Anglo-Australian Observatory

Annual Report

of the Anglo-Australian Telescope Board

1 July 2002 to 30 June 2003

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COVER: The cover shows a composite colour image from J,H,Ks images of the Trumpler 14 OB association in the Carina Nebula acquired with the IRIS2 wide-field infrared camera.

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PICTURE CREDITS: The editors would like to thank Jonathan Pogson, Urs Klauser, Chris McCowage, Andrew McGrath and David Malin for their photographs and images throughout Chapters 1-3.

The Honourable Dr Brendan Nelson, MP,
Minister for Education, Science and Training
Government of the Commonwealth of Australia

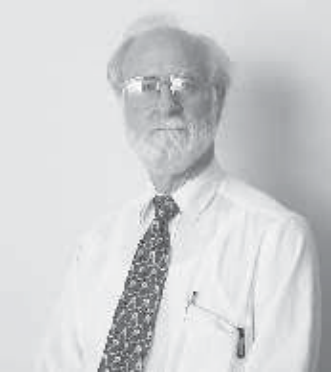
The Right Honourable Patricia Hewitt, MP,
Secretary of State for Trade and Industry,
Government of the United Kingdom of Great Britain
and Northern Ireland

In accordance with Article 8 of the Agreement between the Australian Government and the Government of the United Kingdom to provide for the establishment and operation of an optical telescope at Siding Spring Mountain in the state of New South Wales, I present herewith a report by the Anglo-Australian Telescope Board for the year from 1 July 2002 to 30 June 2003. The report summarises the operations of the Board for the period under review and includes financial statements and statements of estimated expenditure in accordance with the provisions of the Agreement.

R D Ekers
Chair
Anglo-Australian Telescope Board

Anglo-Australian Telescope Board
30 June 2003

Appointed by the Australian Government



Chair
Prof. R D Ekers Director, Australia Telescope National Facility

Prof. K C Freeman Research School of Astronomy and Astrophysics, Australian National University

Prof L Cram Program Director, Australian Research Council

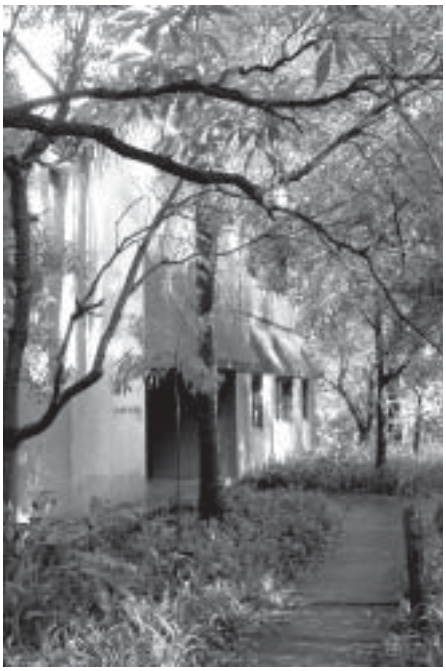
Appointed by the UK Government

Deputy Chair
Prof. M Birkinshaw William P Coldrick Professor of Cosmology & Astrophysics, University of Bristol

Mr G Brooks Head of Astronomy Division, Particle Physics and Astronomy Research Council

Dr P Roche Department of Astrophysics, Oxford University

Anglo-Australian Observatory



Below: Prof B Boyle
Director, AAO

Above: AAO laboratory building, Epping

Below: The Anglo-Australian Telescope and the UK Schmidt Telescope (background) at Siding Spring Mountain

Contents

Chapter 1
About the Anglo-Australian Observatory

Statement of purpose

The Anglo-Australian Observatory provides world-class optical and infrared observing facilities for British and Australian astronomers to ensure the best possible science. It also takes a leading role in the formulation of long-term plans and strategies for astronomy in both countries and, through its research and development of new instrumentation, contributes to the advance of astronomy internationally.

History and governing legislation

The Anglo-Australian Telescope Board is an independent, bi-national authority funded equally by the Governments of Australia and the United Kingdom. The Board operates under the *Anglo-Australian Telescope Agreement* which came into operation in February 1971 for an initial period of 25 years. If either Government wishes to withdraw from the Agreement after this period it must give five years notice. So far, neither party has done so, and both have indicated their support for the AATB until at least 2010.

The Board's facilities consist of the 3.9-metre Anglo-Australian Telescope (AAT) and the 1.2-metre UK Schmidt Telescope (UKST) on Siding Spring Mountain, outside Coonabarabran, NSW, and a laboratory in the Sydney suburb of Epping. Collectively, these are known as the Anglo-Australian Observatory (AAO).

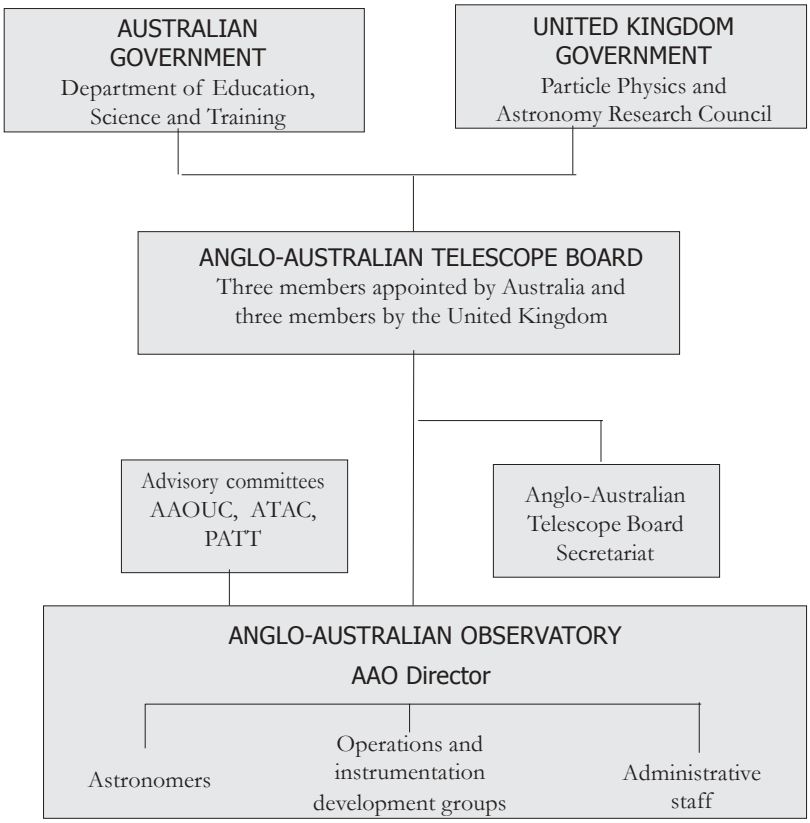
Ministers responsible

The Minister responsible for the AAT Board in the United Kingdom is The Right Hon. Patricia Hewitt, MP, as Secretary of State for Trade and Industry. The Minister responsible in Australia is The Hon. Dr Brendan Nelson MP, Minister for Education, Science and Training.

Designated agencies

Pursuant to Article 1 (2) of the Anglo-Australian Telescope Agreement, each Government acts through an agency designated for the purpose. These Designated Agencies are the Australian Department of Education, Science and Training (DEST) and the Particle Physics and Astronomy Research Council (PPARC) of the United Kingdom. These agencies are jointly responsible for implementing the Agreement.

Figure 1.1 General structure of the AAT Board and the AAO



Structure of the AAO

The AAT Board oversees the operations of the Anglo-Australian Observatory, as Figure 1.1 shows. Apart from an active research group, the Observatory has internationally recognised optical, mechanical and electronics engineering groups and a specialised software group. These five groups are critical to the maintenance and the day-to-day operations of both the telescopes and to the development of state-of-the-art instrumentation. A small administration group contributes significantly to the effective operation of the Observatory.

Board members

The AAT Board has six members, three appointed by each country, and the role of Chair alternates between the two countries. At 30 June 2003 the members were:

Australia
Professor R D Ekers (Chair), Professor K C Freeman, Professor L Cram

United Kingdom
Professor M Birkinshaw (Deputy Chair), Dr P Roche, Mr G Brooks

Further details of Board members, special responsibilities and Board meetings are included in Appendix C.

