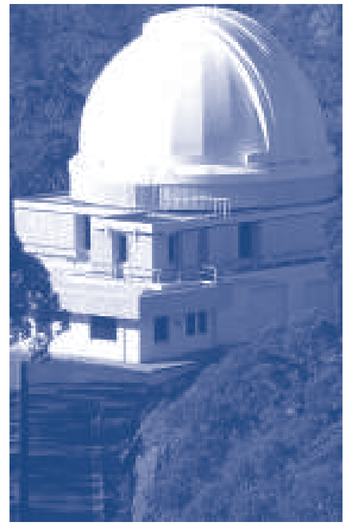
4 Performance



Telescope operations

Strategies

The AAO is committed to listening to the astronomical community, especially its user community, to assess and anticipate its needs. There are several avenues available for this. Principally, the time assignment committees, the AAO Users' Committee and the AAT Board (all representatives of the wider astronomical community in their own right) have a strong influence on the strategic directions of the AAO.

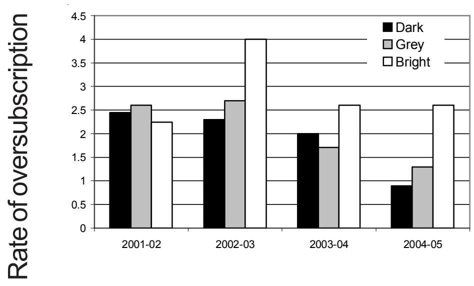
The AAO strives to stay abreast of world best practice, and AAO staff are encouraged to observe at or visit major telescopes overseas. Participation in conferences, seminars and colloquia are also important ways of staying in touch.

Another vital strategy is to ensure that the needs of users are met. This is achieved through maintaining and consolidating existing instrumentation and associated software; providing excellent support in setting up the instruments, operating the telescope, and observing; soliciting users' comments; continuing to develop first-rate, innovative new instrumentation; and achieving ever-greater efficiency in operating the telescopes.

AAT organisational statistics

It is the high standard of AAO facilities and the continuing instrumentation development program that have traditionally ensured that observing time on the AAT is over-subscribed. Figure 4.1 shows the oversubscription rate for the AAT over the past four years, sorted by lunar phase requirement.

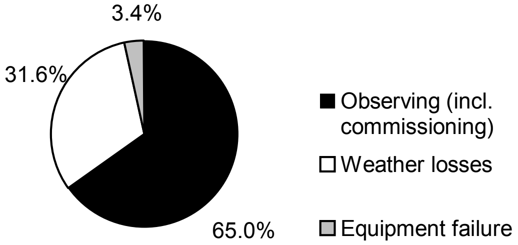
Figure 4.1 Oversubscription rates for the AAT



It will be seen that for the first time, the telescope is undersubscribed in dark time. This has a number of probable causes, the most significant of which is the likelihood that users are deferring their multi-object spectroscopy proposals until after the commissioning of AAOmega. The introduction of this new instrument is almost certain to introduce a significant spike in the oversubscription rate similar to that generated by IRIS2 when it was introduced during 2002–03 bright time.

AAT users come from a wide range of institutions in Australia, the UK, the USA and many other countries.

Figure 4.2 The use of observing time at the AAT in 2004-05



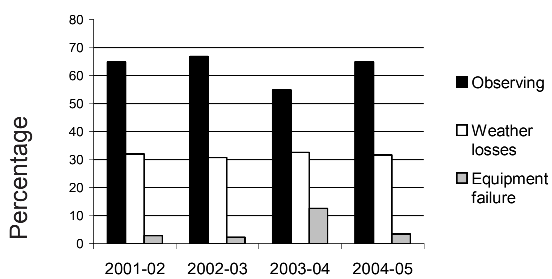
AAT performance indicators

Figure 4.2 shows the use of observing time during the period 1 July 2004 to 30 June 2005. A total of 3222 dark hours were available, and an additional 57 hours of commissioning time were used. The continuing trend of good weather conditions associated with the drought experienced in eastern Australia is evident in Figure 4.3, which compares the use of observing time over the past four years.

A critical metric of user satisfaction is the fraction of available observing time lost through equipment failure. It will be seen from Figure 4.3 that this has returned to typical levels following the time loss due to the catastrophic failure of a dome shutter drive shaft during 2003–04.

In fact, the reported level of 3.4% is still somewhat high, and exceeds the AAO's target level of 3%. Analysis of AAT fault statistics reveals that the major contributor was 2dF, which experienced recurring robotic problems with the optical fibre positioner. These problems occurred mostly during the second half of 2004, and were dramatically reduced from the beginning of 2005 when new field plates were fitted to the instrument in preparation for the AAOmega upgrades. The performance of 2dF since then has been very much improved.

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



User Feedback

All AAT and UK Schmidt Telescope observers are encouraged to complete the web-based feedback form, which asks how well the AAO has fulfilled its obligations under its Client Service Charter (see Appendix C). The responses are ranked in five steps ranging from well below (1) to well above (5) acceptable. Users are also asked to flag key items and to comment on any issues of concern.

During the period 1 July 2004 to 30 June 2005, 65% of users completed feedback forms for the AAT. This response is higher than average (50–60%) and considerably higher than last year's (52%), which was affected by the extended down period caused by the dome shutter failure. Users are actively encouraged to submit feedback forms at the end of their observing runs.

The average scores over the year are shown in Table 4.1, together with those for the previous two years. The statistical error on these mean grades is ~0.2. They show that the level of satisfaction is generally high, and fairly consistent over the three years.

The AAO sets a goal of a score of at least 3.5 in all categories. All performance areas have met that target in 2004–05. General Computing, previously a weak area in the reply categories, shows promising signs of responding to the strategic IT initiatives. Many of the feedback reports contain suggestions for improvements, most of which have been acted upon. Usually they involve small, instrument-specific changes to improve ease of observing. All comments, both positive and negative, are followed up through appropriate management channels and acknowledged.

