continued to raise awareness throughout the organisation, with specific foci on emergency and evacuation policy and procedures, safe handling of chemicals, and the use of laser equipment.

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 the last five years.

In 2005, the AATB commissioned an external review of its OH&S infrastructure needs. The report identified various remedial works that needed to be undertaken at both Head Office and Siding Spring with the bulk of the work to be undertaken at the AAT.

Figure 4.16 shows infrastructure upgrades by location



Following an approach by the AATB, the Australian and United Kingdom Governments provided $2.7 million to fund a remedial works program. This program commenced in 2006 and has virtually been completed with more than 98% of the individual work tasks having commenced and/or been completed. The AAO Safety Committees are involved in the project.

Financial Resources

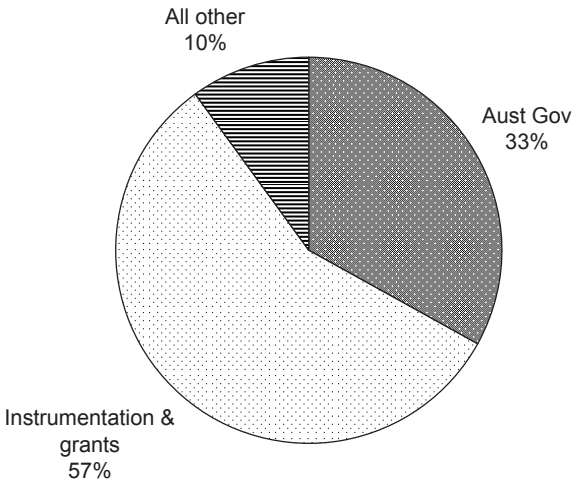
The financial statements in Appendix A outline the AAO's financial position. The Australian National Audit Office (ANAO) has audited the financial statements of the AATB and has again provided a clear audit certificate. The auditor's report is also contained in Appendix A.

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.
- 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.

The AATB is 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

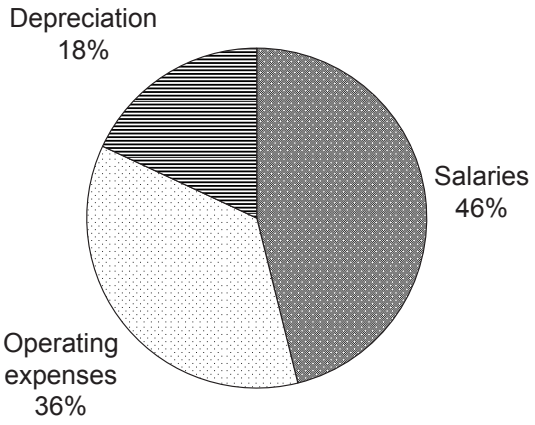
Figure 4.17 Revenue for 2008-2009



(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).

The results for 2008-09 show that the AATB has net assets of $44 million with a small net accounting operating surplus. The AATB focus for the year has been both on its short term budget position and its longer term needs post June 2010 after the treaty end.

Figure 4.18 Expenditure for 2008-2009



The Board is also attempting to increase its external revenue through its instrumentation program, both domestically and overseas. The AATB expects to be able to fund an expenditure program of $16 million for 2009-10.

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 implemented business software which:

- 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 GMT instruments.

Information Technology

We have now completed the second year of the current three year IT Strategic plan. Implementation is on track, and the budget available for IT is in line with the plan.

A significant achievement for the Observatory this year was the completion of the new Telescope Control System Project. This has enabled the original Interdata 70 minicomputer to be retired. The computer itself has been donated to the Powerhouse museum in Sydney.

We have made excellent progress with the modernisation of the IT infrastructure. In particular, all core IT infrastructure services at Coonabarabran have been migrated from the legacy Solaris platform to the current Linux environment.

This year has seen significant personal milestones for two of the IT team. Robert Dean achieved 35 years service with the AAO on the 25th of February, and Helen Davies achieved 30 years service on the 12th of March. Our congratulations to both team members, and our thanks for their long term contribution to the AAO.

Robert Dean has now been appointed to a new position of Telescope Systems Manager.

Environmental Issues

Following proposed changes to NSW planning codes, the Observatory was alerted to the possibility of self-certified developments failing to comply with the lighting standards required to keep Siding Spring's skies dark.

As a result of discussions between the Director AAO, Acting Director RSAA, and a senior representative of the Department of Planning, the Regional Environmental Plan Revision Working Group was able to introduce special requirements suitable for building surveyors working under the new exempt and complying development rules. In particular, a simple questionnaire-type pro-forma has been drafted for use within the Warrumbungle Shire, with the expectation that this will also be adopted by adjoining councils. It is expected that this will be incorporated into the final version of the new code, due for publication in 2010.

In parallel with this, the Working Group has significantly updated the Warrumbungle Shire Development Control Plan on lighting to reflect recent changes in available technology, and this will be exhibited shortly. Once it is passed by the Warrumbungle Shire Council, other local councils will be encouraged to adopt it.