Advisory committees

The Anglo-Australian Observatory Users' Committee (AAOUC) advises the Director on aspects of the Observatory's operation.

Observing time on the AAT is allocated by two national committees: the Australian Time Assignment Committee (ATAC) and the UK Panel for the Allocation of Telescope Time (PATT).

Details of these committees are also included in Appendix C.

Chapter 2

Scientific highlights

Dr Michael Drinkwater (University of Queensland) heads a team which has used 2dF on the AAT to discover a new type of galaxy. Credits: UQ Communications/ ESO (background)

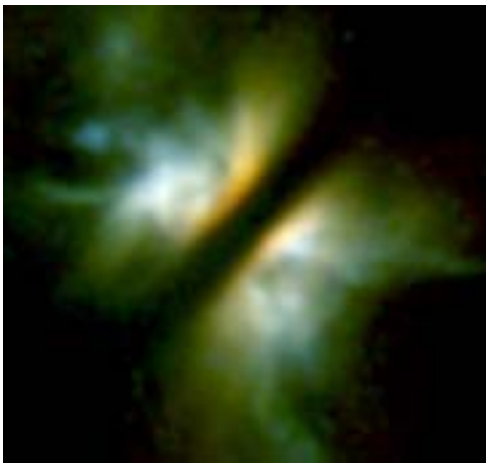
Introduction

The 3.9-m Anglo-Australian Telescope and the 1.2-m UK Schmidt Telescope continue to carry out a wide range of scientific projects. A major highlight is the release of the 2dF Galaxy and Quasar surveys in 2003. A wide community of astronomers in Australia, the UK and world-wide is now able to use these enormous databases in their own research. The past year has also seen three major surveys underway on the UKST - all producing results of major scientific impact.

In total, 72 programs obtained time at the AAT this year. On average, each program results in about one publication. However the past year has seen this return on telescope time double to almost two papers per program, (see Figure 3.13).

As well as providing support for the Observatory, astronomical staff carry out their own research programs, with strong links to the world-wide astronomical community. In addition to AAO facilities, they make use of major international facilities such as the Hubble Space Telescope, VLT, NTT and SEST facilities of the European Southern Observatory, the Gemini North and South telescopes and the Australia Telescope Compact Array.

A number of scientific highlights from the past year follow, showing the significant contribution made by the AAO to a wide range of scientific questions. At least two of these programs show how AAO astronomers have continued to carry out world-class science with two of the oldest of the AAT's instruments: the RGO spectrograph and Taurus/TTF.



A close look at young stars

A HST infrared image of the Butterfly Star - a young stellar system in which the star itself is hidden behind the dust in its circumstellar disc. The smallest detail HST can see corresponds to 15 AU.

The environment in the inner regions of young stars tells us much about star and planet formation. In the regions within 10 AU of the parent star (ie within ten Earth-Sun distances, or the equivalent of lying within just outside Saturn in our own Solar System), the star collects material from its circumstellar disc and drives an energetic jet or wind. In the circumstellar disc, planets are growing and interacting with the local environment. Many of these young stars also have binary companions within these regions. The study of these binary companions can help us to understand how such pairs are created and survive.

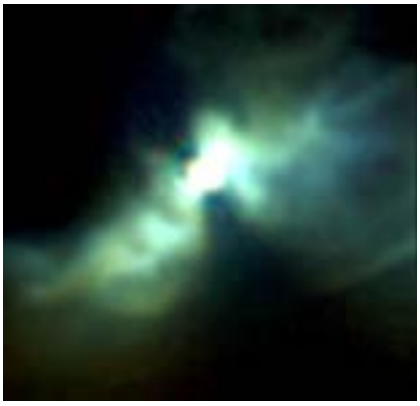
Unfortunately, even the Hubble Space Telescope (HST), or the most powerful adaptive optics system on a 10-m telescope, cannot resolve objects to this detail for even the closest star forming regions.

Ten Times the Detail of Hubble

Jeremy Bailey (AAO) has developed a powerful new technique for probing these systems he calls “spectro-astrometry”. He uses the oldest instrument at the AAT — the RGO Medium Dispersion Spectrograph — to obtain information on the structures in these systems at scales over ten times smaller than the smallest features seen in HST images. He does this by measuring the spectrum of the target at different orientations on the sky. Shifts between the spectra can be translated to super-resolved images. For this project, Takami, Bailey and Chrysostomou have used Spectro-astrometry to observe 28 young stars, studying disk structure, jets, outflows, and any binary companions, down to AU scales.

Binaries Formed by Core-splitting

Of the 28 stars observed, structure at small scales was found in 12. Nine binary systems were detected, and three of these were not previously known. One of the binaries (R CrA) also has a jet. Three other stars have jets, including one (VV CrA) with a bow shock as well. The number of binaries found support the theory that binaries are more common in lower-mass star-forming regions, but more objects are needed to check this result. The hydrogen emission from the stars in binary systems are strikingly similar to each other, which supports the idea that binaries are formed by the splitting of the collapsing core of a molecular cloud.



A young binary system with a bipolar outflow, also observed in the infrared with the HST. Credit for both images: D. Padget (IPAC/ Caltech), W. Brandner (IPAC), K. Stapelfeldt (JPL) and NASA.

Hole in Disk due to Giant Planet?

Recent planet searches have discovered a number of extra-solar gas giants. Theories suggest that a young planet could interact with a circumstellar disk, opening up a gap or hole. These structures would be only AU-sized in the nearest star-forming regions, and cannot be seen directly. One of the stars in this study, CS Cha, has a bipolar jet which is most easily explained by a gap or hole in the disk allowing the jet flow to be seen. Infrared observations support the possibility that a gas giant planet is responsible for the hole.

Fossil hunting in our Galaxy

The Tadpole Galaxy (UGC10214), taken by the Hubble Space Telescope, is an example of a thick disk in formation by the merger of a satellite galaxy. (Credit: NASA, Ford, Illingworth, Clampin, Hartig, the ACS Science Team, and ESA)

There are many processes which go towards the building of galaxies: the local variations and mix of the matter of the universe; the rate and location of star formation; the way chemicals are created and spread through the galaxy; the recycling of matter and energy through the birth and death of stars; the tendency for matter to cool; and the inexorable pull of gravity.

Stellar populations retain some part of the fossil record of the evolution of the parent galaxy. Measurements of the orbits and chemical make-up of the old stars in our Milky Way Galaxy act as our Rosetta stone, revealing the dominant physical processes which were at work during the evolution of the Galaxy.

An Ancient Collision

It is known that old stars have higher velocities, and travel on more elliptical orbits, than younger stars. This means that older stars, on average, are further from the Sun than younger stars, and can be selected by choosing a brightness and colour range. All indications are that the stellar population in our Galaxy known as the thick disk is composed of very old stars with ages of around 12 billion years. It is suggested that the thick disk formed when a small satellite galaxy collided with, and was merged into our Galaxy. It may be possible to identify stars captured from the satellite galaxy, and to compare them with stars formed before the collision in the thin disk of the Galaxy.

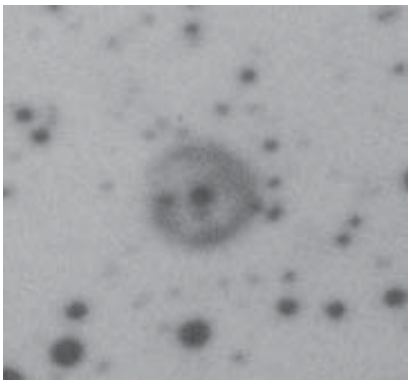
A New Stellar Population

The Anglo-Australian Old Stellar Populations Survey (AAOSPS), was set up by an international collaboration of astronomers (Wyse, Norris, Freeman & Gilmore) to locate these fossil stars. The survey used the 2dF multi-object spectrograph on the AAT, which provides 400 spectra simultaneously. After several years of observations, AAOSPS now contains spectra of around 2000 stars. This sample is now large enough for meaningful study.

The group have found that the movements, or kinematics, of stars a few kiloparsecs from the Galactic Plane are very different than had been thought. They detect a new population of stars which have properties which fall between the thick disk and the older halo of the Galaxy. These stars provide strong evidence for a significant merger event, so there is more kinetic structure than expected in the Galaxy halo. At the same time, there is no evidence for a series of mergers, as suggested by hierarchical clustering theories. Our Galaxy is both more complex and more simple than previously believed.

