3 The year in review

Above: Interest in the 2dF exhibit at the Anglo-Australian Telescope's Open day held in May 2004. Left to Right: Shaun James (AAO) Prof. Penny Sackett (RSAA), Mrs Julie Shinton, Cllr Peter Shinton (Mayor of Coonabarabran), and Dr Fred Watson. Photo courtesy Chris McCowage

Operational environment

Astronomy excites the imagination of scientist and lay-person alike and it provides an important framework for many of the major ideas that underpin our society. The long-term nature of the scientific questions being investigated demands exceptional intellectual and scientific skills and sophisticated equipment. To be effective, astronomical research requires stable, long–term funding.

The British and Australian Governments demonstrated a substantial commitment to astronomical research by establishing the Anglo-Australian Telescope Board, which has operated the Anglo-Australian Observatory for thirty years.

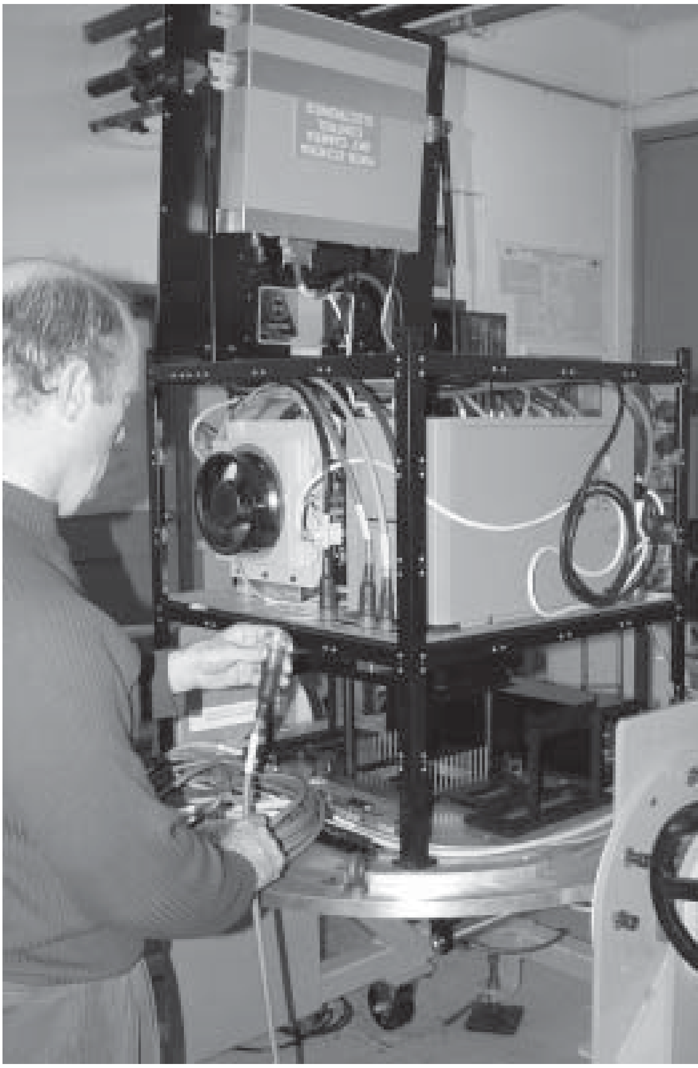
Above: Public interest in the AAO's Echidna exhibit at the Society of Photo-Optical Instrumentation Engineers (SPIE) Conference in Glasgow in June 2004. Photo courtesy Keith Shortridge

The Observatory provides world-class optical astronomy facilities for scientists from both countries. The telescopes of the AAO have been responsible for many fundamental discoveries and continue to provide a large portion of the data used by astronomers in Australia and the UK. The results of the observing programs carried out using these facilities are published in the scientific and technical media for the benefit of other scientists and the academic community. They are also widely publicised in more accessible places for the general public.

The intellectual challenge of astronomical research attracts some of the finest scientific minds. Astronomy is both international and highly competitive. The AAO maintains strong links with other scientific organisations on astronomical and technical matters, particularly in the development of new instrumentation, and therefore plays a major role in the international astronomical community. AAO staff collaborate on a range of scientific research programs with other astronomers around the world. Through its strong links with the universities in both Australia and the United Kingdom, the Observatory also plays an active role in higher education.

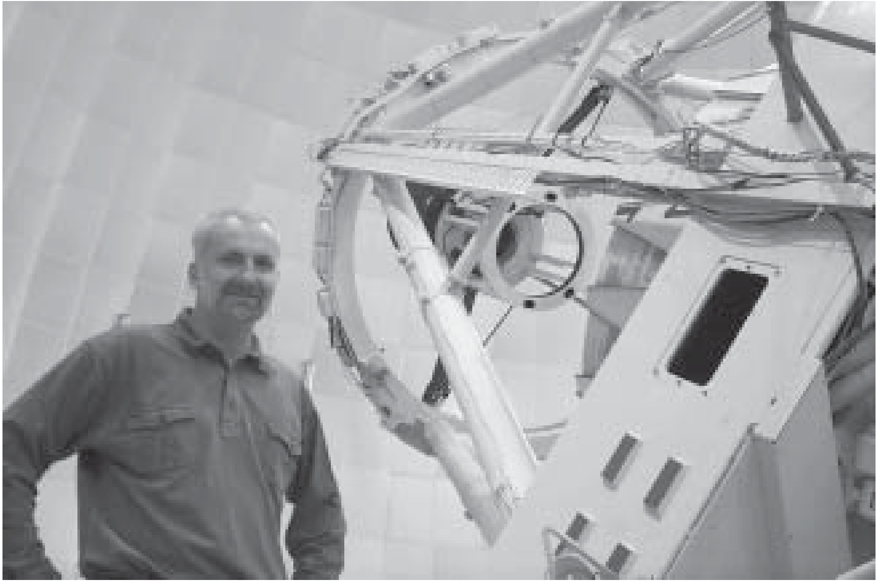
The AAT is the largest optical telescope in Australia and remains one of the world's most scientifically productive telescopes. The UKST is the most productive survey telescope in operation anywhere. Both telescopes were state-of-the-art when observing commenced in the early 1970s. Thirty years later, as a consequence of the vision of their designers, a long period of stable funding and a continuing program of enhancements, the telescopes of the AAO remain at the leading edge of astronomical research, against considerable international competition. The Observatory's expert scientific and engineering staff have constantly upgraded the telescopes by incorporating the latest technological developments into instrument design. Staff are considered world leaders in many areas of astronomical instrumentation and are often asked to provide advice to other organisations and build instruments for their telescopes.

The new generation of telescopes with mirrors 8 metres or more in diameter are now achieving maturity and producing a steady stream of high-quality results. The AAO has demonstrated that a 4-metre class telescope such as the AAT can be scientifically competitive with the large 8-metre telescopes if it has leading-edge instrumentation and concentrates on strengths relative to the larger telescopes. For example, the wide field of view and large multi-object capability of the 2dF spectrograph make it one of the world's most effective survey spectroscopy facilities. Similarly, the IRIS2 infrared imager and spectrograph has a wide-field of view and was one of the first infrared instruments to achieve multi-object spectroscopy. The 6dF facility on the smaller UK Schmidt Telescope provides an extreme wide-field spectroscopy capability that is unique in the world and enables all-sky survey programs. These powerful facilities ensure that the AAO telescopes will continue to carry out high-impact scientific programs for years to come.



Right: AAO Senior Electronics Technician Ed Penny terminates another cable in the electronics enclosure. Visible in the electronics enclosure are the cooling unit (left) & the Echidna Control Computer (right). The FPI is barely visible on the underside of the base plate.

Dr Matthew Colless pictured with the Anglo-Australian Telescope, took up the position of Director of the Anglo-Australian Observatory in January 2004. Photo courtesy Jonathan Pogson



Strategic directions

The AAO is not exclusively responsible for the scientific results that arise from use of its facilities: external users do most of the research. The AAO nevertheless makes a significant contribution to the quality of the results in the following ways:

- First, by running the telescopes efficiently and providing good support during observing runs, the likelihood of good results is maximised.
- Second, by ensuring that the best mix of instrument and software development is undertaken, the Board, the AAO Users' Committee and AAO staff contribute very positively to the kind of science possible with AAO facilities.
- Third, by recruiting first-class research astronomers to support visiting astronomers and encouraging and supporting the AAO astronomers in their own research, the Observatory creates a climate which facilitates the best possible scientific output from all astronomers using the AAO's telescopes.