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 range of readers, 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

The AAO issued three media releases this year. Over the year, AAO staff gave 184 media interviews, wrote 15 popular science articles, and gave 77 talks to audiences other than professional astronomers. They also gave at least 30 talks to astronomical colleagues.

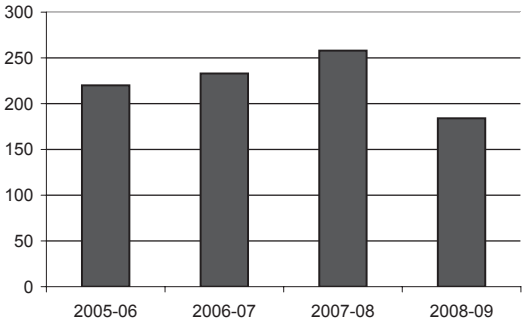
Professor Fred Watson with sci-writer Sean Williams at a 'Science vs Sci-Fi' discussion hosted in Adelaide by the Royal Institution of Australia on 3 June. Photo: Paul Curnow

The AAO organises two annual lectures: the Bok lecture, given in memory of astronomer Bart Bok, and presented in Coonabarabran and the nearby town of Dubbo; and the Allison-Levick memorial lecture, funded by a bequest from Melbourne psychiatrist Mr Jack Allison-Levick. This year the Bok lecturer was Professor Harvey Butcher, Director of the ANU's Research School of Astronomy and Astrophysics.

He spoke about Near Earth Objects and the research being conducted to find them.

The 2008 Allison-Levick Lecture was an overview of the current state of cosmology given by Professor Malcolm Longair, Emeritus Jacksonian Professor of Natural Philosophy, Cavendish Laboratory, Cambridge University, which was held at Scienceworks in Melbourne.

Figure 4.19 Media Interviews



Two AAO staff, Matthew Colless and Andrew Hopkins, took part 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.

Dr Tanya Hill of Museum Victoria with the 2008 Allison-Levick lecturer, Professor Malcolm Longair (Emeritus Jacksonian Professor of Natural Philosophy, Cavendish Laboratory, Cambridge University). Professor Longair gave the AAO's annual Allison-Levick lecture to a capacity crowd at Museum Victoria's science centre, Scienceworks. (Photo: H. Sim)

International Year of Astronomy

1609 was the year that Galileo Galilei heard about the optical telescope, made his own versions, turned them to the sky, and subsequently published what he saw, thus starting modern instrumental astronomy. To mark the 400th anniversary of this historic turning point, the UN General Assembly endorsed 2009 as the International Year of Astronomy (IYA).

Chief Scientist for Australia, Professor Penny Sackett, launching IYA at Questacon in Canberra on 28 January 2009. (Photo: Steve Keough)

Globally, IYA has been coordinated by the International Astronomical Union. In Australia, the Academy of Science's National Committee for Astronomy has had formal responsibility for coordinating IYA activities. As Chair of the NCA, AAO Director Professor Matthew Colless has taken the lead in doing this. The AAO and the CSIRO Australia Telescope National Facility have jointly formed the 'national node' for organising IYA. Helen Sim (CSIRO ATNF) has had the role of linking IYA activities in Australia with the IAU IYA secretariat. In 2007 an IYA Advisory Group, with 28 participants from the amateur and professional astronomy communities, business, education and the media, was established to scope possible activities and advise on a general strategy for running the Year. *Science in Public*, a consultancy specialising in science communication, was also engaged to help develop the program. During 2009 another consultancy, *Quick Thinking Communications*, was engaged to help publicise IYA events and make arrangements for touring speakers.

Funding for a number of specific IYA programs and functions was provided by the Science Connections Program of the Commonwealth Department of Innovation, Industry, Science and Research, through a contract with the AAO. Other activities have been funded by their organising institutions, sponsorships and other sources. Volunteers, particularly amateur astronomers, have made a large in-kind contribution to the Year.

In the first six months of 2009, Australia took part in one of the major international IYA programs, *the 100 Hours of Astronomy*. *The 100 Hours* was an umbrella covering many different

Public stargazing in the NSW town of Parkes during the "100 Hours of Astronomy" IYA event in April. (Photo: John Sarkissian)

activities; in Australia 64 public events were registered, mainly star-gazing sessions. The professional astronomical institutions contributed to a 24-hour webcast, "Around the world in 80 telescopes",organised by ESO. This was a behind-the-scenes look at 77 of the world's observatories. Each observatory provided an introductory 5-minute video about its work, followed by a live 15-minute interview with an astronomer from the observatory's control room. At the AAO, the honours were done by staff astronomer Paul Dobbie—accompanied by 20 students taking

part in the residential astronomy course, RYSTARS, which is organised each year by the Rotary Club of Coonabarabran. RYSTARS is an annual residential program for students in Years 9 to 11 aimed at developing the students' interest in astronomy and the fields that support it. Several AAO staff contribute to it. RYSTARS always involves a visit to the AAT, and talks by AAO staff, but being able to take part in the webcast was a bonus.