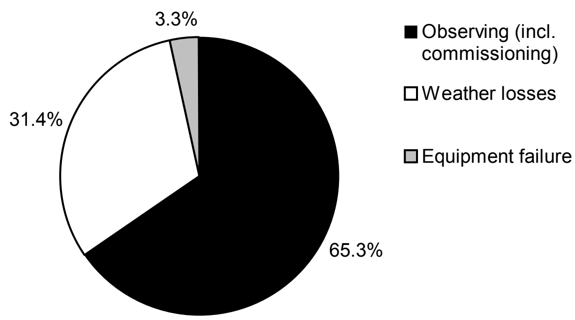
Table 4.1 User Feedback at the AAT

	2002–03	2003–04	2004–05
Night Assistant Support	4.7	4.7	4.8
Staff astronomer before	4.5	4.3	4.5
Staff astronomer during	4.6	4.5	4.6
Other technical support	4.3	4.1	4.2
Instrumentation & related software	3.8	3.7	4.0
General Computing	3.7	3.4	3.7
Working environment	3.8	3.9	3.9
Travel & Administrative support	4.4	4.1	4.0
Data reduction software	4.2	3.9	4.1
Instrument manuals	3.8	3.9	4.1
Library facilities	3.9	3.7	3.7
AAO WWW pages	3.9	4.0	4.1

UK Schmidt Telescope organisational statistics and performance indicators

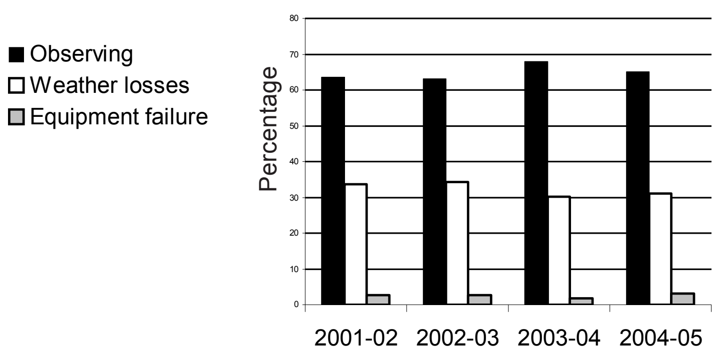
Figure 4.4 shows the use of UK Schmidt Telescope observing time during the period 1 July 2004 to 30 June 2005.

Figure 4.4 The use of observing time at the UKST in 2004-05



In Figure 4.5, the use of observing time over the past four years is shown, revealing once again the effect of continuing good weather.

Figure 4.5 The use of observing time at the UKST



System-loss statistics were slightly higher than usual in 2004–05 because of the loss of two complete nights during the period, one due to the failure of the 6dF guide-star camera (after 16 years of faultless service, initially with FLAIR II), and the other to the failure of an hour-angle drive amplifier. The 6dF instrument, now four years old, has attained a very stable operating mode with only ongoing fibre breakages presenting problems of reduced efficiency.

The 6dF program has occupied all UK Schmidt Telescope observing time since the beginning of 2003, and Table 4.2 summarises the data obtained for the principal observing campaigns since 6dF operations started.

Table 4.2 Total 6dF observations

	2001-02	2002-03	2003-04	2004-05
6dFGS fields	261	351	392	383
RAVE fields	–	47	320	407
Non-survey fields	124	162	118	112
Total fields	385	560	830	902
Total exposure	713	1078	1219	1288

6dF is an extremely labour-intensive instrument in use, involving a high level of physical involvement by the (solo) observer. The continuing improvement in observing efficiency revealed in Table 4.2 reflects outstanding performance on the part of UK Schmidt Telescope observers.

The 6dF Galaxy Survey (6dFGS) is now complete at right ascensions less than ~21h, and the remaining fields will be completed during Semester 05B. The fraction of scheduled observing time devoted to the 6dFGS was approximately 75%, the target recommended by the time allocation committees. A second data-release took place in April 2005.

Non-survey programs were also undertaken for the following principal investigators: Coates (UCL), Drew (Imperial), Fleenor (NC), Littlefair (Sheffield), Parker (Macquarie), Peyaud (Macquarie) and Vaughan (Macquarie).

Since 11 April 2003, seven unscheduled bright-of-moon nights per month have been allocated to the international RAVE survey of stellar radial velocities and metallicities (RAVE = RAdial Velocity Experiment), which funded the time externally. By the end of Semester 05A, 774 RAVE fields (telescope pointings) had been carried out, and a total of 68,422 spectra amassed. From 1 August 2005, however, all time on the UK Schmidt Telescope is available for RAVE (specifically 25 nights per month, of which 20 are supported by AAO observers).

Research

Research and organisational statistics

There were 11 research astronomers on the staff of the AAO at 30 June 2005. Five of them, while spending about half of their time on Observatory duties such as supporting visiting astronomers, spend the rest of their time on research. Three are members of the Instrument Science group and spend the majority of their time on research activities related to new instrumentation technologies. The other three, including the Director, the Astronomer-in-Charge and a shared position with Macquarie University, have significant responsibilities not directly related to their own research. The full-time equivalent research effort is about four people. In addition, there are two externally funded visiting astronomers, and two emeritus astronomers.

The total number of AAT observing programs for the past five years is shown in Figure 4.6.

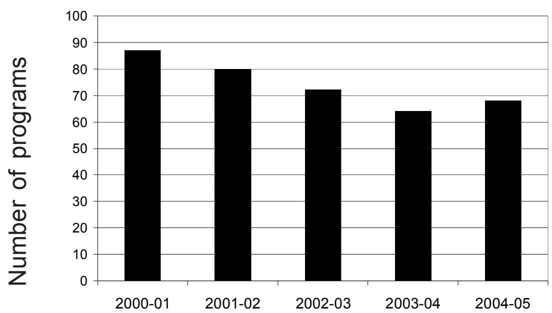
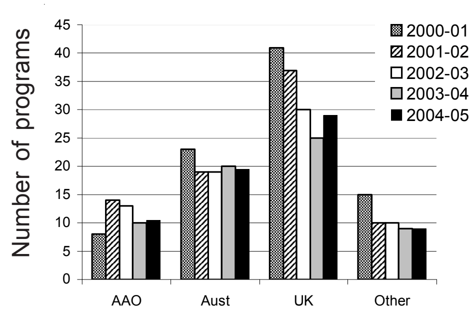


Figure 4.6 Total number of scheduled AAT observing programs. Note that long term proposals are counted for each semester they are scheduled

The long-term trend for a decreasing number of observing programs over the period is a consequence of policies to promote survey-style and longer-term programs at the AAT. Figure 4.7 shows the distribution of AAT observing programs by location of the Principal Investigator (P.I.).

Figure 4.7 Number of scheduled AAT observing programs by location of Principal Investigator



In Figure 4.8, the number of nights allocated at the AAT is distributed by the location of all the investigators in proportion. In both figures 4.8 and 4.9 we see that users from the U.K. continue to make active use of the telescope, although with a tendency to be the Principal Investigator less frequently. This may reflect the increasing use of the AAT for surveys, which are run by large consortia of astronomers. This also explains the large jump in percentage use by investigators from other countries, now the user group with the largest effective share of AAT time, despite the low numbers of programs with Principal Investigators from this group.