The AAO is committed to achieving results in five key areas, with the principal aim of obtaining the best possible science for its user communities.

These five key result areas are:

- Telescope operations
- Research
- Instrumentation
- Use of AAO resources
- External communications

The range of strategies adopted to achieve the AAO's objectives fall into two main groups. The first group involves staying in touch with developments in astronomy, instrumentation, telescope operations and management; listening to, and anticipating, the needs of the astronomy community; and publishing and publicising the research and other outcomes achieved. The second group encompasses technical, professional and administrative excellence and an ethos of continuous improvement.

Key result area (1) Telescope operations

Key outcome

Satisfied users and good data

Strategies

An important strategy is to listen carefully to the astronomy community, especially the users of the AAO's telescopes, to assess and anticipate their needs. Several avenues are available for this. The time assignment panels, the AAO Users' Committee and the Board all have a strong influence on the strategic directions of the AAO and are representative of the astronomy community. AAO astronomers and other staff are encouraged to observe at or visit major telescopes overseas and to provide feedback on world best practice. Informal networks and attendance at conferences, seminars and colloquia are also important ways of staying in touch.

A second strategy is to ensure that users' needs are met. This is achieved by maintaining and consolidating existing instrumentation and associated software; by developing first-rate new instrumentation; by providing good support in setting up the instruments, operating the telescope and with observing; and by soliciting users' comments.

The third strategy for achieving satisfied users is to seek ever greater efficiency in running the telescopes.

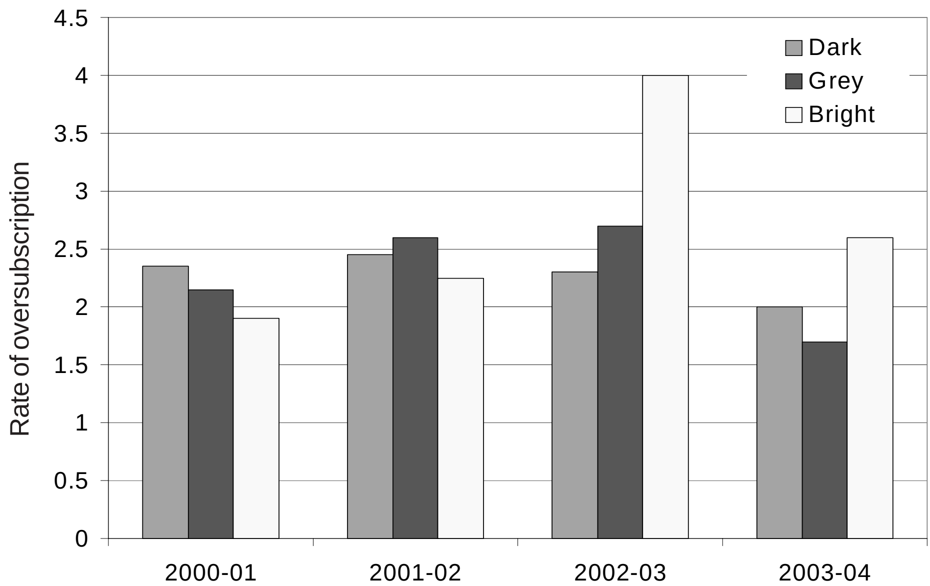
AAT organisational statistics

The high standard of the AAO's facilities and new developments in its instrumentation ensure that observing time on the AAT is always over-subscribed. Figure 3.1 shows the oversubscription rates for the AAT over the past four years, sorted by moon phase. In 2003–04 the over-subscription rates were similar to previous years. The bright-time over-subscription rate has now returned to average levels after the peak in 2002–03 due to the commissioning of IRIS2. Grey time oversubscription has dropped due to the decommissioning in 2003–04 of several instruments which are traditionally assigned during grey time. This has increasingly enabled the scheduling of bright time instruments like IRIS2 and UCLES in grey time, which effectively evens out the over-subscription rates. AAT users belong to a wide range of institutions from Australia, the U.K., U.S.A., and many other countries.

AAT performance indicators

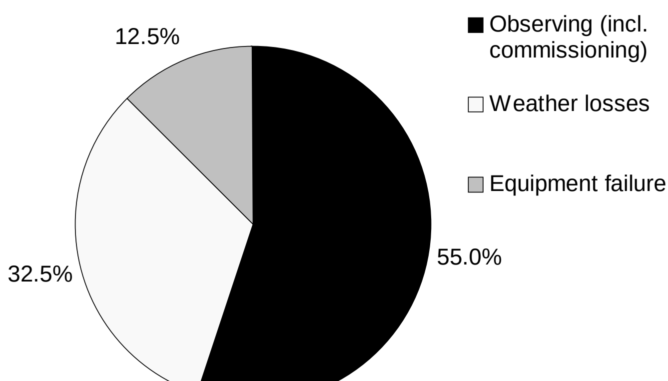
The use of observing time for the period 1 July 2003 – 30 June 2004 is shown in Figure 3.2. This year there were 3235 night hours available. In addition, a further 42 hours of commissioning time were used. The continuation of good weather during this period is still evident in Figure 3.3, which compares the use of observing time for the past four years.

Figure 3.1 Oversubscription rates for the AAT



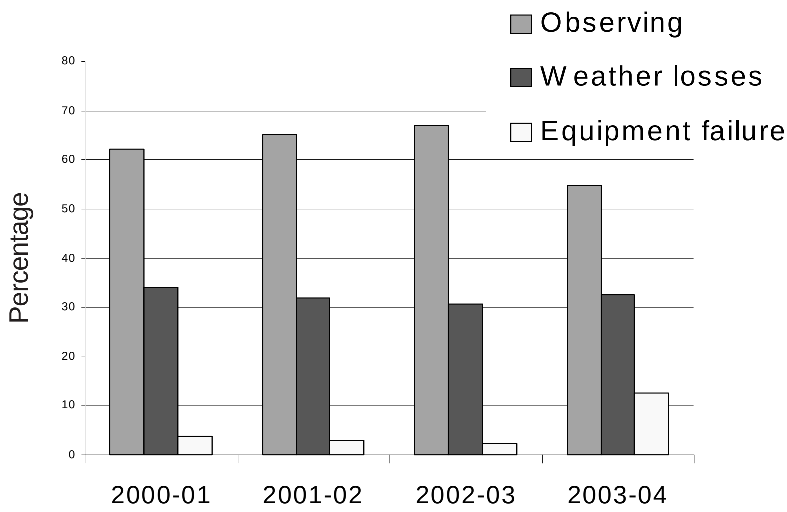
One measure of the extent to which users are likely to be satisfied with the levels of service provided at the AAT is the amount of available observing time lost through AAT equipment failure. 2003–04 saw the first major failure of the AAT in its thirty-year history. A main driveshaft for the dome shutter snapped. Heavy machining was required to fix the equipment which powers the 17-tonne sliding shutter. A country-NSW firm normally catering to the mining industry was able to carry out the machining and work was carried out at the

Figure 3.2 The use of observing time at the AAT in 2003–04



highest speed consistent with safety. The downtime was used as an opportunity to carry out upgrades that could not be done when the telescope is in operation, including improvements to the computer systems and the control room. In total, the telescope was out of commission for 40 nights, resulting in 12.5% loss of time lost to equipment failures, well above the corporate goal of three percent, but remarkably small given the seriousness of the dome shutter failure.

Figure 3.3 The use of observing time at the AAT over the last four years



User feedback

All AAT and UKST observers are encouraged to complete the WWW-based feedback form, which asks how well the AAO has fulfilled its obligations under its Client Service Charter. The responses cover key areas of observing support, instrumentation, technical manuals, administration and web pages. They 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 2003 to 30 June 2004, 52% of users completed feedback forms for the AAT. This response rate is lower than last year's (59%), mostly because of the extended down period caused by the dome shutter failure. Nevertheless, it remains slightly higher than the long-term average. 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 3.1, together with those for the previous two years. The statistical error on these mean grades is ~0.2. They show that the level of user satisfaction is generally high, and fairly consistent over the three years.