Galaxy Prehistory

What formed this population of stars? One possibility is that the thick disk actually consists of at least two subsystems — if true this will help determine how the thick disk formed. Another possibility is that this population is the remnant of a merger event at very early times which heated the thin disk, before the merger which created the bulk of the thick disk. Other possibilities exist which do not require a merger. Observations continue which will help us to further understand these fossil stars.



Three new surveys at the UKST

One of the 1000 new planetary nebulae discovered in the AAO/ UKST H-alpha Survey. (Credit: Quentin Parker)

The UKST was designed to photograph the whole of the southern sky — an ambitious aim which was achieved with great success. Much of southern astronomy of the past two decades has been based on this resource. The catalogue has been used to select different types of astronomical objects for further study, and the images, now digitized and available over the web, are still used to locate objects with more powerful telescopes. Over the past couple of years, the UKST has been given a new lease of life with the introduction of new technology. Three new surveys are being produced at a time when almost all other Schmidt telescopes have been retired.

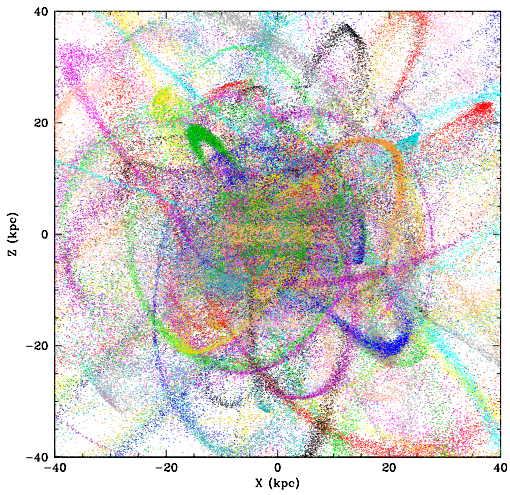
Hot Gas in our Galaxy

A final photographic survey has come to a close this year. The AAO/UKST H-alpha Survey targeted emission from hot hydrogen gas in our Galaxy and the nearby Magellanic Cloud galaxies. The observations were made with the world's largest monolithic interference filter, which selects the hot gas emission and blocks out other light. Photographs were taken with Kodak Tech-Pan film — the first time such a large program has been done with a film rather than a glass plate — in order to achieve much higher efficiency, resolution and uniformity.

Hot gas is associated with star-forming regions, outflows from energetic stars and old stars like planetary nebulae (PNe). The outer layers of the central star of PNe are expelled, forming gas clouds around the star. Over 1000 new planetary nebulae have been found in the survey. Several multi-band studies of star-forming regions are under way, and a number of new supernova remnants, the remains of exploded stars, have been located. The photographs have been digitized and the survey is available via the web.

The Nearby Universe

The 6dF Galaxy Survey (6dFGS) is the first UKST all-sky spectroscopic survey. A robotic multi-object spectrograph, 6dF, and a CCD detector take the place of the photographic plate. Spectra are taken of over 100 galaxies at a time, and in total 160,000 galaxies will be observed. By measuring the position and velocity of each galaxy we can learn about the structure of the local universe, the life cycle of galaxies and the nature of dark matter. The survey will run for another two years. The first 25% of the survey was released via the web late last year.



A simulation of how the Galactic Halo may have been formed by the accretion of 100 satellite galaxies. RAVE will search for these fossil orbits. (Harding et al. 2001)

Rave Hits the Galaxy

A new UKST all-sky survey has begun this year. The Radial Velocity Experiment (RAVE) aims to measure velocities of the brightest 50 million stars in our Galaxy. The initial pilot survey uses the current UKST multi-object spectrograph, 6dF, to obtain spectra for 100,000 stars by 2005. In order to carry out the full survey, a new spectrograph is needed, such as UKidna, which would use new technology to obtain over 2000 spectra at a time.

An all-sky map of velocities in the Galaxy would provide information on the structure of our Galaxy and comparison with other galaxies and galaxy formation models. It is believed that early formation events such as collisions with satellite galaxies have left fossil signatures in the movements of the older stars. Astronomers hope to trace the early history of our Galaxy from this map, the most extensive of its kind. Like the other UKST surveys, the data would be released to the world via the web, and is planned to form a part of “Virtual Observatory” databases.

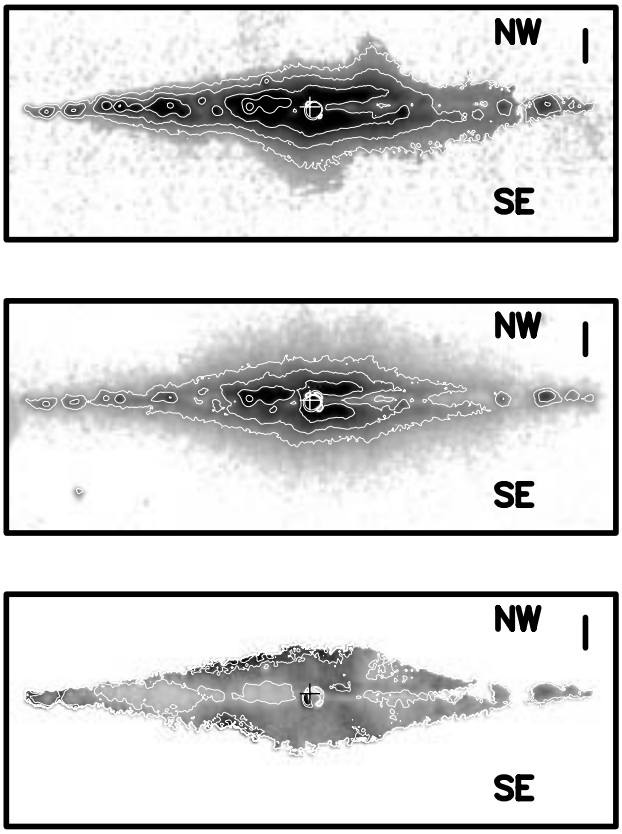
Hot gas above and below the plane

Close-up of an image of the edge-on spiral galaxy NGC 891. The gas can be seen extending above and below the plane. (Credits: C. Howk (JHU), B. Savage (U. Wisconsin), N.A.Sharp (NOAO)/ WIYN/NOAO/ NSF.)

While most hot gas in spiral galaxies is found in the disk, some gas is detected well above and below the plane of the disk, and is known as extraplanar diffuse ionized gas (eDIG). The most prominent example of eDIG is in the edge-on spiral NGC 891, which is believed to be very similar to our own Galaxy. While few other edge-on spirals have shown as much extraplanar gas, some gas is often seen extending in plumes and filaments. Veilleux and Miller of the University of Maryland have used a range of instruments including the Taurus/TTF at the AAT and the WHT to carry out a survey of eDIG in edge-on galaxies.

Highly ionized and extended gas

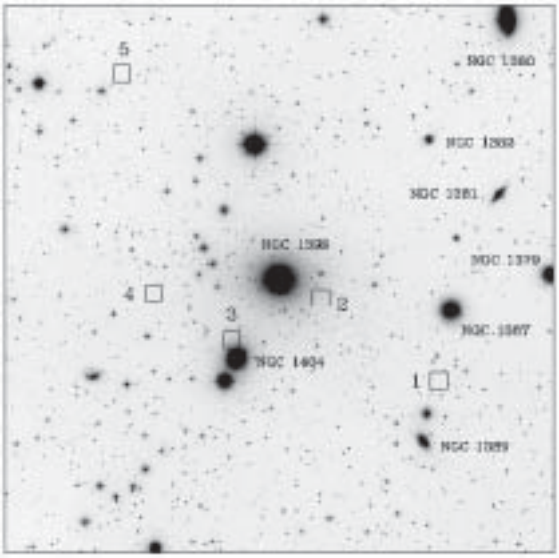
All but one of the 17 galaxies in the sample have extraplanar diffuse ionized gas. On average, this gas was found to extend further than in our own Galaxy and NGC 891. The most likely explanation for this unexpected result is that the measurements are more sensitive to faint traces of gas. The amount of heating needed to keep this gas ionized varies between 10% of the disk value, and over three times the disk value, with an average mass of 1.2×10^8 suns.