Figure 4.8 Percentage use of the AAT by location of all investigators

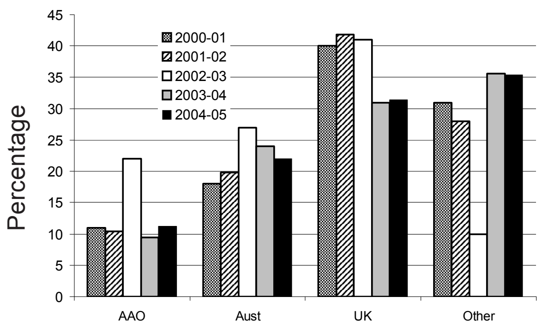
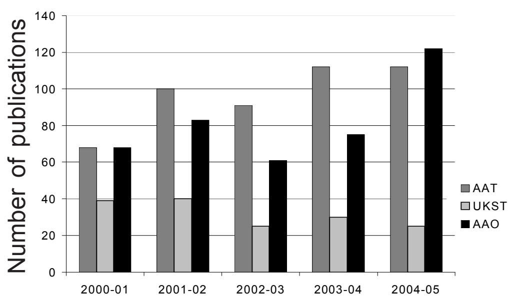


Figure 4.9 Total number of publications using AAT and UKST data, and AAO publications



This high level of international demand for the AAT in an increasingly international and competitive telescope “market” is seen as reflecting the Observatory’s strengths in innovation and instrumentation. Figure 4.9 shows the total numbers of research papers published in refereed journals and conference proceedings using data from the AAT and the UKST. Also shown are the total number of AAO papers, published by AAO staff, students and visitors. In total, 112 AAT data papers, 25 UKST data papers and 122 AAO papers were published. AAT publications in this year have matched the all-time high reached in 2003–2004. The results from the 2dF redshift surveys are largely responsible for this, with a shift this year to a stream of secondary investigations based on the survey data.

AAO staff consistently produce a large number of high–quality publications, demonstrating the strong links between AAO astronomers and the international community, as well as the strong AAO involvement in surveys carried out with the Observatory's telescopes.

The distribution of publications in refereed journals by location of the P.I. is shown in Figures 4.10 and 4.11 for papers using AAT data and UKST data (respectively). Papers making use of UKST survey data

Figure 4.10 Research papers published using AAT data by location of First Author

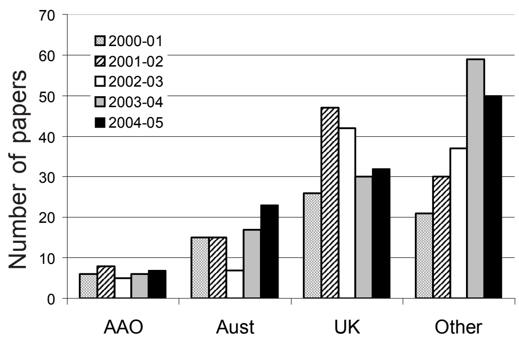
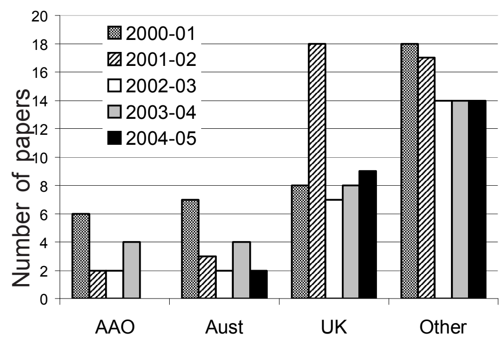


Figure 4.11 Research papers published using UK Schmidt data, by location of First Author.



only are not included. There is an increase in many areas and the AAT publications from other countries have continued strength due to secondary 2dF Survey papers. Figure 4.12 gives the number of AAO publications produced by staff, students and visitors, sorted by papers including AAT data, UKST data, and other papers. Publication numbers are strong in all areas, with particular growth in the 'Other' category boosted by large numbers of papers on new instrumentation technologies under development at the AAO. The trend to papers without AAT and UKST data continues but the number of AAT papers with AAO authors is also well up on previous years.

Figure 4.13 shows how well AAT observing programs are converted into scientific papers. To allow for the delay between observations and publications, the statistic given here is the number of publications in a given year divided by the number of proposals in the previous year. Typically between 0.7 and 1.0, this year sees an increase on the previous year's all-time high of 1.56 to 1.75 papers per program – another record. This figure reflects the impact of the move to survey observing programs, in the fact that the total number of observing programs has dropped, the longer time needed to complete and publish results from major surveys and the high rate of secondary research. Averaged over the past five years, an impressive rate of 1.26 papers per AAT observing program is being achieved.

Figure 4.12 AAO publications by AAO staff, students and visitors

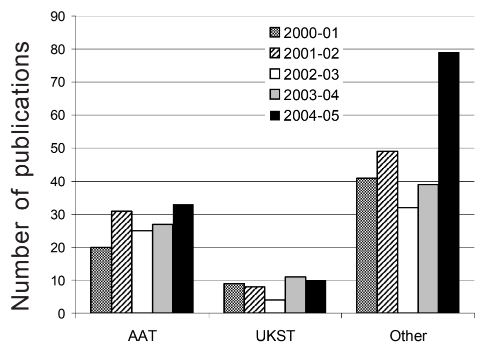
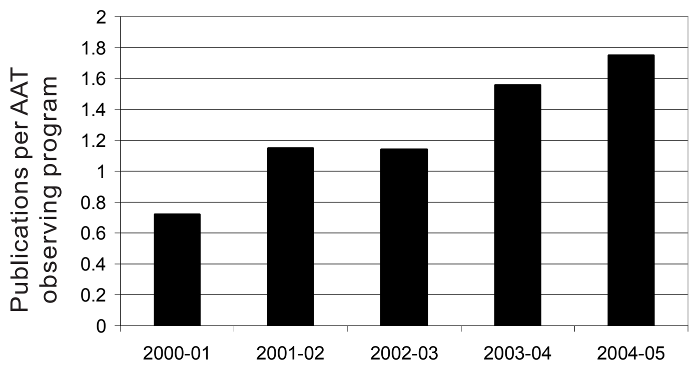


Figure 4.13 Publications per AAT observing program



Instrumentation

The AAO spends about 15 percent of its budget each year on new instruments and associated software and detectors. Table 4.3 summarises the use made of instruments on the AAT over the last few years.

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

Instrument	2002-03*	2003–04*	2004–05*
2dF	22.6	33.9	33.0
UCL coude echelle spectrographs (UCLES & UHRF)	29.7	23.9	31.3
Infrared imager/ spectrograph (IRIS2)	11.5	24.5	26.3
Wide field imager (WFI)	7.4	2.8	2.5
Taurus II & Taurus tunable filter (TTF)++	9.9	4.7	–
RGO spectrograph++	10.9	4.3	–
SPIRAL integral field spectrograph++	4.6	0	–
Instruments supplied by users	3.8	5.9	6.9

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

++*TTF, RGO and SPIRAL were decommissioned in 2003–04.*

Observing time on the AAT is now split almost equally between the use of the Two-degree Field (2dF) multi-object spectrograph; the high-resolution optical spectrographs UCLES and UHRF; and the near-infrared imager and spectrograph IRIS2. A small fraction of the time is used by visiting instruments (notably the French-built Semel Polarimeter used in conjunction with UCLES) and the Wide-Field Imager (WFI) CCD camera shared with the Australian National University. Tests were also carried out with a new high-speed

WATEC video camera, allowing the AAT to record extremely sharp images of planets including Mars and Jupiter at times of low atmospheric turbulence.