The AAO Corporate Plan sets a goal of a score of at least 3.5 in all categories. All performance areas have met that target in 2003–04 with the exception of general computing. This was addressed in June 03 by the appointment of a new IT Manager to oversee the Systems Groups at Epping and Siding Spring. It is expected that the strategic initiatives taken as a result will take some time to make themselves felt in average feedback scores. 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.

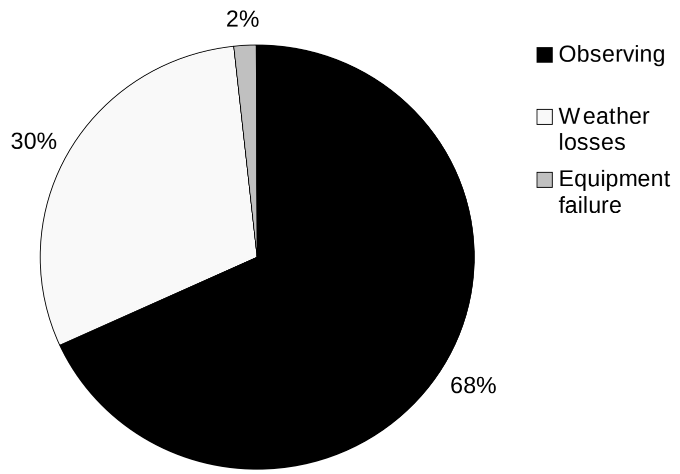
Table 3.1 User feedback at the AAT

Average rank (maximum 5)	2001–02	2002–03	2003–04
Night assistant support	4.8	4.7	4.7
Staff astronomer support before observing	4.6	4.5	4.3
Staff astronomer support during observing	4.7	4.6	4.5
Other technical support	4.6	4.3	4.1
Instrumentation and related software	4.0	3.8	3.7
General computing	3.7	3.7	3.4
Working environment	4.1	3.8	3.9
Travel and admin support	4.2	4.4	4.1
Data reduction software	4.1	4.2	3.9
Instrument manuals	4.0	3.8	3.9
Library facilities	4.1	3.9	3.7
AAO Web pages	4.0	3.9	4.0

UKST Organisational Statistics and Performance Indicators

Statistics for the use of the UKST during Semesters 03B and 04A are presented in figures 3.4 and 3.5 together with statistics for the previous years.

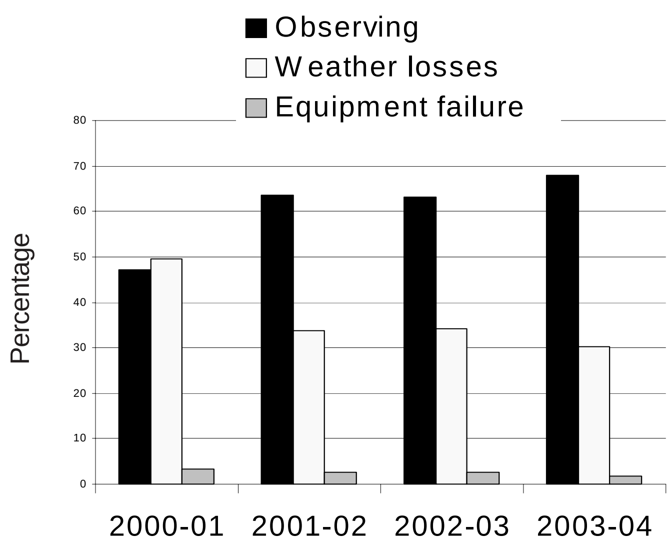
Figure 3.4 The use of observing time at the UKST in 2003–04



The year 2003–04 has seen exceptionally good weather conditions at Siding Spring. The April/May lunation was the best on record at the Schmidt Telescope, with 86.1% of time used. Down time due to system failure has also been extremely low, with 6dF attaining a very stable operating mode.

Although the Schmidt Telescope's photographic program has ended, one photographic exposure was made during the year to fulfil an award of photographic non-survey time. Two further similar exposures remain outstanding.

Figure 3.5 The use of observing time at the UKST



Since the beginning of 2003, essentially all observing time has been used for the 6dF program. The following table summarises the data obtained with 6dF during the period 2003–04, together with the two previous years in which 6dF was operating.

Table 3.2 6dF observations

	6dFGS Fields	RAVE Fields	Non-survey Fields	Total Fields	Total exp. (hours)
2001-02	261		124	385	713.6
2002-03	351	47	162	560	1078.6
2003-04	349	305	114	768	1116.6

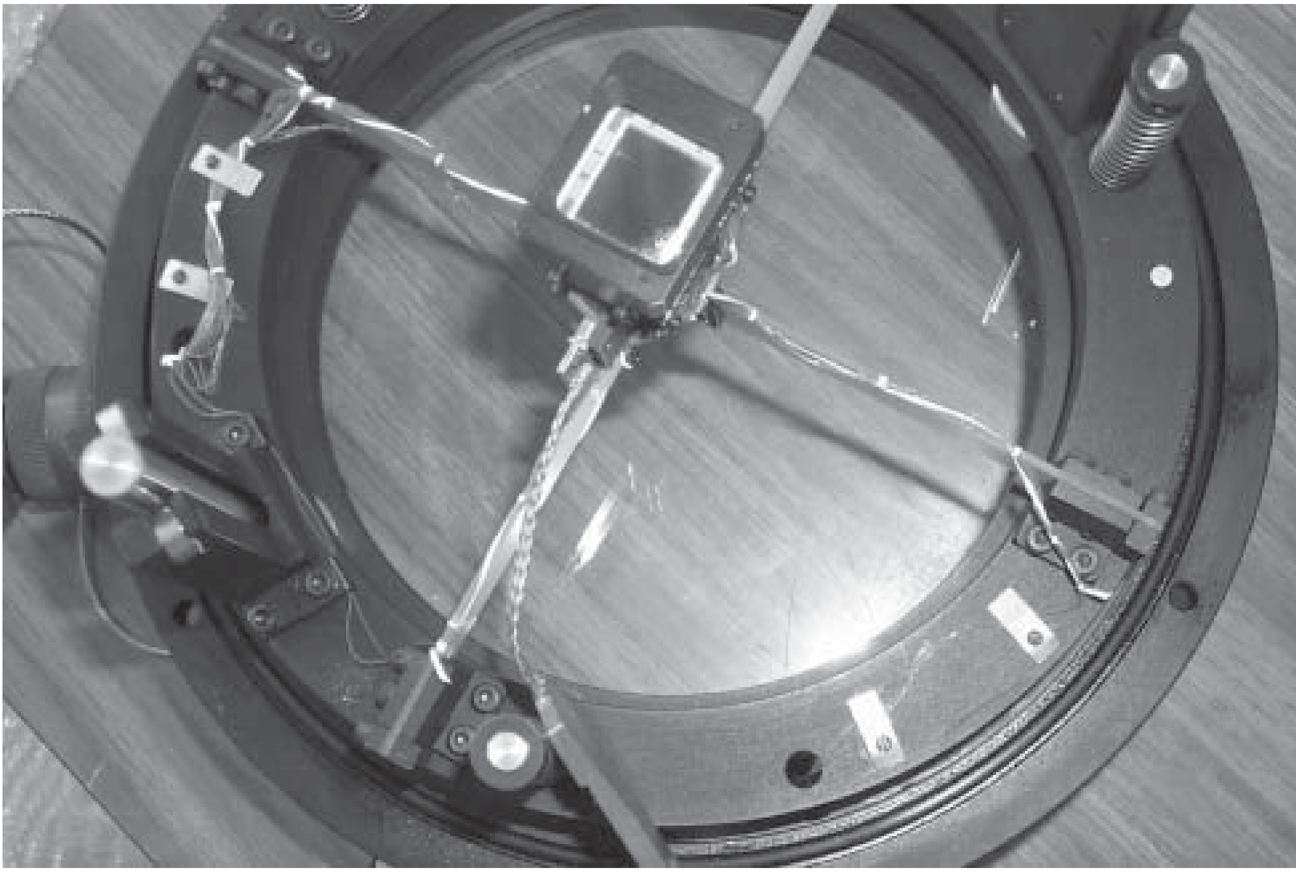
The 6dF Galaxy Survey (6dFGS) is progressing satisfactorily, and is now well past the half-way stage. The early data release of December 2002 was followed by the first full public release in March 2004. Non-survey programs were also undertaken for the following Principal Investigators: Bessell (ANU), Drew (Imperial College), Gaensicke (University of Warwick), Parker (Macquarie/AAO), Peyaud (Macquarie) and Vaughan (Macquarie). The fraction of scheduled observing time devoted to the 6dFGS is approximately 75%, the target recommended by the TACs.