Other events under the IYA umbrella included a national web briefing for journalists on Dark Energy, run by the Australian Science Media Centre, in which AAO Director Professor Matthew Colless took part, and a range of events organised for the general public—variously involving a magician, jazz musicians, and bush poets—in which Professor Fred Watson had starring roles. Fred was also one of the users of AAO telescopes interviewed at Siding Spring for the US documentary, "*400 Years of the Telescope*", a 50-minute program funded by the NSF primarily for release through PBS television in 2009. Additionally, in 2008 he led a European tour focused on sites important in the development of the telescope and in 2009, was a speaker on the "*Southern Stars*" tour run by the Orion cruise line.

AAO astronomer Dr Paul Dobbie and students from the RYSTARS program, taking part in an international webcast from the AAT control room in April 2009. The webcast, on 3 April, was a 24-hour "behind the scenes" look at observatories around the world, coordinated by the European Southern Observatory as part of the International Year of Astronomy.

Many institutions have arranged individual talks or lecture series for IYA: 57 talks were given in the first six months of 2009. A program of touring speakers, sourced from Australia and overseas, was one of the major components of the DIISR contract. Under that, three international speakers—Professor Mike Turner (U.

Chicago), Professor Matthias Steinmetz (Astrophysical Institute, Potsdam) and Dr Marcus Chown (New Scientist)—gave talks in Sydney, Melbourne and Brisbane. A further nine overseas speakers are to follow in the second half of the year.

Star-viewing sessions have been one of the most popular IYA activities. The two largest have been Stargazing at Parramatta Park in Sydney, at which amateurs with 50 small telescopes engaged an audience of approximately 2000 people; and the star-gazing session at Little Creatures brewery in Fremantle, which attracted several hundred people.

Other IYA activities have included the live performances of "*Hot Stars, Cool Jazz*", which combined the talents of the AAO's Fred Watson and jazzman James Morrison and "*Harmonious Revolutions*", an early-music multimedia performance about the life of Galileo and his musician father Vincenzo.

Astronomy in National Parks in NSW was a theme incorporated into the regular "discovery programs" run by the education centre attached to each Park; and Exhibitions with astronomical themes included " *The Shared Sky*", a cross-cultural exploration of the night sky over Australia, and "*Light Years*", an exhibition of imagery relating to space travel. In all, more than 530 Australian IYA events were registered for calendar year 2009.

The rst performance of "Harmonious Revolutions", a musical work developed for IYA, in Canberra on 4 March. The work combines music of Galileo's period with astronomical images, many of them made with the AAO's telescopes. (Photo: Steve Keough)

Appendix A
Financial Statements

Financial Statements

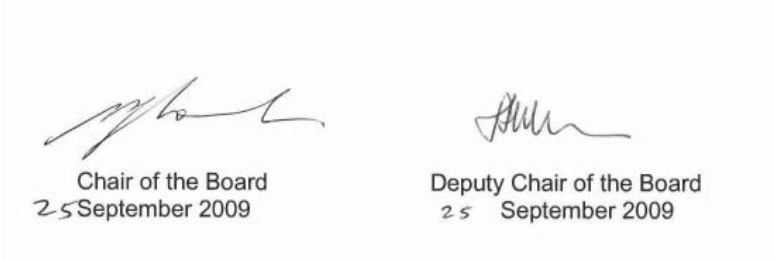
As provided for in the Anglo-Australian Telescope Agreement, the accounts, records and financial transactions of the Board are audited by the Australian Auditor-General. The form of the Board's financial statements for the year ended 30 June 2009 is in accord with orders made by the Finance Minister under the Commonwealth Authorities and Companies Act 1997.

Statement by the members of the Board

In our opinion, the attached financial statements for the year ended 30 June 2009 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.

In our opinion, at the date of this statement, there are reasonable grounds to believe that the Anglo-Australian Telescope Board will be able to pay its debts as and when they become due and payable.

This statement is made in accordance with a resolution of the Board.



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 2009, which comprise: a Statement by the Members of the Board; Income Statement; Balance Sheet; Statement of Changes in Equity; Cash Flow Statement; Schedule of Commitments; Schedule of Contingencies; and Notes to and forming part of the Financial Statements, including a Summary of significant accounting policies.

The Responsibility of the Board for the Financial Statements

The members of the Board are 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,* and 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 and the reasonableness of accounting estimates made by the members of the Board, as well as evaluating the overall presentation of the financial statements.

PO Box A456 Sydney South NSW 1235
130 Elizabeth Street
SYDNEY NSW
Phone (02) 9367 7100 Fax (02) 9367 7102

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, in accordance with the Finance Minister's Orders and Australian Accounting Standards of the financial position of the Anglo-Australian Telescope Board as at 30 June 2009, 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 Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997*.