Nearly half of the observing time with the UCLES spectrograph is now devoted to the search for extrasolar planets, with the rest going

Denis Whittard (left) and Vlad Churilov installing the liquid nitrogen can for AAOmega's blue camera, (photo: Jurek Brzeski)

to studies of the chemical composition or vibrational modes ("asteroseismology") of nearby stars. The past year has seen the completion of major galaxy and quasar redshift surveys with 2dF, in anticipation of even more ambitious surveys to begin in the following year with the new high-performance AAOmega spectrograph. IRIS2 has been kept busy with work on everything from low-mass brown dwarf stars within a few light years of our Sun, to radio galaxies at high redshift.

While 2dF, WFI, UHRF, and IRIS2 have their own dedicated electronic detectors, UCLES users may choose between either the blue sensitive EEV2, or the red-sensitive MITLL3. Both these detectors are now in routine use with the new AAO-2 controllers and a fully-fledged graphical user interface. The science-grade infrared array detector in IRIS2 suffered a catastrophic failure during a warm-up/ cooldown process in May 2005. The manufacturer in the USA has agreed to replace this failed detector, and in the meantime an engineering-grade array is providing most of the functionality with only a slight loss in performance.

The coming year will see the introduction of the new general-purpose optical spectrograph AAOmega at the AAT, as well as the transition of the last remaining instruments to more modern control computers, as described in more detail in the following section.

Instrument Science

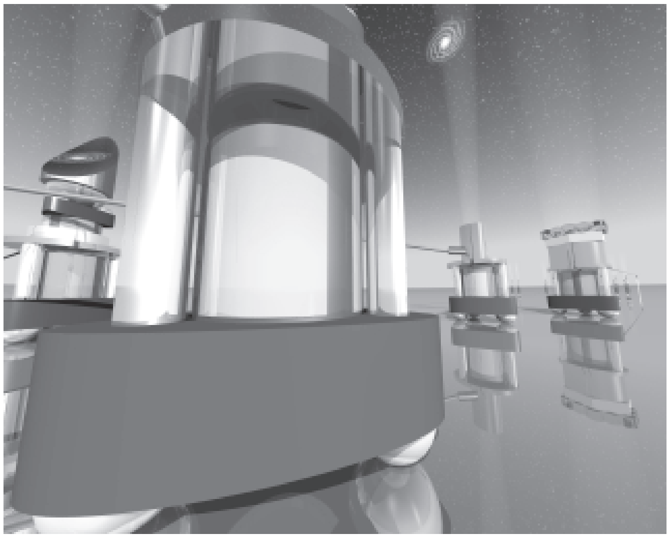
This has been a challenging year for the Instrument Science group. We have had to maintain our research and development against a backdrop of two staff members leaving the AAO (Bailey and Gillingham), and heavy involvement in major instrument developments, including AAOmega and FMOS, and major design studies (WFMOS). However, there have been notable successes in astrophotonics, the development of OH suppression technologies, autonomous robotic positioners (starbugs), and Antarctic technologies. The group was also involved in an industrial showcase and a highly successful series of presentations at the SPIE meeting (July 2004) in Glasgow, Scotland.

The group has continued to innovate and develop new spectrograph concepts and new uses for dispersion gratings. These include a double-pass grating for doubling the resolution of an existing volume-phase holographic grating, new designs for S- and P- phase optimized VPH gratings, and the commissioning of a “Dickson” VPH grating. We have also proposed the first instrument concept which allows for arbitrary formatting of a contiguous field, a device we call a honeycomb spectrograph. This device tiles the field with micro-IFUs which can be edge-butted on all sides.

We have continued to develop the starbug positioning technology, and prototyped a number of different bugs in both a temperate and cryogenic environment. We now envisage a wide range of uses for these bugs on 8m and extremely large telescopes, and are investigating wireless operation for locating and positioning. This work has been sponsored by an OPTICON FP6 grant in association with the Astronomy Technology Centre, Edinburgh.

We have continued our collaboration with the University of Durham on the development and investigation of astrophotonics, i.e. applications of photonics within astronomy. For the second year running, we were successful in attracting funds from the PPARC Innovative

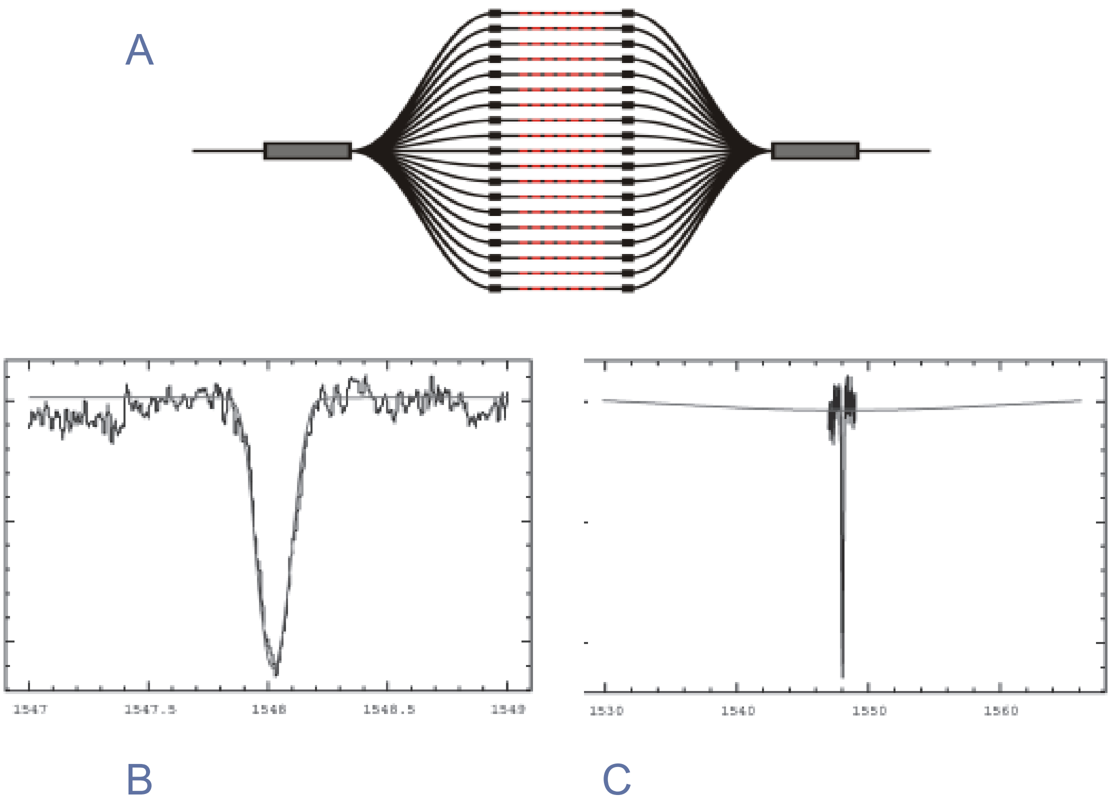
Research into robotic positioners (starbugs) aims, among other things, to develop positioners that are able to move autonomously across a magnetic focal plane (as envisaged in the diagram at right). Diagram: Andrew McGrath



Technology Scheme. We have identified optical fibres with improved blue performance, and these are to be utilized within AAOmega. We are currently investigating near- to mid-infrared fibres based on photonic crystal fibre technology, and fibre tapers for use within AAOmega.