Since 11 April 2002, seven unscheduled Bright-of-Moon nights per month have been allocated to the international RAVE survey (RAdial Velocity Experiment), which is progressing well. By 30 June 2004, over 40,000 spectra had been obtained.

All performance targets for 6dF were met although a slow attrition of science fibres continues. The scheduled program of fibre repairs (which involves removing each of the two field plates in turn from service for short periods) has been very successful with a relatively small loss of efficiency being experienced during single-plate operations.

6dF continues to be offered with 425R, 580B, 1201B, 1516R and 1700I VPH gratings. A long-standing problem with oil contamination inside the spectrograph camera was essentially cured during the year by dismantling and decontamination together with a new viscous-flow pumping regime using a dry vacuum pump.

The program to incorporate the Comsoft PC-TCS (telescope control system) into the Schmidt telescope was formally abandoned during the year, and no further in-house work on a new TCS will take place unless a Ukidna multi-fibre positioner is built and implemented.



Above: Focal plane assembly of the 6dF spectrograph camera showing oil contamination on the field-flattening lens. Darren Stafford, who took this photo, decontaminated the assembly

Key result area (2) Research

Key outcome

Good science

Strategies

Most research using data from AAO telescopes is undertaken by external users. The time assignment committees, which are peer review panels independent of the AAO, are the most important factor in the achievement of the desired research outcome: their strategy is to ensure that only projects likely to result in good science are awarded time.

The AAO also has an effect on the achievement of this outcome. The first AAO strategy for achieving good science mirrors the first strategy for telescope operations: it is for the research astronomers to keep thoroughly in touch with developments in the astronomy community.

A second strategy is to publish research results and to publicise more broadly the work and achievements of the Observatory. Research astronomers spend about half of their time on research, are encouraged to publish, and have the financial costs of publication met by the Observatory.

Finally, the AAO seeks to keep its research outcomes at the forefront by inviting distinguished visiting scientists to work at the Observatory for extended periods.

Research and organisational statistics

There were 12 research astronomers on the staff of the AAO at 30 June 2004. Four 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. The other eight are research astronomers but have significant responsibilities not directly related to their own research. These include the Director, the Astronomer-in-Charge and a shared position with Macquarie University. The full-time equivalent research effort is about 4 people. In addition, there are three emeritus astronomers.

The total number of AAT observing programs for the past five years is shown in Figure 3.6. The decreasing number over the period reflects the promotion of survey-style and longer-term programs at the AAT. Figure 3.7 shows the distribution of AAT observing programs by location of the Principal Investigator (P.I.). In Figure 3.8, the number of nights allocated at the AAT is distributed by the location of all the investigators in proportion. In both figures we see that users from the U.K. continue to make active use of the telescope, although they lead the program less frequently. This may reflect the increasing use of the AAT for surveys, which are run by large consortia of astronomers. This also

Figure 3.6 Total number of scheduled AAT observing programs

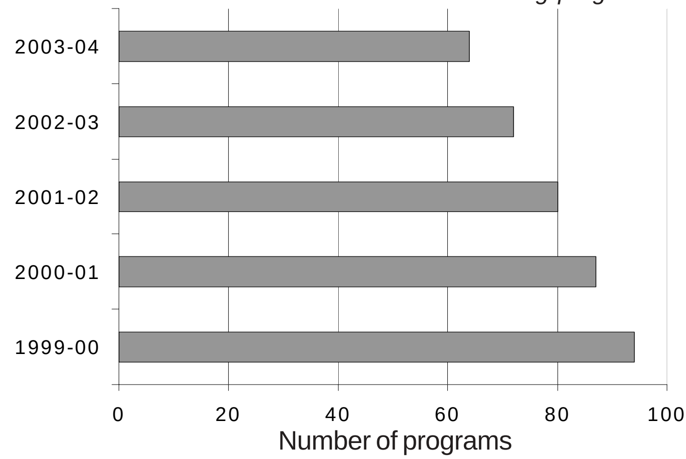


Figure 3.7 Number of scheduled AAT observing programs by location of Principal Investigator

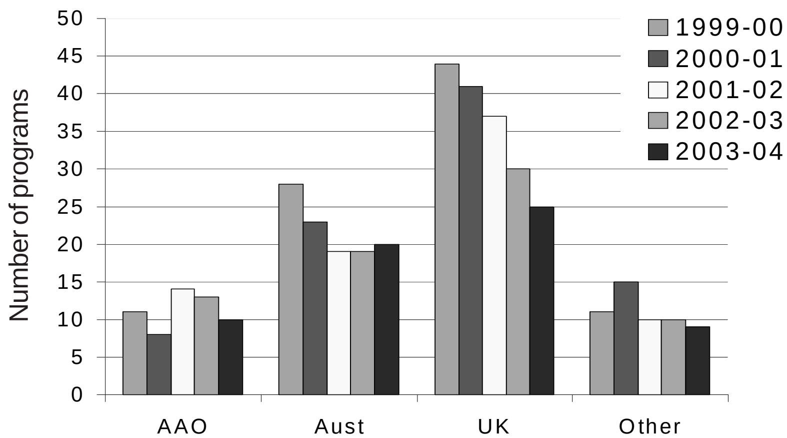
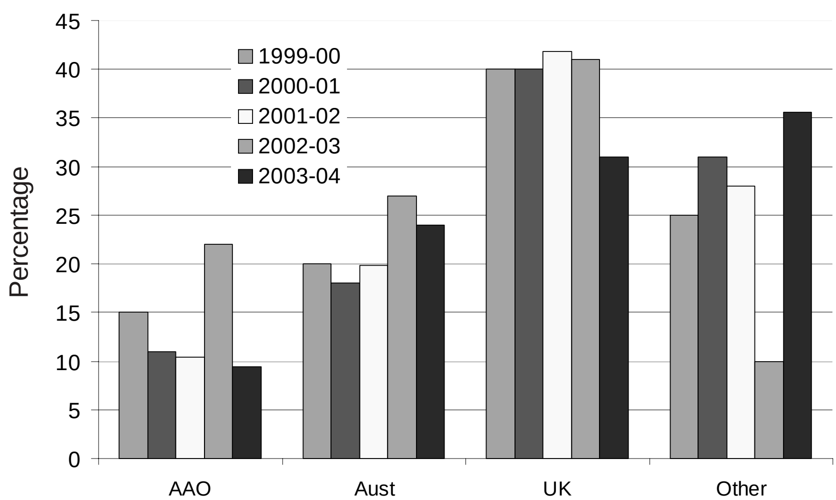


Figure 3.8 Percentage use of the AAT by location of all investigators



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 P.I.s from this group.