Australian National Audit Office

P Hinchey
Senior Director
Delegate of the Auditor-General

Sydney
25 September 2009

ANGLO-AUSTRALIAN TELESCOPE BOARD
INCOME STATEMENT
for the year ended 30 June 2009

	Notes	**2009**	2008
Income		**$'000**	$'000
Revenue			
Revenue from Australian Government	1.4, 2	**5,546**	4,810
Revenue from UK Government	1.4, 2	**-**	1,623
Goods and services	3A	**9,583**	6,617
Other	3B	**1,256**	694
Interest	13B	**211**	367
Total Revenue		**16,596**	14,111
Gains from audit services provided free of charge	12	**36**	34
Total Income		**16,632**	14,145
Expenses			
Employees	4A	**7,274**	6,649
Suppliers	4B	**5,854**	5,120
Depreciation	4C	**2,998**	3,076
Other expenses	12	**36**	34
Total Expenses		**16,162**	14,879
Operating result		**470**	(734)

ANGLO-AUSTRALIAN TELESCOPE BOARD
Balance Sheet
as at 30 June 2009

	Notes	2009	2008
ASSETS		**$'000**	$'000
Financial assets			
Cash and cash equivalents	5A	**3,988**	5,299
Receivables	5B	**522**	536
Total financial assets		**4,510**	5,835
Non-Financial assets			
Land and buildings	6A, 6C	**19,050**	20,168
Infrastructure, plant and equipment	6B, 6C	**21,126**	22,975
Other non-financial assets	6D	**1,835**	883
Total non-financial assets		**42,011**	44,026
TOTAL ASSETS		**46,521**	49,861
LIABILITIES			
Payables			
Suppliers	7A	**357**	239
Other payables	7B	**-**	4,351
Total payables		**357**	4,590
Provisions			
Employee provisions	8A	**2,211**	1,788
TOTAL LIABILITIES		**2,568**	6,378
NET ASSETS		**43,953**	43,483
EQUITY			
Reserves		**40,303**	40,303
Retained surpluses		**3,650**	3,180
TOTAL EQUITY		**43,953**	43,483
Current assets		**6,345**	6,718
Non-current assets		**40,176**	43,143
Current liabilities		**2,335**	5,733
Non-current liabilities		**233**	645

ANGLO-AUSTRALIAN TELESCOPE BOARD
STATEMENT OF CASH FLOWS
for the year ended 30 June 2009

	Notes	2009	2008
OPERATING ACTIVITIES		**$'000**	$'000
Cash received			
Goods and services		**6,767**	3,464
Contribution - Australian Government		**5,551**	7,829
Contribution - UK Government		**-**	1,092
Interest		**228**	383
Other		**761**	155
Total cash received		**13,307**	12,923
Cash Used			
Employees		**6,338**	6,848
Suppliers		**7,819**	6,626
Net GST paid		**425**	507
Total cash used		**14,582**	13,981
Net cash (used by) operating activities	9	**(1,275)**	(1,058)
INVESTING ACTIVITIES			
Cash used			
Purchase of property, plant and equipment		**36**	92
Total cash used		**36**	92
Net cash (used by) investing activities		**(36)**	(92)
Net (decrease) in cash held		**(1,311)**	(1,150)
Cash at beginning of reporting period		**5,299**	6,449
Cash at end of reporting period	5A	**3,988**	5,299

ANGLO-AUSTRALIAN TELESCOPE BOARD

STATEMENT OF CHANGES IN EQUITY

for the year ended 30 June 2009

	Retained surpluses		Asset Revaluation Reserve		Total Equity	
	2009	2008	**2009**	2008	**2009**	2008
	$'000	$'000	**$'000**	$'000	**$'000**	$'000
Opening Balance	**3,180**	3,914	**40,303**	40,303	**43,483**	44,217
Income and Expense						
Net Operating result	**470**	(734)	**-**	-	**470**	(734)
Closing balance at 30 June	**3,650**	3,180	**40,303**	40,303	**43,953**	43,483

ANGLO-AUSTRALIAN TELESCOPE BOARD

SCHEDULE OF COMMITMENTS

for the year ended 30 June 2009

	2009	2008
	$'000	$'000
By Type and Maturity		
Operating Leases		
One year or less (leased motor vehicles)	**93**	90
From one to two years (leased motor vehicles)	**22**	11
GST receivable	**(144)**	(20)
Total Commitments	**(29)**	81

ANGLO-AUSTRALIAN TELESCOPE BOARD

SCHEDULE OF CONTINGENCIES

as at 30 June 2009

There were no contingencies to be disclosed for the year ended 30 June 2009 (2007/08: Nil)

NOTE 1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

1.1 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 statements have been prepared in accordance with:

- A Finance Minister's Orders (FMOs) being the *Commonwealth Authorities and Companies Orders (Financial Statements for reporting periods ending on or after 1 July 2008);* and
- Australian Accounting Standards and interpretations issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The financial report has been prepared on an accrual basis and is in accordance with the historical cost convention, except for certain assets and liabilities which, as noted, are 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 report is presented in Australian dollars and values are rounded to the nearest thousand dollars unless disclosure of the full amount is specifically required.

Unless alternative treatment is specifically required by an accounting standard, assets and liabilities are recognised in the Balance Sheet when and only when it is probable that future economic benefits will flow 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 unrealised are reported in the Schedule of Commitments and the Schedule of Contingencies.

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

1.2 Significant Accounting Judgments and Estimates

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

"The fair value of land and buildings has been taken to be the market value of similar properties as determined by an independent valuer. In some instances, Anglo-Australian Observatory 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.

1.3 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.