This year brought us a step closer to achieving high performance OH suppression within an optical fibre. Last year, we demonstrated the potential of fibre Bragg gratings (FBGs) to knock out 36 OH emission lines in the H-band within a single mode fibre, work that was carried out in collaboration with Redfern Optical Components, Sydney. This year, in collaboration with the University of Bath, we recorded a major milestone by demonstrating the same principle within a multimode fibre, something that was thought to be impossible.

The group continues to pursue the development of Antarctic technologies. The University of NSW sponsored the AAO to investigate the use of photonic suppression to combat auroral emission, and to specify the design parameters of a proposed 2m telescope for Dome C. The group continues to be actively involved in telescope concepts for Antarctica.

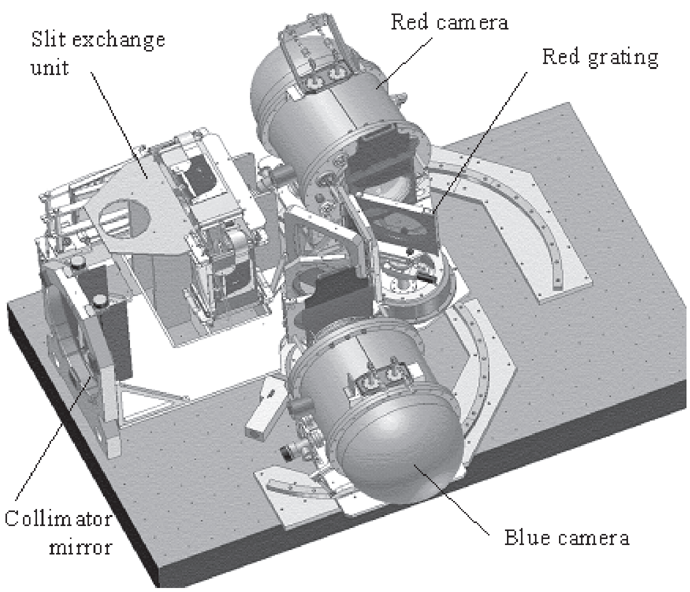


The first ever demonstration of a fibre Bragg grating in a multi–mode fibre. (A) The device used, a tapered multi–mode fibre (MMF) grating. The input multi–mode fibre (MMF; at left) is split into a number of single-mode fibres (SMFs; centre), each with identical fibre Bragg gratings imprinted on them. These SMFs are then merged back into the output MMF (at right). The couplings between the input and output MMFs and the SMFs with the fibre Bragg gratings is achieved via taper transitions. (B) The smooth curve is the notched response of one of the individual SMFs shown at A. The noisy curve is the measured response of the new device, and is essentially identical to the red curve within the notch (the noisy continuum structure is an artefact of the test equipment). (C) The noisy curve is the same as in B; the very broad smooth curve is the notched response of the same grating inserted into a MMF with the same aperture – the notch is broadened by a factor of 200 compared to B!

Current Instrumentation

AAOmega

The AAOmega project proposes to replace the two 2dF top–end–mounted fibre–fed spectrographs with a new bench mounted dual-beam spectrograph. Some upgrade work to the 2dF robotic fibre positioning system is also underway. The new spectrograph uses large format detectors, volume phase holographic gratings and will be able to carry out "red" and "blue" observation simultaneously, providing a facility that will enable much fainter and more detailed



Physical layout of AAOmega, showing the red camera in the high dispersion mode and the blue camera in low dispersion mode

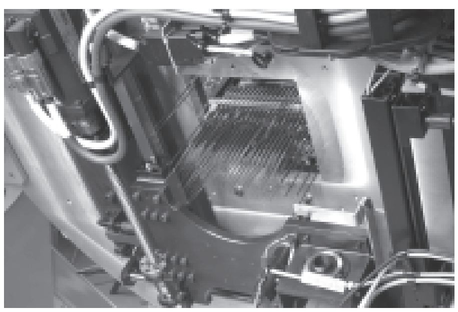
observations. The instrument is scheduled to be commissioned on the AAT at the end of calendar year 2005.

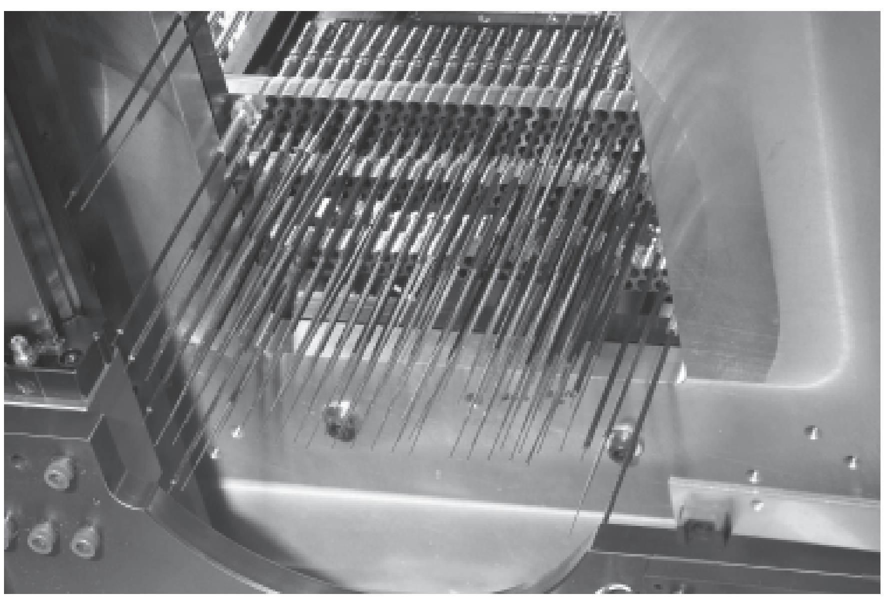
The AAOmega project underwent its final design review in the second half of 2004. The detailed design and fabrication proceeded very well with few problems. The instrument is currently under assembly and test.