Figure 3.9 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, 30 UKST data papers and 75 AAO papers were published. AAT publications reached an all-time high this year. 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

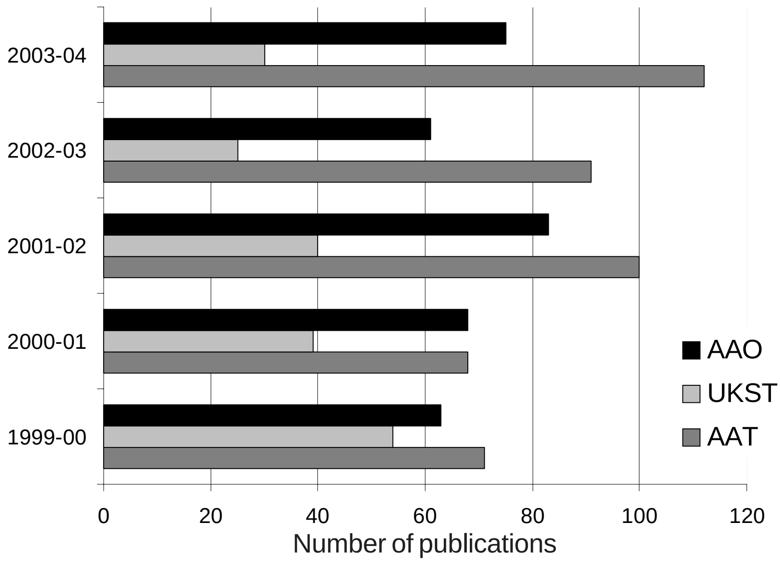


Figure 3.9 Total number of publications using AAT and UKST data, and AAO publications

Figure 3.10 Research papers published using AAT data by location of First Author

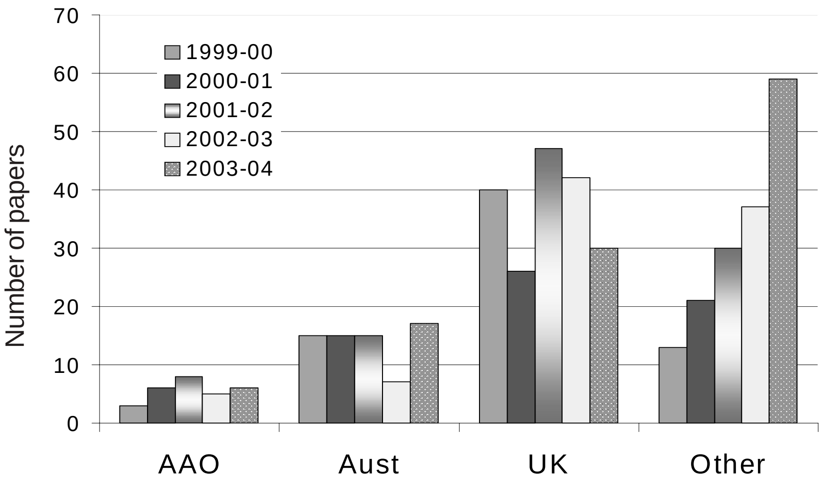
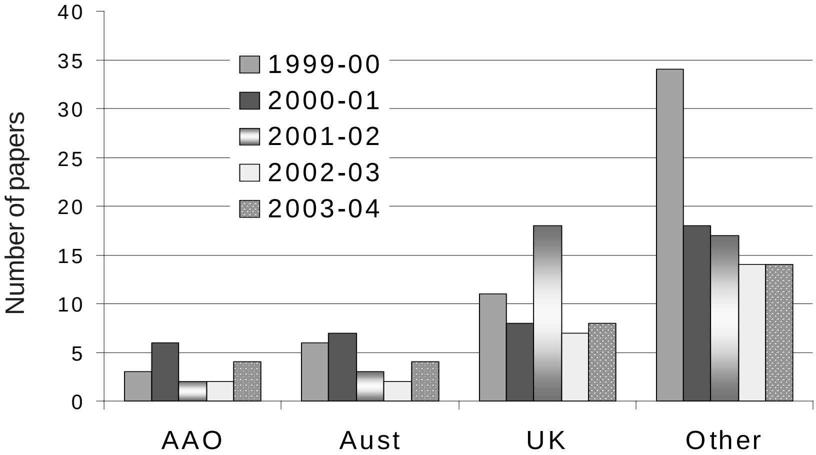


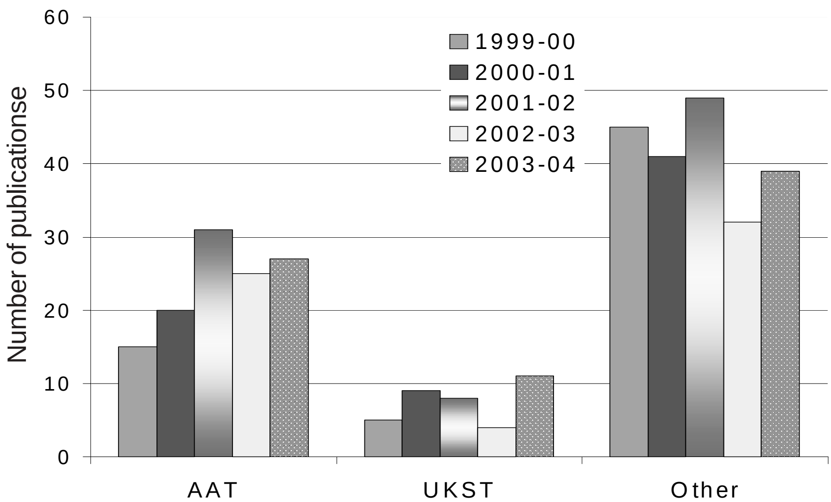
Figure 3.11 Research papers published using UK Schmidt data, by location of First Author.



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 the redshift surveys.

The distribution of publications in refereed journals by location of the P.I. is shown in Figures 3.10 and 3.11 for papers using AAT data and UKST data respectively. Papers making use of UKST survey data only are not included. There is an increase in many areas and the AAT publications from other countries have sharply risen again due to secondary 2dF Survey papers. Figure 3.12 gives the number of AAO publications produced by staff, students and visitors, sorted by papers including AAT data, UKST data, and other papers.

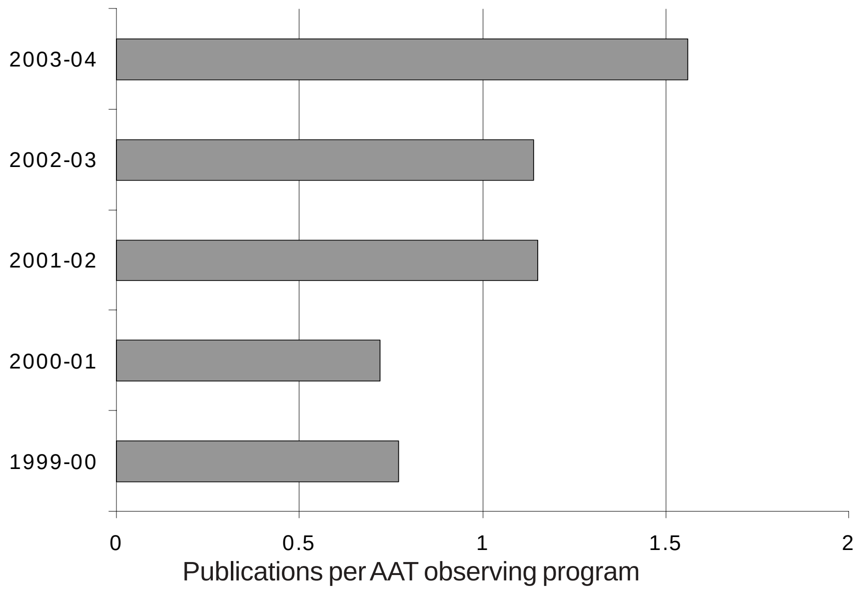
Figure 3.12 AAO publications by AAO staff, students and visitors



Publication numbers have risen in all areas. The trend to papers without AAT and UKST data continues but the number of AAT and UKST papers with AAO authors is also well up.

Figure 3.13 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 0.9, this year sees a huge 1.6 papers per program, an all-time high. 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 1.04 papers per AAT observing program was achieved.