Future Australian Accounting Standard requirements

New standards, amendments to standards, and interpretations that are applicable to future periods have been issued by the Australian Accounting Standards Board. It is estimated that adopting these pronouncements, when effective, will have no material impact on future reporting periods.

1.4 Revenue

The Government of Australia provides revenue to the AATB via a parliamentary appropriation to the Department of Innovation, Industry, Science and Research (DIISR). United Kingdom (UK) funds are 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.

1.5 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.

The UKST is owned by the STFC and operated by the AATB. The UK Government through its agencies has 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.

(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.

1.6 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.

1.7 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.

1.8 Cash

Cash means notes and coins held and any deposits held at call with a bank or financial institution. Cash is recognised at its nominal amount.

1.9 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.

1.10 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.

1.11 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 2009, the AATB held no surplus assets. (30 June 2008: $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	***2009***	***2008***
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.

1.12 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.

1.13 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.

1.14 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 1.5 relating to use of land.

1.15 Comparative Figures

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

NOTE 2. ECONOMIC DEPENDENCY

The Board was established by the *Anglo-Australian Telescope Agreement Act 1970* and operates 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 has indicated its intention to withdraw from the Agreement with effect from 1 July 2010. Arrangements to give effect to this withdrawal and related matters came

into effect in the form of a treaty amendment. This notice period allows for a phased withdrawal by the UK Government and sufficient time for the Australian Government to plan for the future of the AAO.

The Australian Government, as part of its May 2009 Budget announcements for 2009-10, has agreed to taking over the AAO as a fully Australia-owned entity from July 2010 and has agreed to meet its ongoing operational costs. This is in line with an Australian Government review in 2006 which recommended that the AAT operate until at least 2015, 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 is to become part of the Department of Innovation, Industry, Science and Research (DIISR) and is in discussion with DIISR on the details of the transition and governance arrangements.

The Australian astronomy community included, as a priority in its Decadal Plan 2006-2015, the AAO in its funding bid to the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS). NCRIS grants for the AAO were made for a new instrument for the AAT, and for refurbishment of the AAT and related infrastructure.

The AATB also attempts to increase its external revenue through its instrumentation program.

NOTE 3. OPERATING REVENUE	**2009**	2008
	$'000	$'000
3A Sales of goods & services		
Goods - external entities	**3,387**	2,390
Services - external entities	**6,196**	4,227
Total sales of goods and services	**9,583**	6,617
3B Other Revenue		
Grants revenue including fellowships	**1,205**	536
Travel recovery/reimbursement	**11**	-
All other	**40**	158
Total other revenue	**1,256**	694

NOTE 4. OPERATING EXPENSES	**2009**	2008
	$'000	$'000
4A Employees		
Salaries and wages	**5,669**	5,140
Superannuation	**872**	812
Leave	**592**	520
Other employee benefits	**141**	177
Total employee benefits expenses	**7,274**	6,649
4B Suppliers		
Goods from external entities	**3,269**	3,608
Services from external entities	**2,153**	1,030
Motor vehicle lease costs	**118**	125
Supply of goods and services: external projects	**277**	321
Workers Compensation Insurance premiums	**37**	36
Total suppliers expenses	**5,854**	5,120
4C Depreciation and amortisation		
Buildings and Domes	**1,118**	1,118
Telescopes	**805**	805
Instruments	**859**	938
Plant & Equipment	**216**	215
Total Depreciation and amortisation	**2,998**	3,076

NOTE 5. FINANCIAL ASSETS	**2009**	2008
	$'000	$'000
5A Cash		
Cash at bank and on hand	**3,988**	5,299
5B Receivables		
Grants and projects	**378**	516
GST receivable	**144**	20
Total	**522**	536
Current	**144**	42
Overdue by:		
30-60 days	**126**	142
More than 60 days	**252**	352
Total Receivable (Gross)	**522**	536
Credit Terms are Net 30 days		

NOTE 6. NON-FINANCIAL ASSETS

	2009	2008
	$'000	$'000
6A Land and Buildings		
Leasehold Land - at fair value	**2,950**	2,950
	2,950	2,950
Buildings on leasehold land - at fair value	**55,897**	55,897
Less accumulated depreciation	**(39,797)**	(38,679)
	16,100	17,218
Total land and buildings	**19,050**	20,168
6B Infrastructure, Plant & Equipment		
Telescope and ancillary – at fair value	**40,275**	40,275
Less accumulated depreciation	**(27,795)**	(26,989)
	12,480	13,286
Telescope Instrumentation - at fair value	**19,591**	19,591
Less accumulated depreciation	**(11,875)**	(11,016)
	7,716	8,575
Other Plant and Equipment - at fair value	**3,819**	3,789
Less accumulated depreciation	**(2,889)**	(2,675)
	930	1,114
Total Infrastructure, Plant & Equipment (non-current)	**21,126**	22,975

Note 6C

TABLE A - Reconcilliation of the opening and closing balances of Property, Infrastructure, Plant and Equipment