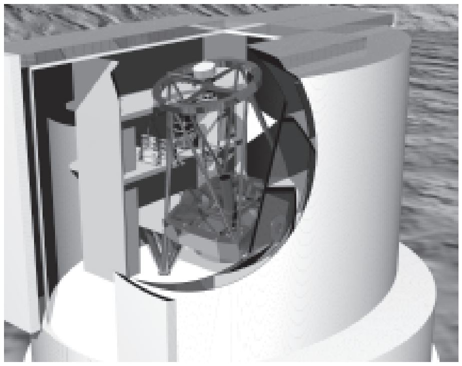
FMOS Echidna

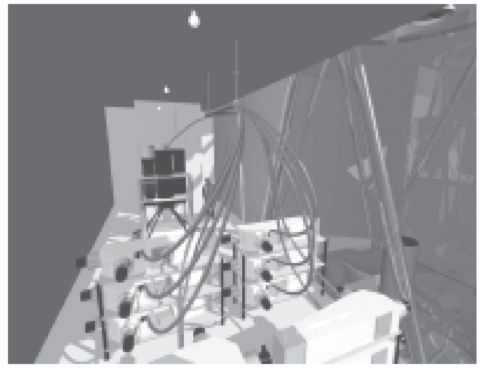
Echidna is a 400–fibre robotic positioning system for the Japanese Subaru telescope in Hawaii and is part of the FMOS system that will provide a highly–efficient near–infrared spectroscopic facility. The principle of operation for Echidna is different from 2dF, 6dF and OzPoz, in that all 400 fibres can be moved simultaneously to their required positions. The project is currently in the assembly and test stage. Delivery to Subaru should take place in the second quarter of 2006.

FMOS Echidna, a 400 fibre robotic positioning system for the Japanese Subaru telescope. Below right, Scott Smedley pictured with the Echidna unit. Below left, Echidna spines in the context of the instrument, and at the bottom close up of the spines that give the instrument its name, (photos: David James)









The figure at top left shows a view of the implementation of WFMOS on the Subaru telescope, with an Echidna style positioner located at the prime focus of the Subaru telescope. The fibre cable drapes off the telescope and enters a spectrograph chamber, shown top right. 1500 fibres feed into a set of high-dispersion spectrographs that will provide a resolving power of 40,000. An additional set of 3000 fibres feed into a bank of low-dispersion spectrographs for low-resolution surveys (diagrams: Andrew McGrath) Bottom. Members of the WFMOS team at the feasibility study review. Chris Evans, (AAO) Bob Nichol (Portsmouth) Sam Barden (AAO) and Arjun Dey (NOAO) are pictured here at the Gemini Observatory in Hilo (photo: Chris Evans).

WFMOS

The AAO led a collaboration, including the US National Optical Astronomy Observatory, Johns Hopkins University, University of Portsmouth, University of Oxford, University of Durham, and the Canadian Astronomical Data Centre, to examine the feasibility of a very wide field (1.5 degree), highly multiplexed (4500 fibers) multi-object spectrograph for the Gemini Observatory. The concept builds upon the Echidna technology. Two telescope platforms were investigated, Gemini and Subaru. The WFMOS feasibility study came to a close with a successful review in Hilo in March 2005. Gemini is now currently soliciting proposals for the next phase, a conceptual design study.

Optical Detector Controllers (ODC)

The ODC project to implement the AAO2 Detector Controllers is officially complete and a post–project review was held in May 2005. These controllers now operate all CCD and IR detectors at the AAT.

Telescope Control System (TCS) and Instrument Control and Integration (ICI)

The telescope control system (TCS) project is to implement a replacement of the original Interdata computer system. Although the current system is very reliable, the Interdata computer is obsolete and replacement parts are very difficult to find. The new system will implement a modern computer platform, but will retain the same functionality. The project had a successful design review nearly a year ago. Completion is expected to take place by mid-2007.

A related project (ICI) is also underway to replace the old instrument control systems. It is expected to be completed in 2006.

Dome Air Conditioning

The aim of the Dome Air Conditioning project has been to air condition the AAT Dome in order to sharpen the images obtainable at the telescope. This project is effectively complete and is currently keeping the telescope environment near the nightly temperature to improve the image quality delivered by the telescope. Records are being kept to track the effect on image quality.

SuperAAPS

The SuperAAPS project is an upgrade to the UCLES system to automate its operations in support of the long-term Anglo-Australian Planet Search observing program. The primary objectives are to:

- mount the iodine cell in the focal modifier wheel;
- mount a CCD camera behind the slit and feed with a 1% pick-off mirror to serve as an exposure meter;
- provide improved imaging functionality for acquisition of bright UCLES targets without human intervention; and
- integrate the above functionality with the new UCLES Instru ment Control System.

Starbugs

The starbugs project is a technology study that has been funded as part of the OPTICON program in Europe. Our effort is to look at the development of autonomous positioners that are able to configure themselves in the focal plane for multi-object spectroscopy with either fiber optics or relay optics. The study has recently completed the “Phase A” work package in which three prototype concepts were evaluated. Cryogenic performance was also attempted successfully.

Acknowledgements

MNRF: The MNRF program supporting Gemini provided additional funds that were required for the AAO to complete the WFMOS study.

Innovation Access Program: The research and development of Starbugs is proudly supported by the Innovation Access Program - International Science and Technology under the Australian Government innovation statement, Backing Australia’s Ability.

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, 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.

Table 4.4 Staff numbers by tenure

	Full-time FTE§	Part-time No.	Part-time FTE	Total FTE
FIXED TERM				
Director*	1	–	–	1
Research astronomers	5	–	–	5
Instrument scientists	–	–	–	–
Other fixed term	5	1	0.50	5.50
INDEFINITE				
Executive Officer*	1	–	–	1
Research astronomers	2	–	–	2
Instrument scientists	3	1	0.75	3.75
Other indefinite	45	2	1.40	46.40
Total staff	**62**	**4**	**2.65**	**64.65**

* *A direct Board appointment*
§ *Full Time Equivalent*

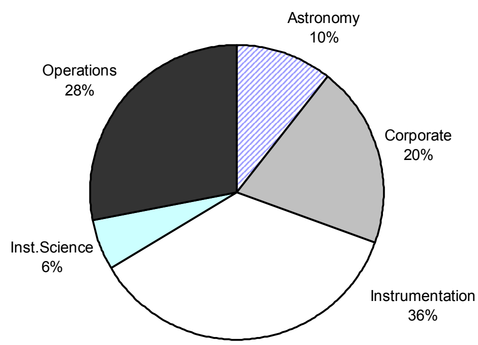
Staff by function

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 information technology, accounting, library and other support services.

Chart 4.15 shows staff by function



Employment arrangements

The AAO's terms and conditions of employment are set via a certified agreement, approved by the Australian Industrial Relations Commission, and the Anglo-Australian Telescope Board (Salaries and Conditions) Award 1999. The 2003-2005 agreement expired in April 2005 and was replaced by the Anglo-Australian Telescope Board Enterprise Agreement 2005-2007.