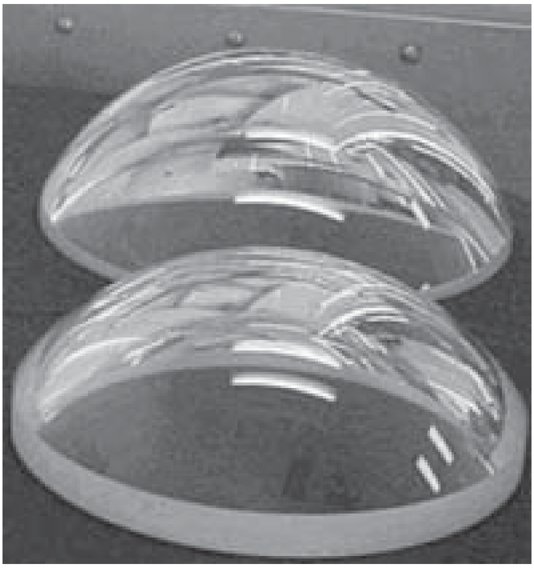
Figure 3.13 Publications per AAT observing program



Key result area (3) Instrumentation

Key outcome

For AAO instrumentation an integrated suite of instruments and telescope controls that best meet, in a timely fashion, the needs of the astronomical community, with the instruments working as well as they need, without being over-engineered. For external projects, satisfied customers



In September 2003, the AAO completed a design study for the Dark Ages "Z" Lyman Explorer (DAZLE) which is now being manufactured by the Institute of Astronomy (IoA) in Cambridge Above: the completed lenses. Photo courtesy IoA, Cambridge

Strategies

A key strategy in achieving the instrumentation objective is always to remain very much aware of developments in astronomy and instrumentation and of the needs of the astronomy community. The AAO Users' Committee (AAOUC) plays a key role here. The AAOUC's terms of reference include advising the Director on a development program which best meets the needs of the astronomy community bearing in mind AAO staff and financial constraints.

Two further strategies are vital to the implementation of the instrumentation development plan. The first is quality project management. Significant improvements in this area have been made in recent years, with the filling of two specialist project manager positions. Throughout 2003–04 the focus has been on improving procedures for the initiation, design review and tracking of future projects. This is supported by the provision of project management and risk assessment training for scientific and engineering staff to assist in their roles.

The second key implementation strategy is involvement at all stages, and at both sites, of all of the Observatory's highly innovative and world class astronomers, engineers, software specialists and technicians. This includes conception, design, construction and commissioning of instruments.

Table 3.3 Use of AAT instruments for the last three years
Percentage of nights allocated

Instrument	2001–02*	2002–03*	2003–04*
2dF	33.8	22.6	33.9
UCL coude echelle spectrographs (UCLES & UHRF)	23.2	29.7	23.9
Infrared imager/ spectrograph (IRIS2)[1]	7.6	11.5	24.5
Wide field imager (WFI)	6.0	7.4	2.8
Taurus II & Taurus tunable filter (TTF)[2]	12.7	9.9	4.7
RGO spectrograph[2]	8.0	10.9	4.3
SPIRAL integral field spectrograph[2]	4.7	4.6	0
Instruments supplied by users	4.3	3.8	5.9

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

[1] *IRIS2 was first used in 2001–02.*
[2] *TTF, RGO and SPIRAL were decommissioned in 2003–04.*

Organisational statistics AAO instrumentation

The AAO spends about 15 per cent of its budget each year on new instruments and associated software and detectors. Table 3.3 summarises the use made of instruments on the AAT over the last few years. It does not include time used for aluminising the primary mirror, and the time the AAT dome was out of operation.

The Two-degree Field (2dF) facility continues to attract the most observing proposals and still receives a large allocation of telescope time. This year we have seen a resurgence in 2dF surveys, including projects designed to complement mid-infrared surveys and galaxy redshift surveys on other telescopes. IRIS2 is now in use for a large range of programs, and the multi-object mode for IRIS2 was commissioned this year. Demand for the high-resolution UCLES and UHRF spectrographs also remains high with 35% of allocated UCLES time devoted to the ongoing search for extrasolar planets. The instruments supplied by users were the Semel Polarimeter and CIRPASS. Two projects were carried out using the Semel Polarimeter, which attaches to UCLES, to study variations in nearby stars. The Cambridge Infra-red Panoramic Survey Spectrograph (CIRPASS) was mounted at the AAT, using the old plate-mounted fibre input of FOCAP at Cassegrain, to carry out surveys of brown dwarfs in nearby clusters and star formation rates at redshift z=1.

At the close of semester 2003B the AAO reached the completion of the rationalisation of the AAT's instrument suite in order to increase operational efficiency and make way for new instrumentation. The decommissioned instruments include Taurus, SPIRAL and the RGO spectrograph, leaving the AAT with a streamlined suite of four instruments: 2dF, UCLES/UHRF, WFI and IRIS2.

Detector use: Charge coupled devices (CCDs) remain the astronomical detector of choice. 2dF, WFI and IRIS2 have a fixed detector. Users have a choice of CCDs on UCLES, either the blue-sensitive EEV or the red-sensitive MITTL3. The new AAO-2 optical controller has been commissioned with 2dF in November 2003 and is in routine use. The new controllers for EEV and MITLL3 are due to be commissioned in August 2004.

There is an increasing emphasis at the AAO in instrumentation design and construction. AAOmega, the next major instrument intended for the AAT, successfully navigated the final design review – the instrument is on track for first light near the end of 2005 (see page 36).

Instrument Science

The Instrument Science group is exploring new technologies on several fronts. The main projects can be divided into four categories: photonic devices; smart focal planes; ELT design; and inertial drive compensation for wind shake. The group is currently engaged in positioning mechanisms for beam steering and fibre optic relays, work that is funded by the European FP6 program. This is a continuation of the cryobot positioner study mentioned in last year's report.

Michael Kanonczuk of the mechanical section at the telescopes is shown dismantling IRIS2 in preparation for adjusting the grisms

The Instrument Science group works hard to establish important contacts across Australia and overseas. Currently, they have industrial partners in eight countries, with links to six universities which carry out technology development. Some of the most important developments at the AAO have come from these close links with industrial groups. Examples are the 'echidna' spines which lie at the heart of FMOS, the ultra narrowband filters used in DAZLE, and the VPH gratings used in several of the AAO's existing and planned instruments. The Instrument Science group is currently seeking links to assist with new development work on centimetre-sized cryogenic autonomous robots.

The group has coined the expression "astrophotonics" to describe one of its latest development areas. Here it seeks to advance astronomical instrumentation by clever use of photonic mechanisms which came out of the recent boom in telecommunications. One example is the use of tapered fibres where the input beam is efficiently converted to a different f/ratio on output. Photonics is a key strength of the Australian industrial landscape. The group maintains close links with several companies located at the Australian Technology Park in Sydney. A very promising development since February 2004 is photonic suppression of the near-infrared background by shining light through fibre Bragg gratings imposed on optical fibre bundles.

Internal Projects

AAOmega

The AAOmega project (http://www.aao.gov.au/AAO/local/www/aaomega/) proposes to replace the two 2dF top end mounted fibre fed spectrographs with a new coude mounted dual beam spectrograph. Some upgrade work to the 2dF robotic fibre positioning system is also planned. The new spectrograph uses large format detectors, volume phase holographic gratings and will be able to carry out "red" and "blue" observations simultaneously, providing a facility that will enable much fainter and more detailed observations. The project has recently passed its final design review and is in the construction phase. Commissioning is anticipated at the end of 2005.

IRIS2

IRIS2 (http://www.aao.gov.au/AAO/iris2/iris2.html) is the near infrared spectrograph/imager for the AAT. The multi-object spectroscopic mode for the IRIS2 instrument was fully implemented and released for scientific use at the end of 2003.

Dome Air Conditioning

The project to air condition the AAT Dome in an effort to sharpen the images obtainable at the telescope is close to completion. The Summer mode has been implemented. The Winter mode is nearly finished and should be implemented in the coming year.

AAT Infrastructure Project

The AAO infrastructure project consists of a number of small but high-priority tasks, using a small percentage of staff and time and aiming to increase telescope productivity with the minimum outlay for the maximum return. The AAO2 controllers have been commissioned on 2dF and have been reliably used on 2dF observing runs since early 2004. Commissioning of the two controllers for UCLES will be completed by the end of August 2004.