Item	Land	Buildings	Infrastructure Plant & equipment	Total
	$'000	$'000	$'000	$'000
as at 1 July 2008				
Gross book value	**2,950**	**55,897**	**63,655**	**122,502**
Less: Accumulated depreciation/amortisation		**(38,679)**	**(40,680)**	**(79,359)**
Opening net book value	**2,950**	**17,218**	**22,975**	**43,143**
Additions		**-**	**36**	**36**
Disposals		**-**	**-**	**-**
Depreciation		**(1,118)**	**(1,880)**	**(2,998)**
as at 30 June 2009				
Gross book value	**2,950**	**55,897**	**63,685**	**122,532**
Less: Accumulated depreciation/amortisation	**-**	**(39,797)**	**(42,559)**	**(82,356)**
Closing net book value	**2,950**	**16,100**	**21,126**	**40,176**
as at 1 July 2007				
Gross book value	2,950	55,897	63,564	122,411
Less: Accumulated depreciation/amortisation	-	(37,561)	(38,722)	(76,283)
Opening net book value	2,950	18,336	24,842	46,128
Additions	-	-	92	92
Disposals	-	-	-	-
Depreciation	-	(1,118)	(1,958)	(3,076)
as at 30 June 2008				
Gross book value	2,950	55,897	63,656	122,503
Less: Accumulated depreciation/amortisation	-	(38,679)	(40,680)	(79,359)
Closing net book value	2,950	17,218	22,975	43,143

6D Other non-financial assets

	2009	2008
	$'000	$'000
Prepayments	**219**	129
Work in progress	**1,616**	754
Total other non-financial assets	**1,835**	883

NOTE 7. PAYABLES

7A Suppliers

Trade creditors (current)	357	239

7B Other

Non-trade creditors	-	2
MNRF - Magellan Fellows	-	642
AAL - HERMES Project	-	1,020
ARC - WFMOS 'A'	-	250
AAL - AAT Refurbishment program	-	500
Other project payments in advance	-	1,437
Remedial Works program	-	500
Total other	-	4,351

NOTE 8. PROVISIONS

	2009	2008
	$'000	$'000
8A Employee Provisions		
Salaries and wages	**194**	69
Leave	**2,017**	1,719
Aggregate employee benefits liability and related costs	**2,211**	1,788
Current	**1,978**	1,464
Non-current	**233**	324
Aggregate employee benefits liability and related costs	**2,211**	1,788

NOTE 9. CASH FLOW RECONCILIATION

	2,009	2008
	$'000	$'000
Reconciliation of Income Statement operating result to Statement of Cash Flows		
Cash at year end per Statement of Cash Flows	**3,988**	5,299
Balance Sheet items comprising above cash:		
Financial Assets - Cash and cash equivalents	**3,988**	5,299
Reconciliation of operating result to net cash from operating activities:		
Operating Result (deficit)	**470**	(734)
Depreciation and amortisation	**2,998**	3,076
Gain audit resources free of charge	**(36)**	(34)
(Increase)/decrease in receivables	**14**	96
(Increase)/decrease in prepayments	**(952)**	(800)
Increase/(decrease))in liabilities to employees	**259**	(405)
Increase/(decrease) in supplier payables	**118**	(141)
Increase/(decrease) in other payables	**(4,146)**	(2,116)
Net cash from / (used by) operating activities	**(1,275)**	(1,058)

NOTE 10. RELATED PARTY DISCLOSURES AND REMUNERATION OF DIRECTORS

Members of the Board at 30 June 2009 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 Board of Directors.

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

Professor Gaensler is a member of the Steering Committee of the CSIRO's Australia Telescope National Facility.

NOTE 11. EXECUTIVE REMUNERATION

	2009	2008
	$	$
The aggregate amount of executive remuneration is	**983,614**	1,120,537

The number of senior executives who received or were due to receive total remuneration of $130,000 or more		
$130,000-144,999	**3**	2
$145,000-159,999	**-**	2
$160,000-174,999	**3**	2
$190,000-204,999	**-**	-
$205,000-219,999	**1**	1
Total	**7**	7

NOTE 12. REMUNERATION OF AUDITORS

	2009	2008
	$	$
Fair value of audit services provided by the Auditor-General for the auditing of the financial statements for the reporting period.		
	36,000	34,000

Due to a change in the ANAO fee charging policy in 2008, resources are provided free of charge.

Services were also provided by the Auditor-General during the year in validating expenditure related to the AATB participation in the European Opticon programme.

NOTE 13. FINANCIAL INSTRUMENTS

13A Categories of financial instruments	**2009**	2008
	$'000	$'000
Financial Assets		
Loans and receivables financial assets		
Cash at bank	**3,934**	5,288
Cash on hand	**54**	11
Receivables	**522**	536
Carrying amount of financial assets	**4,510**	5,835
Financial Liabilities		
Other Financial Liabilities		
Suppliers	**357**	78
Other	**-**	4,510
Carrying amount of financial liabilities	**357**	4,588

13B Net income and expense from financial assets

Loans and receivables		
Interest revenue	**211**	367
Net gain/(loss) loans and receivables	**211**	367

13C Net income and expense from financial liabilities

There is no net income or expense from financial liabilities not at fair value through profit or loss in the year ending 30 June 2009.