Maps of the hot gas in NGC 4013 taken with TTF on the AAT. The top maps show hydrogen and nitrogen emission, and the bottom shows the ratio, which measures the excitation structure. (Veilleux & Miller)

Mapping the Hot Gas

With TTF, light from hydrogen, nitrogen and cool gas can be observed simultaneously. The ratio of these observations maps the variation in heating of the gas throughout the galaxy. It was found that for many of the galaxies in the sample the hot extraplanar gas is not distributed evenly. Instead, we see complex structures. There is often more extraplanar gas near HII regions (clouds of hot gas) located in the disk. This supports the idea that the gas is heated by hot, young OB stars in the HII regions.



A new class of galaxy

The Fornax Cluster — a nearby group of galaxies. Boxes show some of the new ultra-small galaxies. Credit: Drinkwater; UKST image, digitized by SuperCOSMOS.

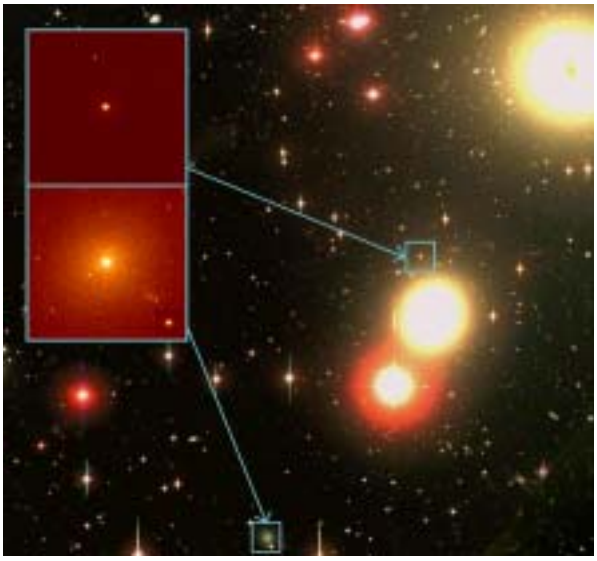
An international team of astronomers, headed by Michael Drinkwater of the University of Queensland, has discovered a new type of very small galaxy, known as an "ultra-compact dwarf galaxy" (UCD). The galaxies are so compact that astronomers previously mistook them for nearby stars in galaxy censuses. There has always been the concern that galaxy surveys are biased against finding very diffuse galaxies, because they are so faint, and very compact galaxies, because they look just like stars.

It is very important that a complete inventory is made of all galaxy types if we want to have an accurate knowledge of how much luminous (and even dark) matter is in the universe. We also want to understand all the ways in which galaxies are formed.

Needles in a Haystack

The ultra-compact dwarf galaxies were found while observing all objects in the direction of the Fornax Cluster — a bound system of about 300 galaxies which is 60 million light years away. The Fornax Cluster is, relatively speaking, at our doorstep. Even so, it is still difficult to tell whether galaxies in its direction appear small because they actually are, or because they are so far away.

The UCDs were first discovered using the Two-Degree Field (2dF) Spectrograph at the AAT, which can measure 400 objects simultaneously. Of the 2500 objects which had been identified as stars, 7 were found to be members of the Fornax Cluster. At this distance they were too bright to be stars, but rather had to be a new class of extremely compact dwarf galaxy.



Two of the new galaxies. They are so small they had been mistaken for stars. Credit: background taken by Hilker on 2.5m Du Pont Telescope, inserts taken with HST

Weighing the UCD Galaxies

The researchers then won rare time on the Hubble Space Telescope to measure how big these dwarf galaxies were, as well as time on the European Southern Observatory's Very Large Telescope in Chile to measure how fast stars are moving around inside these galaxies.

These two measurements are used in combination by astronomers to "weigh" galaxies and find out how massive they are. This confirmed the UCDs to be a new type of low-mass galaxy held together by gravity. These galaxies will be able to help test theories as to how galaxies in large groups like the Fornax Cluster are transformed and even destroyed.

Chapter 3
The year in review

The Deputy Prime Minister of Australia, the Hon John Anderson (left) presents an Award for IRIS2 to (L-R) Stuart Ryder, John Dawson, and Brian Boyle of the AAO. The President of the Institution of Engineers Australia, Dr Peter Greenwood, is at right. The occasion was the Engineers Australia 2002 Australian Engineering Excellence Awards. Mike Jensen Photography

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 twenty-eight years.

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 eight metres or more in diameter is beginning to come online. These telescopes will be able to carry out many of the scientific programs currently undertaken with the AAT much more efficiently. To ensure a stable future, it is important the AAO demonstrates it can compete effectively with these larger telescopes, concentrating on those programs which the eight-metre-class telescopes will not be able to do, or which support the scientific aims of these large telescopes. To this end, Observatory staff have developed facilities that exploit the unique wide-field capabilities of the AAT and the UKST. The Two-degree Field (2dF) facility for the AAT and the Six-degree Field (6dF) for the UKST are examples of this. Developments such as the wide-field infrared camera IRIS2 will ensure a continued high international profile and scientific productivity for the telescopes for many years to come.

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.

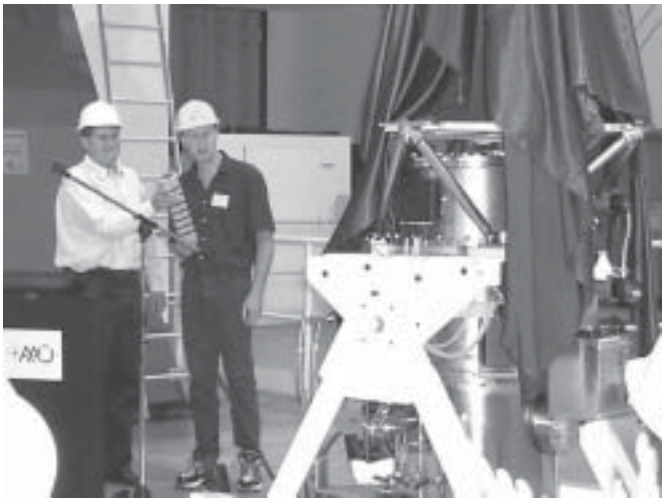
Second, by ensuring that the best mix of instrument and software development is undertaken, the Board, the AAO Users' Committee and AAO staff contribute very positively to the kind of science possible with AAO facilities.

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.



The Minister for Science the Hon. Peter McGauran MP unveils the AAO's newest instrument, IRIS2 on Febuary 21, 2003; Brendan Jones, workshop supervisor on right

Key result area: 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.

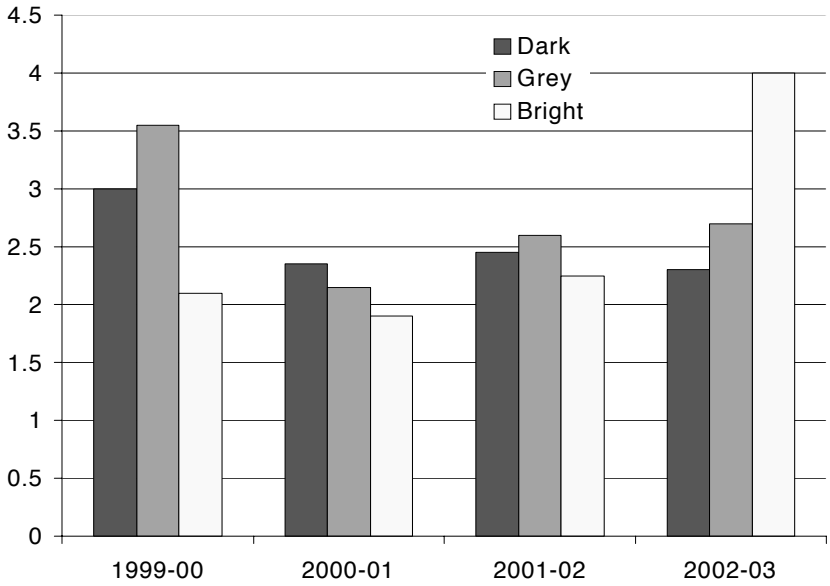
AAT organisational statistics

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 2002-03 we saw a rise in oversubscription rates for grey and bright time. Most notable is the increase in requests for bright time due mostly to the new infrared instrument IRIS2, and the large-scale Anglo-Australian Planet Search. More than four times the available bright time was requested during the period 1 July 2002–30 June 2003. 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 2002–30 June 2003 is shown in Figure 3.2. This year there were 3240 night hours available. In addition, a further 17 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. In 2002–2003, this was only 2 percent, which continues the trend of improvements over the past four years and is lower than the corporate goal of three percent. The bulk of problems arose from aging infrastructure, upgrades to which are continuing, and imaging problems with the recently commissioned IRIS2. The lowest fault rate in four years meant that useful observing time has increased by 2% over the previous year.