The design stage for upgrades to the AAT's telescope and instrument control systems are now moving forward into their phase 2 programs. The upgrade will be carefully managed over the next 2 years to ensure alteration causes minimal "down time" for the telescope.

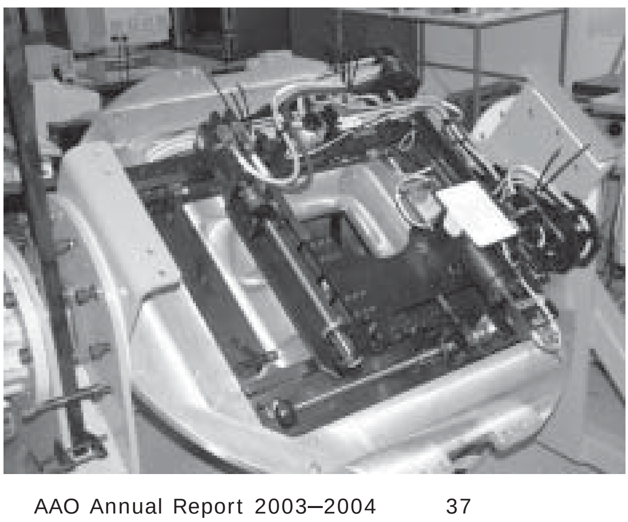
External Instrumentation

OzPoz

OzPoz (http://www.eso.org/instruments/flames/OzPoz.html), a robotic fibre positioner built by the Anglo-Australian Observatory to feed the FLAMES facility at the Very Large Telescope (VLT) in Chile, is in routine use and performing very reliably.

FMOS/Echidna

FMOS/Echidna is a 400 optical fibre robotic positioning system for the Japanese Subaru telescope in Hawaii and is part of the FMOS system (http://www.naoj.org/staff/akiyama/FMOS/) 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



Right: The Echidna Focal Plane Imager (FPI) is used for spine position feedback simultaneously to their required positions. Echidna is in the fabrication stage. All components were effectively fabricated by the end of the fiscal year. The project is currently awaiting delivery of the fibres for installation and testing in the instrument. Delivery of the instrument is now set for the first half of 2005.

MOMFOS

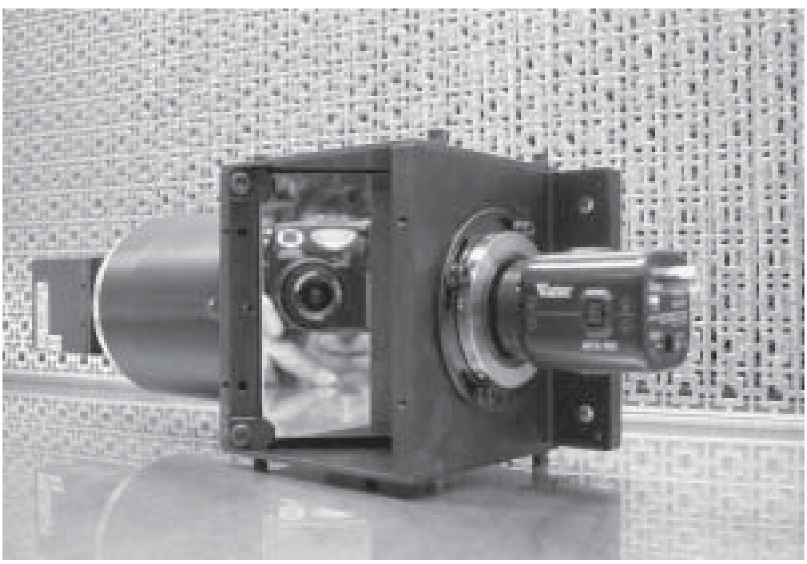
The MOMFOS concept design project http://aaossi.aao.gov.au/AAO/momfos/ is for an FMOS Echidna style multi-object spectrograph for the 30m GSMT. It has been funded through the AURA New Initiatives Office. The project was completed and submitted to AURA in November 2003.

Gemini WFMOS Feasibility Study

The AAO submitted a proposal to Gemini to do a feasibility and cost study for a Wide-Field, Fibre-Fed, Optical, Multi-Object Spectrograph (WFMOS). This instrument will have a 1.5 degree diameter field of view and will allow the simultaneous spectroscopic observation of several thousand objects. The AAO is serving as the prime contractor to Gemini, working in collaboration with the US National Optical Astronomy Observatory (NOAO), The University of Oxford, the University of Durham, the University of Portsmouth, John Hopkins University, and the Canadian Astronomical Data Centre (CADC). The study was awarded by the Gemini Board, and this instrument will move into a conceptual design phase by mid-2005.

Performance indicators

The instrumentation program is informed by the advice given to the Director by the AAO Users' Committee. The committee consists of experienced representatives of the user communities who are responsible for ensuring that the agreed program does indeed meet the needs of the astronomical community. The best way to judge this after the event is to survey telescope users as to their satisfaction with the suite of instruments and the way the instruments, software and detectors perform. As mentioned above, this information is compiled from the user feedback survey responses (see Table 3.1). The level of user satisfaction with instrumentation and related software has remained fairly steady, dropped slightly from 3.8 last year to 3.7 this year, still however meeting the performance indicators as outlined in the corporate plan.



Left: Urs Klauser (AAO) takes a photo of the spine & sky (Watec) cameras. The 45° mirror is used to image in opposite directions. The spine camera has a 0.33x telecentric lens attached to ensure images of tilted (ie. defocussed) spines are optimally acquired.

Key result area (4) AAO resources

Key outcome

AAO funds are to be used optimally and to stimulate productive, creative and focused staff working in a safe environment

Strategies

Perhaps the best strategy for achieving this objective is the involvement of all staff in corporate planning and other reviews. Their involvement means that many different perspectives can be taken into account, leading to a more rounded approach. It also means that everyone understands the final outcome of such a process and feels more commitment to, and ownership of, the results than would otherwise be the case.

The Observatory is committed to equal employment opportunity and occupational health and safety best practices as a way of meeting its objective of stimulated, productive, creative and focused staff working in an environment in which they feel secure. Training in these concepts and practices is a well-established part of AAO life.

Organisational statistics (People)

Staff numbers

The AAO employs research scientists, technical staff, software engineers, electronics engineers, optical and mechanical engineers, administrative and library staff. There are 10 full–time equivalents (FTE) on fixed term contracts, one of them part-time, and 57.25 FTE on indefinite appointments, five of them part-time. Staff members are located at both the Epping Laboratory and at Siding Spring Observatory. Table 3.4 shows staff numbers by tenure.

Most of the FMOS-Echidna Project team gathered in the laboratory. Back row: Neal Schirmer (Mech. Eng.), Peter Gillingham (Proj. Eng.), David Correll (Elec. Eng.) Middle row: Rolf Muller (Elec. Eng.), Scott Smedley (Soft. Eng.), Scott Croom (Astron.), Anna Moore (Instr. Sci.), John Dawson (Mech. Eng.), Roger Haynes (Instr. Sci.), Jurek Brzeski (Mech. Eng.) Front row: Ed Penny (Elec. Eng.), Dwight Horiuchi (Mech. Eng.), Gabriella Frost (Proj. Manager), Greg Smith (Mech. Eng.) Photo taken by David Smyth.

Table 3.4 Staff numbers by tenure

At 30 June 2004 the staff positions were:

	Full–time	Part–time	Part–time FTE
Director	1		
Research astronomers (fixed term)	4		
Instrument scientists (fixed term)	-		
Other fixed term	5	1	0.50
Research astronomers (indefinite)	1	1	0.60
Instrument scientists (indefinite)	5	1	0.75
Other indefinite	48	3	1.90
Total	64	6	3.75

Performance indicators (People)

Equal employment opportunity (EEO)

The *Equal Employment Opportunity (Commonwealth Authorities) Act 1987* requires the Board to develop an EEO program for each of the four designated groups identified within the Act.