13D Fee income and expense

There is no fee income or expense arising from financial instruments in the year ending 30 June 2009.

13E Fair value of financial instruments

FINANCIAL ASSETS	**Carrying amount 2009 $'000**	**Fair value 2009 $'000**	Carrying amount 2008 $'000	Fair value 2008 $'000
Cash at bank	**3,934**	**3,934**	5,288	5,288
Cash on hand	**54**	**54**	11	11
Receivables for goods and services	**522**	**522**	536	536
Total	**4,510**	**4,510**	5,835	5,835
FINANCIAL LIABILITIES				
Suppliers	**357**	**357**	78	78
Other	**-**	**-**	4,510	4,510
Total	**357**	**357**	4,588	4,588

13F Credit risk

The AATB is exposed to minimal credit risk as the majority of amounts owed is from the Australian Taxation Office in the form of a GST refund. The maximum exposure to credit risk is the risk that arises from potential default by a debtor. This amount is equal to the total amount of trade receivables (2009: $378,000 and 2008: $516,000).

The AATB manages its credit risk by undertaking, where required, background and credit checks prior to allowing a debtor relationship. In addition, the AATB has policies and procedures for employee debt recovery techniques if required.

13G Liquidity risk

The AATB's financial liabilities are payables and employee provisions such as annual and long service leave. The exposure to liquidity risk is based on the notion that the AATB could possibly encounter difficulty in meeting its obligations associated with financial liabilities. This is highly unlikely due to appropriation funding and mechanisms available to the AATB as well as internal policies and procedures in place to ensure there are appropriate resources to meet financial obligations.

13H Market risk

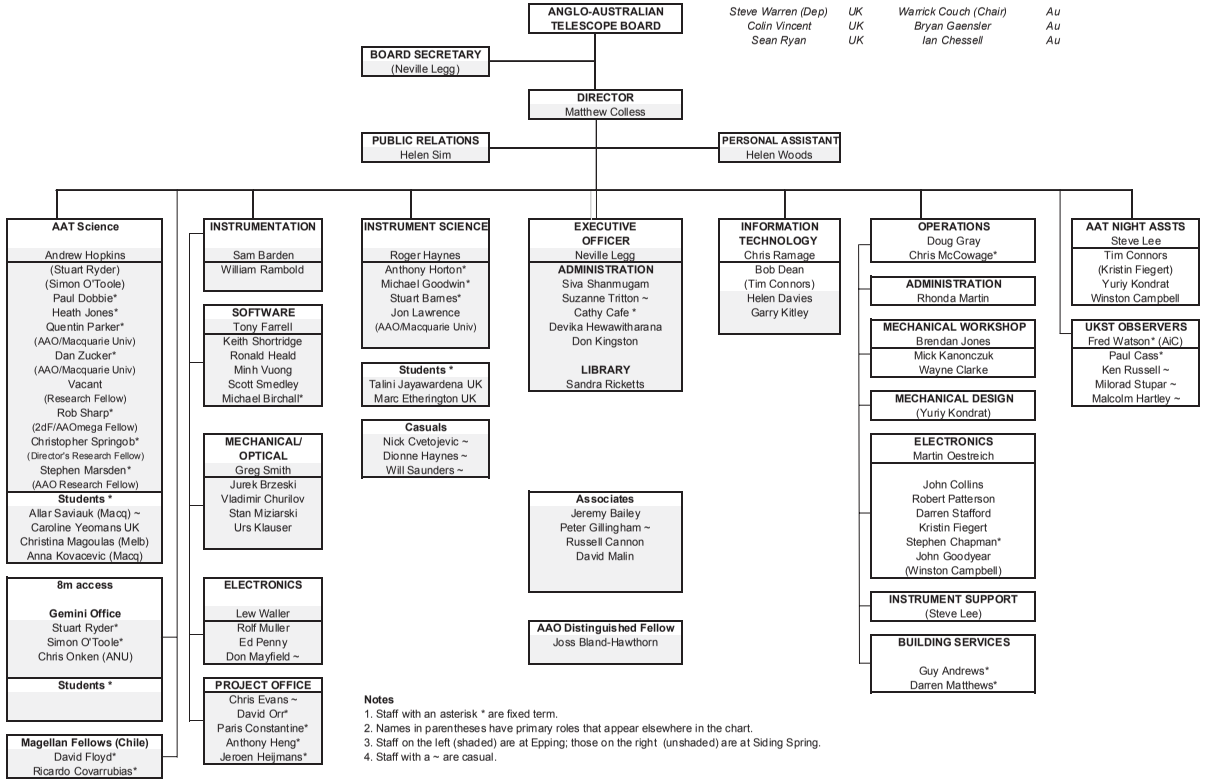
Market risk is defined as "the risk that the fair value of future cash flows of a financial instrument will fluctuate because of changes in market prices" and includes interest rate risk, currency risk and other price risk. The AATB is not exposed to any form of material market risk on financial assets or liabilities.