Figure 3.2 The use of observing time at the AAT in 2002-03

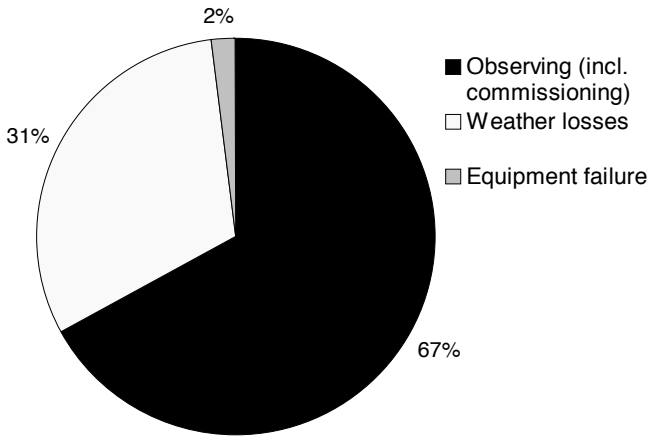
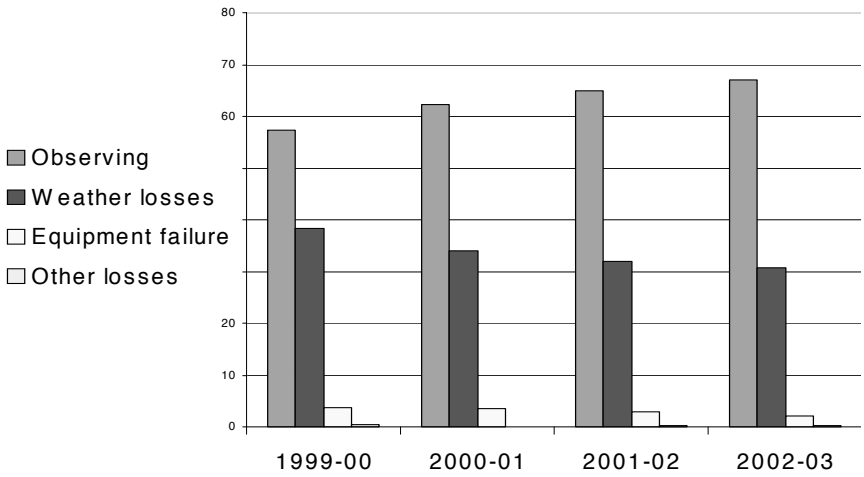


Figure 3.3 The use of observing time at the AAT over the last four years



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.

Users are actively encouraged to submit feedback forms at the end of their observing runs. During the period 1 July 2002 to 30 June 2003, 59% of users completed feedback forms for the AAT. This response rate is similar to last year's, and slightly higher than the long-term average.

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 has been consistent over the past three years.

The Corporate Plan sets a goal of at least 3.5 in all categories (a level 2.5σ above an acceptable performance level). All performance areas have met that target in 2002-3 with the exception of general computing. This has now

been addressed by the appointment in June 03 of a new IT Manager to oversee the Systems Groups at Epping and Siding Spring. Many of the feedback reports contain suggestions for improvements, most of which have been acted upon. Many 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)		
	2000-01	2001–02	2002-03
Night assistant support	4.6	4.8	4.7
Staff astronomer support before observing.	4.5	4.6	4.5
Staff astronomer support during observing.	4.6	4.7	4.6
Other technical support	4.5	4.6	4.3
Instrumentation and related software	3.7	4.0	3.8
General computing	3.7	3.7	3.4
Working environment	3.9	4.1	3.8
Travel and admin support	4.2	4.2	4.4
Data reduction software	3.9	4.1	4.2
Instrument manuals	3.8	4.0	3.8
Library facilities	3.9	4.1	3.9
AAO Web pages	4.0	4.0	3.9

UKST Organisational Statistics and Performance Indicators

Statistics for the use of the UKST during Semester 03A to date are presented in figures 3.4 and 3.5 overleaf.

The small amount of time lost to the weather results from a combination of generally very good conditions and the ability of 6dF to use marginal conditions. The time lost to faults includes down-time due to 6dF and is a relatively small loss rate for a telescope operating a complex new instrument. The most significant causes of system down-time were various 6dF-related

Figure 3.4 The use of observing time at the UKST in 2002-03

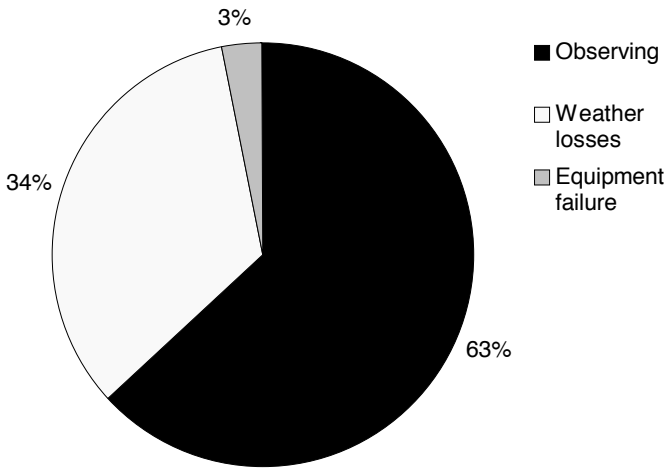
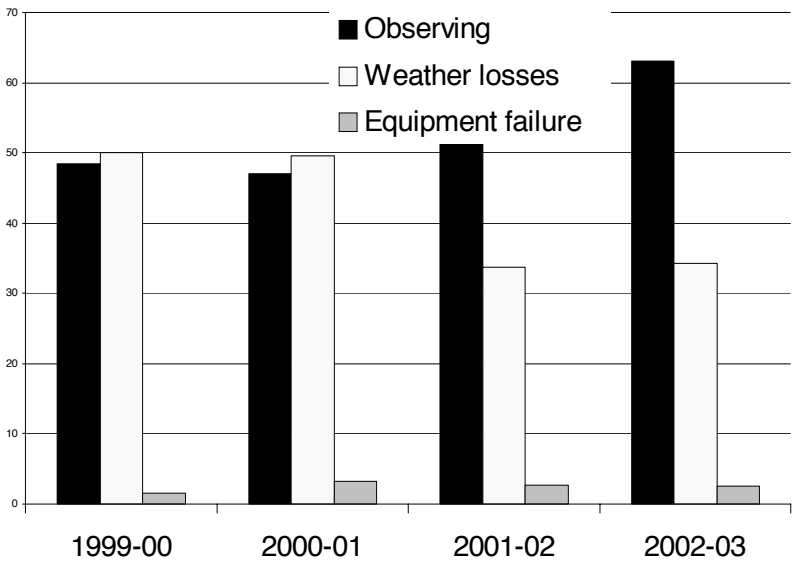


Figure 3.5 The use of observing time at the UKST



faults and a whole night lost due to a failure of the dome hydraulic pump in January 2003.

The year 2002-03 has seen the end of the UKST's photographic program. Twenty exposures were made early in the period, mostly during 6dF engineering work. Of these exposures, 7 were H-alpha survey films still outstanding, a further 7 were high-priority non-survey films, and the remainder were polar-axis test films and I-survey attempts on the south polar field. This is the only remaining I survey field with no A or B grade plate. Unfortunately, the best of the recent attempts is only a C-grade.

Since the beginning of 2003, all scheduled observing time has been used for the 6dF program. The following table summarises the data obtained with 6dF during the period 2002-03 together with those for the previous year (the first in which 6dF was in full operation on the telescope).