In accordance with the 2003 Agreement, negotiations on a new Agreement commenced within six months of the expiry of the Agreement. A Working Group consisting of staff elected delegates, the union (CPSU), and the Personnel and Executive Officers negotiated the new Agreement. The brief of the Working Group was to deliver to the Board an agreement that was well prepared, affordable, provided good outcomes for staff, and which had staff support. This was done and the staff vote was 98% in favour of the new agreement. The staff at the AAO are to be commended for their understanding of the AAO's financial position, the productivity gains made and their acceptance of the new Agreement.

In addition to developing a new agreement, the opportunity was taken to update some existing human resources policies as well as develop new ones.

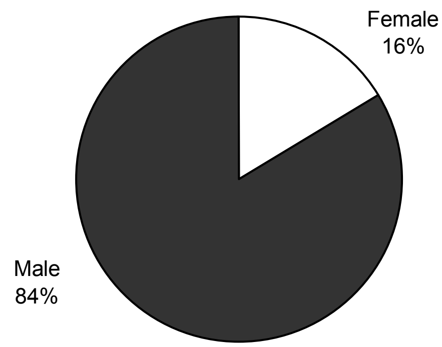


Chart 4.16 shows the relative numbers of male and female staff at the AAO

Equal Employment Opportunity (EEO)

The AATB is an equal employment opportunity employer and strongly supports workplace diversity. Chart 4.16 shows the ratio of males to females at the AAO and reflects the difficulty of attracting and retaining females in science.During the year the AAO also had 16 visiting students. Of this number 25% were female.

Occupational Health and Safety (OH&S)

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.

The OH&S plan for the year continued to raise awareness throughout the organisation with the specific focus for the year on emergency and evacuation policy and procedures.

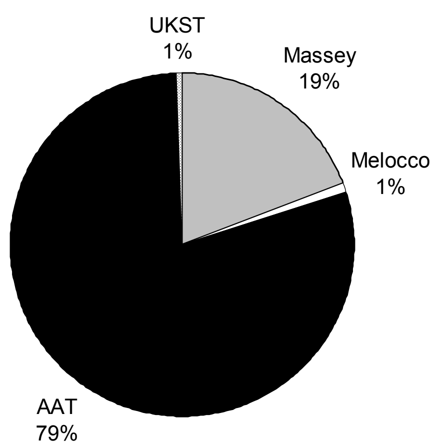
Comcare is a statutory authority responsible for workplace safety, rehabilitation and compensation in the Commonwealth of Australia's jurisdiction and is the AAT Board's Workers Compensation insurer. The AAO has worked hard to maintain a safe working environment. There have been no notifications of dangerous occurrences for the last five years.

Table 4.5 Workers' compensation and dangerous occurrences

	2000-01	2001-02	2002-03	2003-04	2004-05
No of claims	0	1	5	2	2
Payments made	0	$75	$12,400	$2,735	$3,241
Dangerous occurrences	0	0	0	0	0
Workers Compensation premiums	$23 751	$16 926	$15 612	$32 500	$37,309

During the year the AAT Board commissioned an external review of its OH&S infrastructure needs. The report identified various remedial works that need to be undertaken at both Epping and Siding Spring with the bulk of the work to be undertaken at the AAT (79% of all works by dollar value).

Chart 4.17 shows infrastructure upgrades by location



Following an approach by the AAT Board, the two Governments have agreed to provide in 2005/06 an amount of $2.7 million to meet identified OH&S infrastructure needs. Remedial works are expected to be completed over a 3 year timeframe commencing in late 2005. The AAO Safety Committees will be actively 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 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 (DEST) and the United Kingdom (PPARC).
- Contracts for the building of instruments for external clients.
- Other revenue, including research grants, fellowships funded via the ARC and PPARC, and the RAVE international consortium for survey work on the UKST.

The AAT Board is funded mostly for recurrent expenditure and has to strike a balance between that expenditure, capital needs and tel-escope refurbishment. Funding from the Australian Government is made via the Department of Education Science and Training (DEST Output 3.1). This funding is indexed whilst that provided by the UK Government is not.

Chart 4.18 Sources of funds for 2004-05

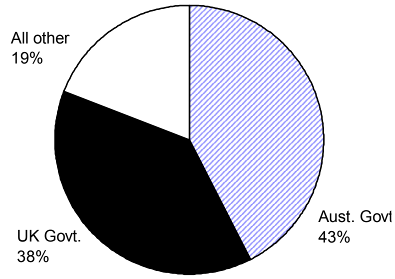
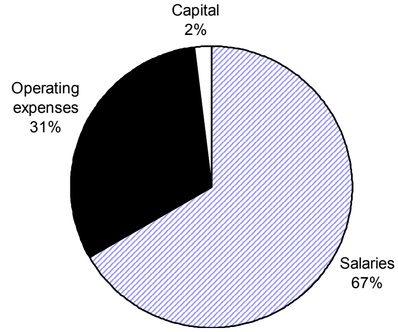


Chart 4.19 Application of funds for 2004-05



The financial focus of the AAT Board for the year has been on its short term budget position and identification of its longer term needs, especially in the context of the UK's gradual withdrawal over the next few years.

Performance during the year

The results for 2004-05 show that the AATB has net assets of $47.5 million; revenue increased by 2% over the previous year; expenses have decreased by 12% over the previous year; and a consequent reduced operating loss for the year. Operating losses in past years have been almost equal to the unfunded annual depreciation expense of the organisation. Estimated revenue for 2005–06 is $10.7 million and expenditure $10.5 million.

Information Technology

The development of a new IT Strategic Plan has been the major achievement this year. Key areas addressed are infrastructure management, security, communication between sites, replacement of legacy systems, the Telescope Control System and business interruption and disaster recovery. A lack of funds has inhibited capital investment in IT, but a new implementation plan should see the strategy realised over the next three years.

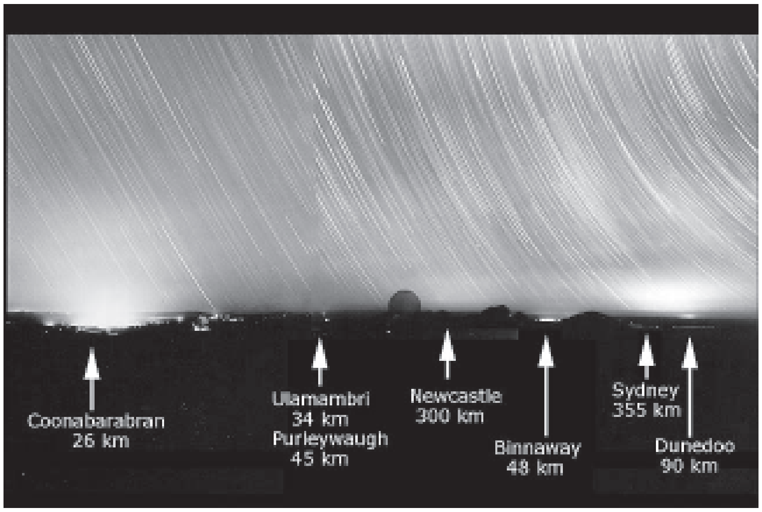
Environmental Performance

Dark-sky Protection

The AAO participates in activities designed to protect the dark sky of Siding Spring Observatory, and Dr Fred Watson (Astronomer in Charge) chairs an inter-organisational Working Group that develops and implements strategies to this end. While the principal activity of the group centres around lighting control legislation, another important function is to educate and inform the public about good and bad lighting, and the impact of light pollution on optical astronomy.