Appendix B
Staff

Staff at 30 June 2009

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	R Haynes, PhD
Operations Manager	D Gray
Astronomer-in-Charge	F G Watson, PhD
Head of Information Technology	C Ramage, MEngSc
Astronomy	P Dobbie, PhD; D H Jones, PhD; S Marsden, PhD; Q A Parker, PhD; R Sharp, PhD; C Springob, PhD; D Zucker, PhD
AusGO	S J O'Toole, PhD
Instrument Science	S Barnes, PhD; M Goodwin, PhD; J Lawrence, PhD; A J Horton, PhD
Magellan Fellows	R Covarrubias, PhD; D Floyd, PhD
Project Office	P Constantine, MIEAust CPEng; C J Evans, MIEAust CPEng; JAC Heijmans, MSc; A Heng; D Orr, BE, BSc; W Rambold, DipIT
Administration	C Cafe; D Hewawitharana; D R Kingston, CPA; R L Martin; S Shanmugam, B Comm; S Tritton, Ad Cert HR; H M Woods, MLitt
Library	S D Ricketts, BSc
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: R G Dean; G J Kitley
Electronics Group	S Chapman; J A Collins, DipEE; J Goodyear; R Muller; R G Patterson;
Optical and Mechanical	E J Penny; D J Stafford; L G Waller, BE
Telescope Operations and Maintenance	J K Brzeski, BE; V Churilov, MSc; M M Kanonczuk; U Klauser; S Miziarski, DipME; G A Smith, BE, BSc UKST: C J P Cass; M Hartley, BSc; K S Russell; M Stupar, PhD; AAT: W Campbell; W T Clarke; T Connors, Sc(Hons); K Fiegert; B Jones; Y Kondrat; S Lee
Public Relations	H Sim, MSciSoc
Building Services	G Andrews; D Matthews
AAO Associates	J A Bailey, PhD; J Bland-Hawthorn, PhD; R D Cannon PhD; P R Gillingham, BE, DSc; D F Malin, DSc; W Orchiston, PhD.

Anglo-Australian Observatory
Organisation Chart 30 June 2009



Notes
1. Staff with an asterisk * are fixed term.
2. Names in parentheses have primary roles that appear elsewhere in the chart.
3. Staff on the left (shaded) are at Epping; those on the right (unshaded) are at Siding Spring.
4. Staff with a ~ are casual.

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 nstrumentation 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 enerality 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 2008 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 for an indefinite period

During the year, the following Board member's term expired:

Professor Brian Schmidt, ARC Federation Fellow, Research School of Astronomy and Astrophysics, Australian National University; appointed 1 January 2005 till 31 December 2008.

C. Board meeting attendance

The AATB met five times in 2008-09.

Board Member	No of meetings attended
Professor W Couch (Chair)	5/5
Professow S Warren (Deputy chair)	4/5
Dr I Chessell	4/5
Professor S Ryan	4/5
Professor B Gaensler	3/3
Dr C Vincent	3/5**
Professor B Schmidt	1/2

**Dr Vincent was granted leave of absence for two meetings due to potential and declared conflict of interest

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 2008–09. 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. Divisional 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 intereollaborative research;
- peer review;
- research misconduct
- 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 AATAC 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.

At 30 June 2009, membership of AATAC was:

Dr S Croom (Sydney), Chair

Dr Y Unruh (ICL), Deputy Chair

Professor K Glazebrook (Swinburne)

Dr L Kiss (Sydney)

Dr R de Grijs (Sheffield)

Professor C Tinney (UNSW)

Dr S Wyithe (Melbourne)

The AAO Users' Committee

The AAO Users' Committee (AAOUC) consists of six members: three from Australia and three external members, two of these being from the UK and one international member.

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 2009 the six AAOUC members were:

Dr M Brown (Monash) (Chair)

Dr H Jones (Deputy Chair) (Herts)

Dr T Jarrett (Caltech)

Dr B Carter (USQ)

Dr J Bryant (Sydney)

Ms E Wisnioski (Swinburne)

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
AAOmicron	Planned new instrument 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	AdaptiveOptics
ARC	Australian Research Council
ASA	Astronomical Society of Australia
ATNF	Australia Telescope National Facility
AURA	Association of Universities for Research in Astronomy
CCD	Charge coupled device
CSIRO	Commonwealth Scientific and Industrial Research Organisation, Australia
CUDOS	Centre for Ultrahigh Bandwidth Devices for Optical Systems
DAZLE	Infrared narrowband imager
DIISR	Department of Innovation, Industry Science and Research
Durham	University of Durham, UK
Echidna	A fibre positioner built for National Astronomical Observatory of Japan by the AAO, for use on the Subaru Telescope
EEO	Equal Employment Opportunity
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
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
kpc	kiloparsecs
LIEF	Linkage, Infrastructure, Equipment and Facilities, ARC grant program
MMF	Multimode fibre
MOS	Multi Object Spectrograph
NSF	National Science Foundation, USA
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
PILOT	Proposed 2.4-metre telescope in Antarctica
PSS	Public Sector Superannuation Scheme
QSO	Quasi-stellar object
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
SNR	Supernova remnants
Spectrograph	A device for disbursing light into a spectrum so that the intensity at each wavelength can be recorded by a detector
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
TCS	Telescope Control System
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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