Table 3.2 6dF observations

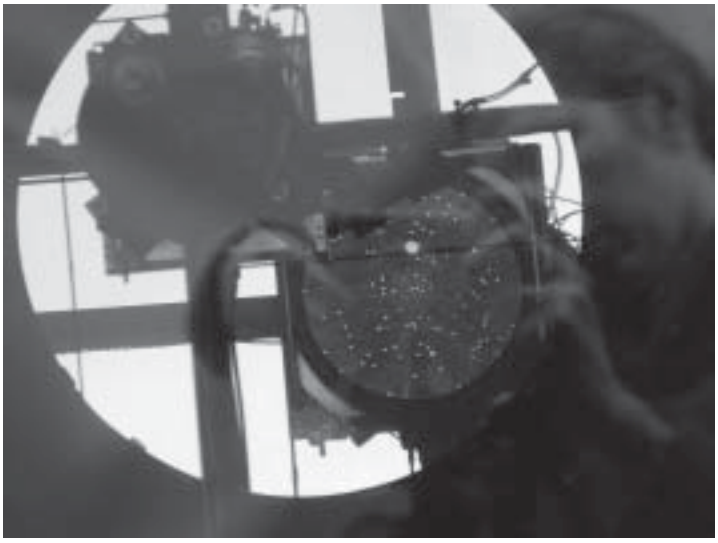
	6dFGS Fields	RAVE Fields	Non-survey Fields	Total Fields	Total exp. (hours)
2001-02	261		124	385	713.6
2002-03	351	47	162	560	1078.6

The 6dF Galaxy Survey (6dFGS) is progressing satisfactorily, and is now approaching its half-way stage. The first 6dFGS public data release took place in December 2002. Currently, 6dFGS uses approximately 75% of the available time on the UKST. The remaining time was used for non-survey programs undertaken by Bessell, Casali, Colless, Croom, Drew, Harrison, Parker, Rose and Vaughan.

Six additional unscheduled Bright-of-Moon nights per lunation were used by the Bessell/Beers contract 6dF program (radial velocities of high-latitude stars) until this terminated in April 2002. (These observations are included in the above statistics as non-survey fields.) Since 11 April 2002, seven unscheduled Bright-of-Moon nights per month have been allocated to the start-up phase of the RAVE (RAdial Velocity Experiment) survey.

All performance targets for 6dF are now being met, although there continues to be a slow attrition of science fibres. A program of scheduled repairs has been introduced to maintain a high level of fibre availability. This involves removing each of the two field plates from service for short periods so that 6dF is operated in 'Autofib' (one field plate) mode; however, a relatively high level of performance is still maintained.

Major upgrades to the 6dF spectrograph took place during September 2002. A number of efficiency-increasing steps were taken, including the introduction of VPH gratings. A side-effect has been improved pupil imagery resulting from the geometry of the VPH layout, yielding a better PSF over the area of the detector. The use of reflectance gratings has now been discontinued, and 6dF is offered with 425R, 580B, 1201B, 1516R and 1700I VPH gratings. A further aspect of the upgrade was a new walk-in housing for the spectrograph, which greatly improves accessibility for field-plate and grating exchange.



Above: A zoomed image of the back-lit 6dF plate with the dome lights switched off.

Right: A picture of the 6dF field plate with fibres back-illuminated. This picture was taken with a SONY Cybershot S75 digital camera attached to the tripod. The dome lighting was left on to show the internal telescope structure. The primary mirror is clearly visible.

Key result area: 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.

Organisational statistics

There were 12 research astronomers on the staff of the AAO at 30 June 2003. Six 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 six 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 4.5 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 last three years 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 are 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. The strong increase in AAO P.I.s shows that staff are taking more of a leading role in programs, while the proportion of programs with AAO involvement stays fairly constant.

Figure 3.6 Total number of scheduled AAT observing programs

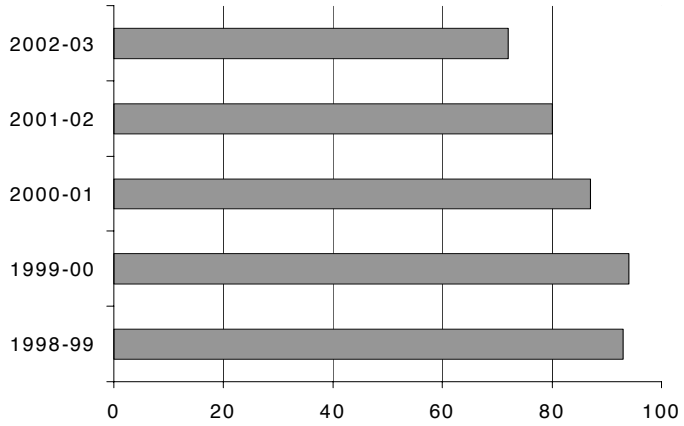


Figure 3.7 Number of scheduled AAT observing programs by location of Principal Investigator (P.I.)

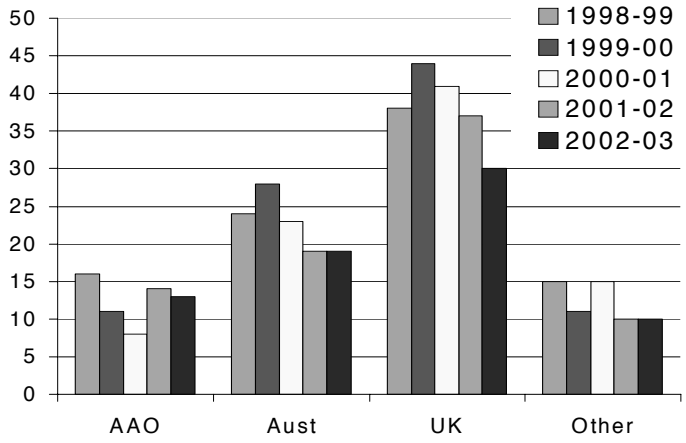


Figure 3.8 Percentage use of the AAT by location of all investigators

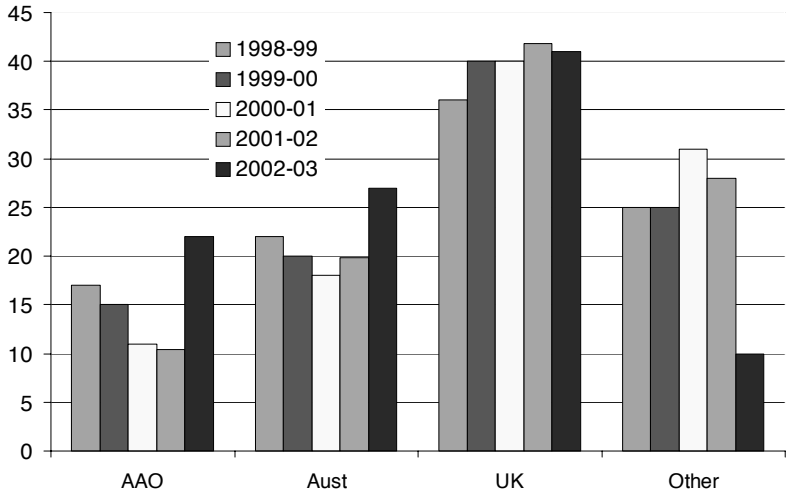


Figure 3.9 shows the total numbers of research papers published in refereed journals using data from the AAT and the UKST. Also shown are the total number of AAO papers, published by AAO staff, students and visitors. When conference papers are included, the corresponding totals are 110 AAT data papers, 29 UKST data papers and 110 AAO papers. This year sees a sharp increase in AAO publications, which have reached an all-time high. The results from the 2dF redshift surveys are largely responsible for this peak. 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 Principal Investigator (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 UK publications from the AAT and UKST are almost double that of the previous year. 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. Note that the total AAO papers does not equal the sum of the three columns in Figure 3.12 because a few papers contain both AAT and UKST data. As mentioned, publication numbers has peaked. The trend to papers without AAT and UKST data continues, but the number of AAT 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 2.3 papers per program. This figure reflects the longer time needed to complete and publish results from major surveys such as the redshift surveys.