The Warrumbungle Shire Council (formerly Coonabarabran Shire) has adopted a Development Control Plan to limit upward light spill within its boundary. Work is also in progress on a new Orana Regional Environmental Plan (REP), which will address the issue of upward light spill in a large area of the state with a radius of 200 km centred on Siding Spring. The requirements for this have now been submitted to Parliamentary Counsel, as required by the appropriate planning protocols. The new REP attracted some media coverage during 2004–05 because of the four-fold increase in the area that the plan will cover, compared with the earlier version. The response to this sensitive issue has been generally positive.

Considerable work has been done during the year in establishing a technique for monitoring the Siding Spring horizon sky-glow. Invaluable help in this has come from Bob Shobbrook (formerly of Sydney University), and it is now possible to see (qualitively at least) the changes that have taken place since David Malin's well-known horizon images of the late 1980s (right). While there appears not to have been any significant overall degradation of the sky, the lights from several neighbouring centres have increased in prominence, most notably the cities of Dubbo and Tamworth.



Considerable work has been done in establishing a technique for monitoring the Siding Spring horizon sky-glow (photo: David Malin)

External Communications

The AAO is aware that good two-way communication is central to all its activities. While it must listen to its stakeholders, it must also communicate with the wider community. The stakeholders are the AAO staff, the astronomy community, responsible Ministers, funding agencies, the Board and its advisory committees and the time assignment panels. The community includes the general public, hence the broad term 'Public Relations.'

World Wide Web and digital images

The AAO's primary conduit for external communication, the website, has recently been upgraded. It continues to attract a large audience, with a consistent hit rate of over a million a month. These figures do not include the Cambridge (UK) mirror of the AAO site. Most of the Internet visitors are attracted by the images pages, which now support a total of about 220 photographs.

A newsletter is published three times 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.

A wealth of more technical information is also available and is constantly being updated and developed.

Publicity and Outreach

This year the AAO issued media releases on five topics. The highest-profile of these was the announcement, in January 2005, of the detection of "baryonic wiggles" (see page 9 acoustic oscillations) in the data from the 2dF Galaxy Redshift Survey. The detection, and a complementary detection in data from the Sloan Digital Sky Survey, was announced simultaneously at press conferences in London and San Diego, California (at a meeting of the American Astronomical Society). It made front-page news in Australia.

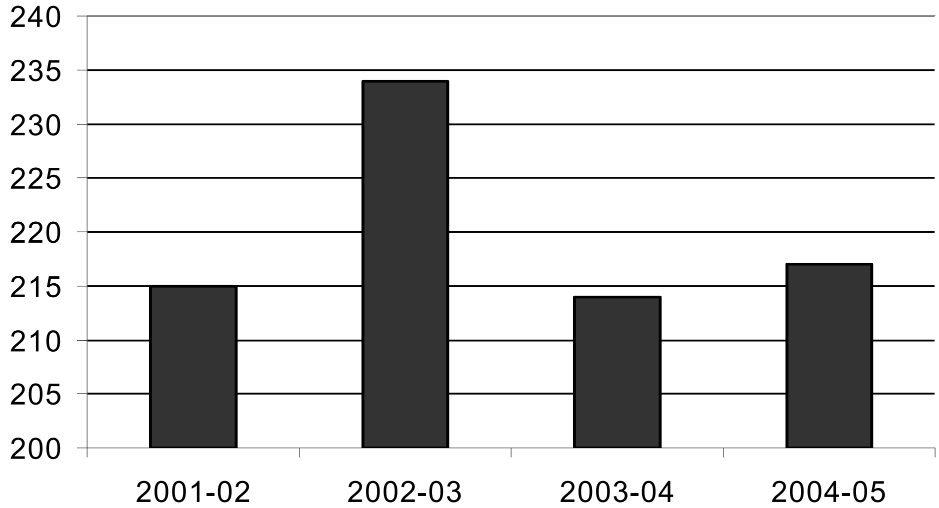
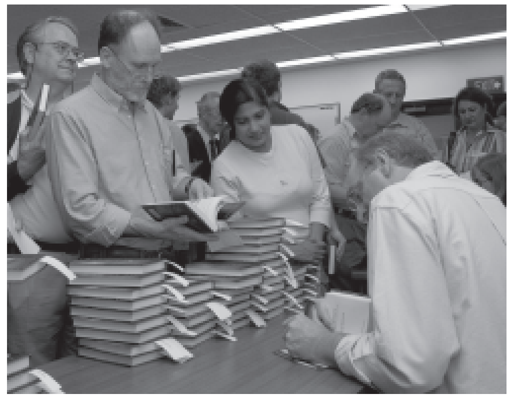


Figure 3.14 Media Interviews

The Director, Matthew Colless pictured in a panel discussion with Simon Singh at the Sydney Writer's Festival, which attracted a full house, (photo: Australian Broadcasting Corporation)

During the 2004–05 year AAO staff gave 217 media interviews, 72 recorded talks to professional audiences, and a further 66 to audiences of lay–people. Many of the latter talks were given to amateur astronomy societies, but some reached wider audiences. In November 2004 AAO Director Matthew Colless gave, by invitation, the Malcolm McIntosh memorial lecture, established by CSIRO in memory of one of its former CEOs. The lecture was held at CSIRO's Black Mountain site in Canberra and attracted a capacity crowd. In June Dr Colless took part in a panel discussion on "Einstein's Big Bang" at the Sydney Writer's Festival (again to a full house); in June he participated in a similar event at the Mind, Body and Spirit Festival in Grafton, NSW. Both events were organised by the Australian Broadcasting Corporation as part of its 'Café Scientific' series, and were recorded for radio. Dr Colless was also the speaker for the 2004 Bok lecture, commemorating Bart Bok, which is one of the AAO's regular contributions to the annual Warrumbungle Festival of the Stars. In April 2005 the AAO's Fred Watson—billed as "Australia's answer to Patrick Moore"—gave the second Allison-Levick Memorial Lecture in Birmingham, UK, in association with the UK National Astronomy Meeting. The lecture, a public talk to be held at regular intervals , is funded by a bequest from Melbourne psychiatrist the late Mr Jack Allison-Levick to enhance the public understanding of astronomy and further the reputation of the AAO.

Fred Watson's long-awaited history of the optical telescope, *Stargazer*, was published in 2004. One of the book's many launches was held at the AAO's Sydney headquarters on 7 October, for more than sixty of Fred's friends and colleagues.



Pictured above some of the many attendees at the launch of Fred Watson's book "Stargazer". Below, Fred Watson (photos: Shaun Amy)