Staff of the UK Schmidt Telescope at the dinner celebrating its 30th anniversary of operations Left to right: John Dawe, Paul Cass, Fred Watson, Kristin Fiegert, Ken Russell, Malcolm Hartley. Photo courtesy Chris McCowage

Only a fifth of the Observatory's staff is female. In earlier years, most of the women were employed in the administrative or research areas. In the past three years, more women have been recruited to the technical areas. As well, there have been several recent recruits from non-English speaking backgrounds. This is an encouraging outcome to a campaign over several years to ensure that the Observatory's recruitment processes did truly offer equal opportunity to all.

Occupational health and safety

The Anglo-Australian Telescope Board's safety policy and its agreement on health and safety with the Community and Public Sector Union are set out in Appendix B.

Comcare is a statutory authority established to administer the *Commonwealth Employees' Rehabilitation and Compensation Act 1988.* The premium the Board has to pay is a function of staff numbers and claims history. There was a jump in compensation claims in 2002–03 reflected in higher premiums for 2003–04, even though all the claims were very minor. There have been no notifications of dangerous occurrences for the last five years.

Table 3.5 Workers' compensation and dangerous occurrences

	1999-00	2000-01	2001-02	2002-03	2003-04
Comcare premium	$19 200	$23 751	$16 926	$15 612	$32 500
No of claims	3	0	1	5	2
Payments made	$635	0	$75	$12,400	$2,735
Dangerous occurrences	0	0	0	0	0

Organisational statistics (Financial)

The financial statements in Appendix A outline the AAO's financial position.

Performance indicators (Financial)

The Australian National Audit Office (ANAO) has audited the financial statements of the AATB and has found them to be acceptable. The auditor's report is contained in Appendix A.

Key result area (5) External communications

Key outcomes

A lively awareness of astronomy in general, and the AAO's role in particular, by all stakeholders

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.'

Strategies and performance indicators

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 1000 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

In line with the AAO's increased need to win instrumentation contracts, this year there was greater emphasis on presenting AAO's technical capabilities to the international astronomical community. Two major undertakings of this nature were exhibits of the AAO's work at the International Astronomical Union's 25th General Assembly held in Sydney in July 2003, and the SPIE Astronomical Telescopes and Instrumentation meeting held in Glasgow in June 2004. About two thousand people attended each meeting, and at both the AAO display attracted a steady stream of interest. A highlight of both displays was a hands-on working model demonstrating the principle of the Echidna instrument: for the SPIE meeting this set-up was also used to demonstrate the 'starbugs' concept.

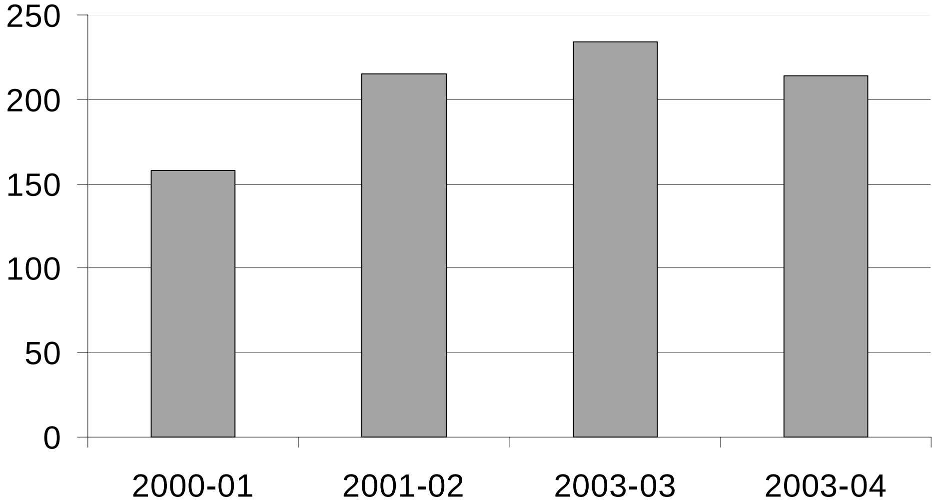
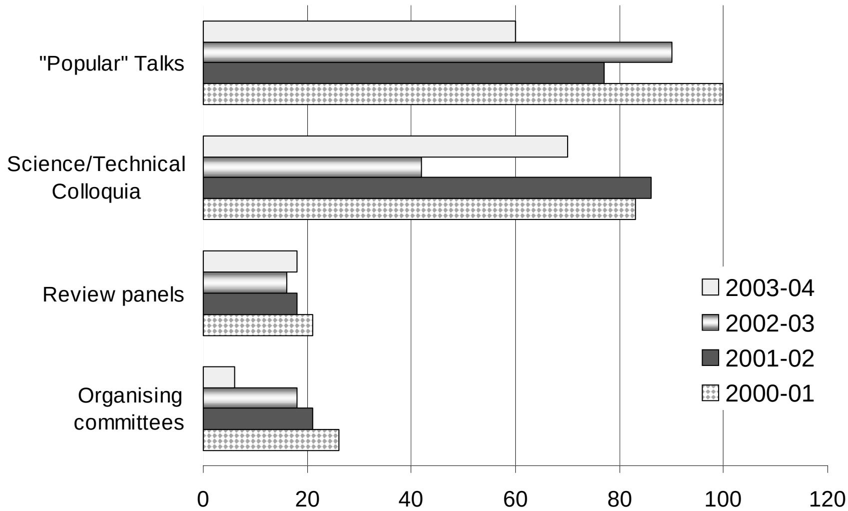


Figure 3.14 Media Interviews

Dr Fred Watson, winner of the 2003 David Allen Prize for communicating astronomy. The award was given at the IAU General Assembly in Sydney in 2003. Fred's "double" was used in the Coonabarabran Shire Exhibit at the General Assembly. Photo by Keiran Dobbin

This year the AAO issued media releases on five subjects: one (on observations of Mars from Earth) led to a front-page picture in the London Times (27 August 2003). Work led by AAO staff member Scott Croom was the subject of a further release issued by the Gemini Observatory in Australia, the UK and Canada. Staff gave 60 popular talks, 70 talks to professional audiences (many of them outside Australia), and 214 media interviews. Staff member Fred Watson has been a particularly tireless communicator, and his efforts were recognised in July 2003, when he was awarded the Astronomical Society of Australia's David Allen Prize for communicating astronomy. Dr Watson is a regular radio interviewee, writes a column for Australian Geographic, and has written a book on the history of the telescope, due for launch in September 2004. He also took part in two sessions of "Science in the Pub" (a moderated discussion with a set format) in Sydney during the July General Assembly: "What is a planet?", for professional astronomers, and "Life, the Universe and Everything", for the general public.

Figure 3.15 External Communications



Public events for the International Astronomical Union (IAU) General Assembly also included the inaugural Allison-Levick Memorial Lecture. Mr Jack Allison-Levick, who died in 2001, was a Melbourne psychiatrist with a life-long interest in astronomy. He had seen photographs taken with the Anglo-Australian Observatory's telescopes by former AAO staff member David Malin and was moved to leave a bequest. The bequest funds an annual public lecture enhancing the public understanding of astronomy and furthering the reputation of the Anglo-Australian Observatory. Given the background of the bequest, it was appropriate that the inaugural lecture was given by David Malin.

In 2002 Fred Watson and David Malin had worked with Australian composer Ross Edwards, contributing to Edwards' fourth symphony, "Star Chant". Described as "a musical fusion of art and science", this choral work incorporates words by Watson and images – extensively reworked for the Sydney performance – by Malin. In January 2004, the work had its first Sydney performance in the Opera House as part of the Festival of Sydney.

The AAO took part in the special "Open Night" of Siding Spring Observatory on 28 May 2004, to mark a series of simultaneous anniversaries of important instruments: the ANU's 40-inch telescope (celebrating 40 years), the AAT (30 years) and the ANU's 2.3-m telescope (20 years). This event was the first time the Observatory had been opened to the public at night.

As in previous years, the AAO contributed to the Coonabrabran Festival of the Stars, held in November 2003, by running the commemorative Bok lecture. The speaker for 2003 was Dr David MacKinnon of Charles Sturt University, who is embarking on a project to set up a "park" of small optical telescopes near Bathurst, NSW, accessible to the general public. The Festival also saw a reprise of the "What is a planet?" Science in the Pub discussion, again compered by Fred Watson.