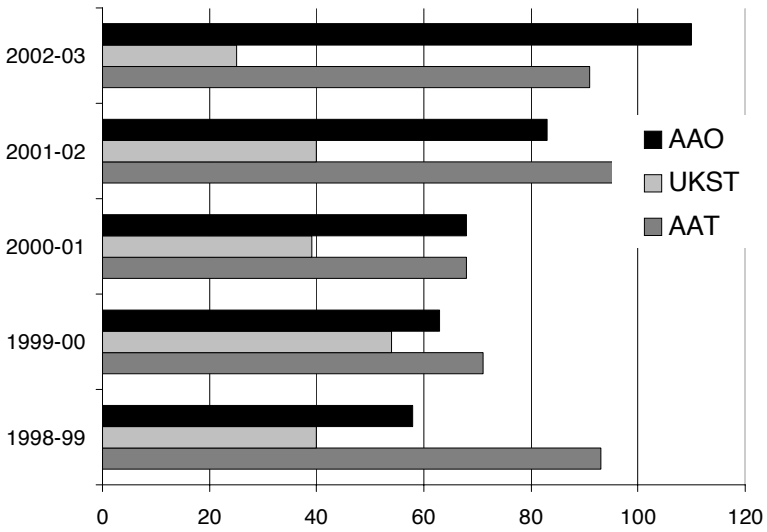


Figure 3.9 Total number of publications using AAT and UKST data, and AAO publications

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

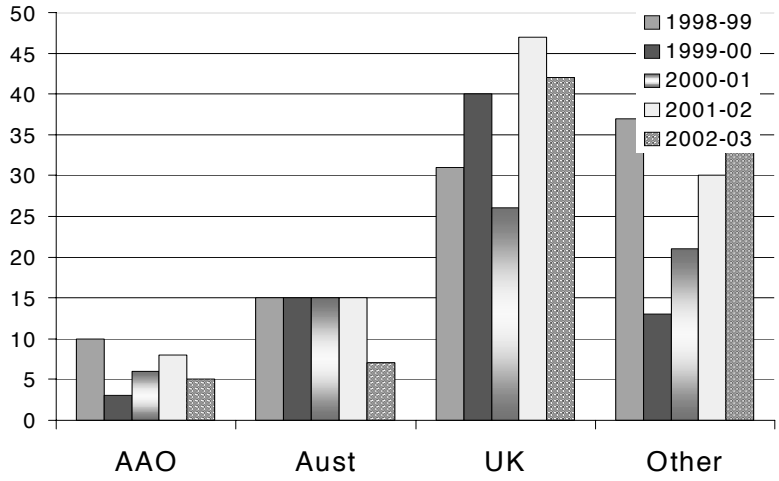


Figure 3.11 Research papers published using UK Schmidt data, by location of First Author.

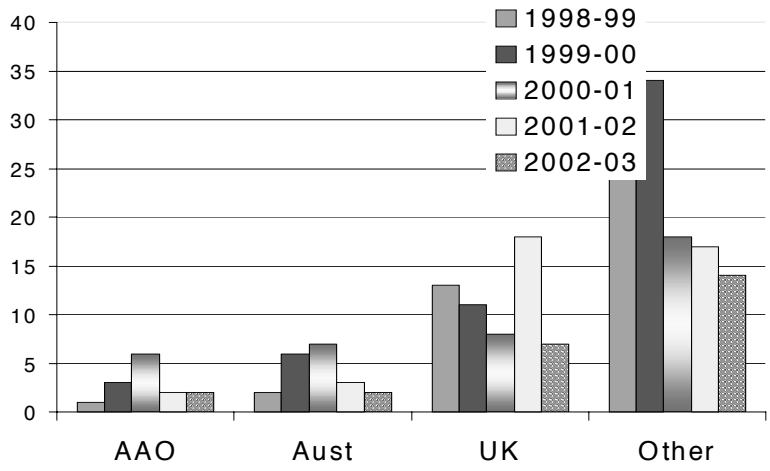


Figure 3.12 AAO publications by AAO staff, students and visitors

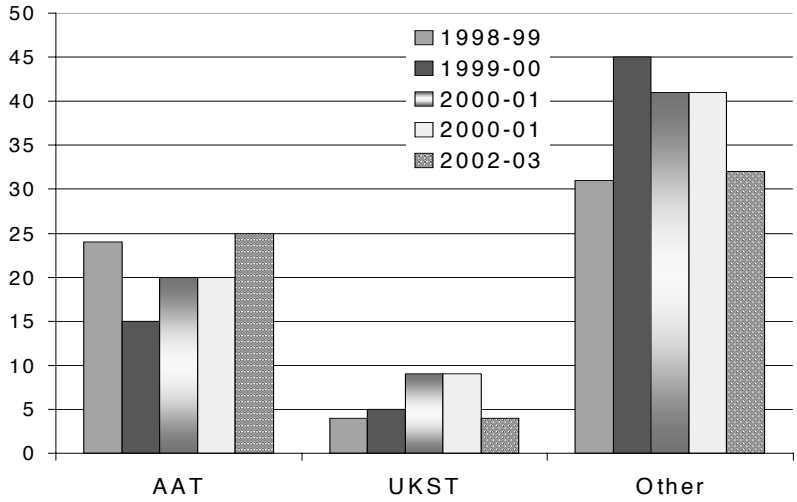
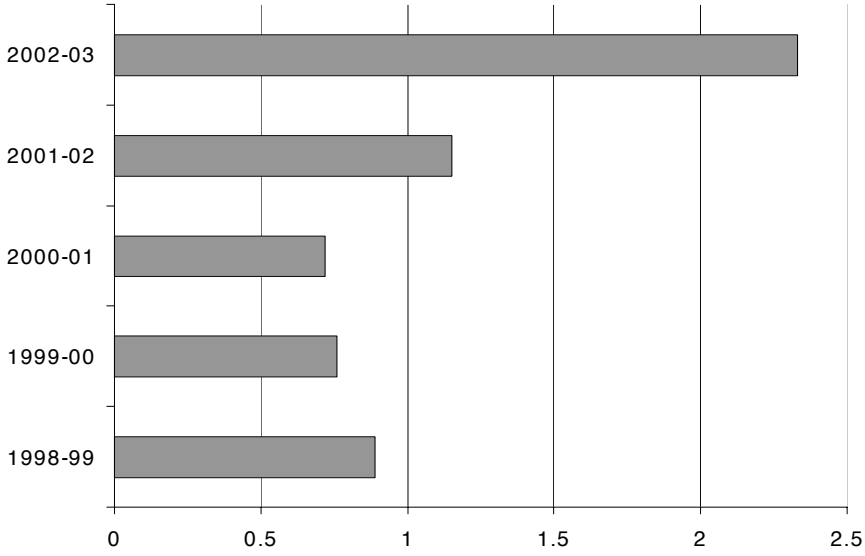


Figure 3.13 Publications per AAT observing program



Key result area: 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

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 2002-03 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.

Organisational statistics: AAO instrumentation

The AAO spends about 15 percent 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.

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

Instrument	2000-01*	2001-02*	2002-03*
2dF	37.0	33.8	22.6
UCL coude echelle spectrographs (UCLES & UHRF)	20.8	23.2	29.7
Taurus II & Taurus tunable filter (TTF)	12.6	12.7	9.9
Infrared imager/ spectrograph (IRIS2)[1]		7.6	11.5
RGO spectrograph	8.3	8.0	10.9
Wide field imager (WFI)[1]	6.3	6.0	7.4
SPIRAL integral field spectrograph[1]	2.3	4.7	4.6
Instruments supplied by users	6.7	4.3	3.8

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

[1] *WFI and SPIRAL were first used in 2000-01. IRIS2 was first used in 2001-02.*

The Two-degree Field (2dF) facility continues to attract the most observing proposals and still receives a large allocation of telescope time. With the completion of the two major redshift survey programs in July 2001, we have seen a shift to smaller and varied programs. Demand for the high-resolution UCLES and UHRF spectrographs also remains high, with 43% of allocated UCLES time devoted to the ongoing search for extrasolar planets. In addition, a number of projects were carried out using the visiting Semel Polarimeter, which attaches to UCLES, to study variations in nearby stars.

The close of semester 2003B will see 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 venerable RGO spectrograph, leaving the AAT with a streamlined suite of four instruments: 2dF, UCLES/UHRF, WFI and IRIS2.

The new workhorse instrument IRIS 2 provides a wide range of observing modes in the infrared, with a far larger and more efficient detector than that in the aging IRIS. It offers a wider range of spectral options, and the ability to observe many objects at once. During its first commissioning run, IRIS 2 was used to help identify the source of one of the mysterious Gamma-Ray Bursts.

Detector use: Charge coupled devices (CCDs) remain the astronomical detector of choice. 2dF, WFI and IRIS 2 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 is due to be commissioned with 2dF in November 2003.

There is an increasing emphasis at the AAO in instrumentation design and construction. During 2002-03, the AAO successfully delivered OzPoz to the European Southern Observatory and in the last few months, it has passed all tests and is already in huge demand by the VLT community. AAO's involvement in the design of DAZLE, a visitor instrument for the VLT, also came to a close. AAOmega, the next major instrument intended for the AAT, successfully navigated the preliminary design review - the instrument is on track for first light in 2005.

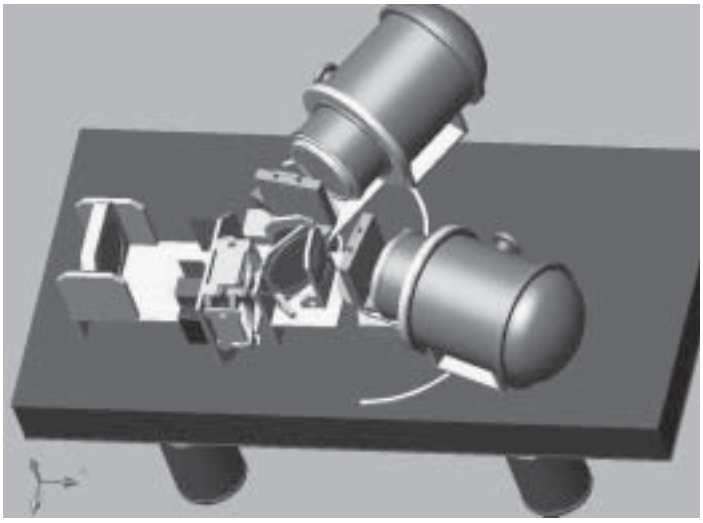
Instrument Science

The Instrument Science group has begun to pursue a number of key technology areas for 8m, 30m and 100m telescopes. These include two new types of fibre positioners, tunable filters, cryostat robotic positioners (cryobots), and telescope inertial drives. The cryobot positioners have many uses, in particular, they can carry adaptive optics units to allow relayed optical imaging over a wide MCAO plane. All of these developments will require close links with industry and other instrument development groups.

Research Networks

The Instrument Science group has worked hard to establish strong links with high tech industry. These links are increasingly important if the AAO is maintain its lead in certain key technology areas. The AAO has negotiated involvement in four technology networks currently under review by the ARC. The four networks seek to advance the fields of optical fibres and photonics, microfabrication, adaptive optics and space technologies. Now that we are better linked to the Australian industrial landscape, the group seeks to make closer links with UK and USA universities and industrial scene.

Internal Projects



Proposed mechanical layout of AAOmega

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 completed (May 2003) its Preliminary Design Review and is expected to be commissioned in early 2006.

IRIS2

IRIS2 (http://www.aao.gov.au/AAO/iris2/iris2.html) is the near infrared spectrograph/imager for the AAT and has been in routine operation for well over a year. However, IRIS2 has recently received recognition amongst the wider Engineering community. At a gala ceremony held at the Sydney Convention Centre on 11 October 2002, IRIS2 took out top honours in the annual Engineering Excellence Awards of the Institution of Engineers Australia (Sydney Division). In being awarded the Bradfield Award for

outstanding engineering achievement, IRIS2 emulated the achievement of its predecessor, IRIS, which won the same award in 1993. Not content with that success however, IRIS2 then went on to pick up an Engineering Excellence Award at the Institution of Engineers Australia national awards ceremony held in Canberra a month later.

6dF Spectrograph Upgrade

The 6dF system (http://www.aao.gov.au/AAO/ukst/6df.html) is a common-user multi-object spectroscopy system operated by the AAO on the 1.2-m UK Schmidt Telescope. It uses an off-telescope robotic fibre positioner to configure up to 150 fibres on interchangeable field-plate units, which replace the original photographic plate-holders of the telescope. In October 2002, the upgrade of the spectrograph was completed allowing volume phase holograph gratings to be used on the 6df Galaxy (6dFGS) and Radial Velocity (RAVE) surveys.

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. Operation with this system is expected to start in the next couple of months and it will be fully operational in both Summer and Winter modes by March 2004.

AAT Infrastructure Project

The AAO2 controllers project has already provided a World class controller for the IRIS2 detector system and is expected to be implemented in its optical detector (CCD) form, replacing all the old controller units for AAT detector systems over the next year.

The design stage for upgrades to the AAT's telescope and instrument control systems have all but been finalised. The upgrade will be carefully managed over the next 3 years to ensure alteration causes minimal "down time" for the telescope.

External Instrumentation

OzPoz

In February 2003 the Anglo-Australian Observatory completed its OzPoz (http://www.eso.org/instruments/flames/OzPoz.html) contract with the European Southern Observatory (ESO) for a robotic fibre positioner to feed the FLAMES facility at the Very Large Telescope (VLT) in Chile. Science verification for the Facility took place in January 2003 and OzPoz has since been in routine operation.

DAZLE

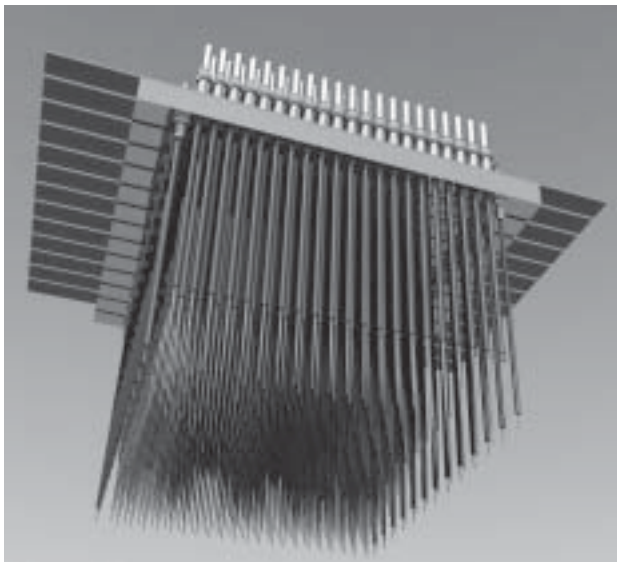
DAZLE (http://www.ast.cam.ac.uk/~optics/dazle/) is a narrow band imaging instrument under joint development by the Institute of Astronomy (IOA) in Cambridge and the Anglo-Australian Observatory with the singular aim of detecting the most distant objects ever detected in the Universe. The instrument has been designed for use at the visitor focus of the ESO VLT in Chile. The AAO has recently completed a contract to design the system, based on the IOA CIRPASS instrument. The design drawings have been sent to Cambridge where the instrument will be manufactured and tested.

Echidna

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 400m fibres can be moved simultaneously to their required positions. The project is currently in the manufacturing stage and is expected to be ready for delivery by mid 2004.

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 is due to be completed by November 2003 at which point a final concept presentation will be delivered to AURA.



Above: The 400-fibre Echidna positioner

Performance indicators

The instrumentation program is shaped 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 dropped slightly from a high of 4.0 last year to 3.8 this year, still however meeting the performance indicators as outlined in the corporate plan.

Siding Spring Observatory lies in the electorate of the Deputy Prime Minister, John Anderson. On 15 March Mr Anderson visited the Observatory, accompanied by his wife Julia and daughters Laura and Georgina, the British High Commissioner Sir Alastair Goodlad and his wife Lady Goodlad, and the Mayor of Coonabarabran, Fred Clancy. The party was shown over the telescopes by ANU and AAO staff. Later in the year Mr Anderson and his family returned to the observatory for an informal, night-time visit. L-R: Professor Penny Sackett, Director, ANU Research School of Astronomy and Astrophysics; Mr John Anderson, Deputy Prime Minister; and Dr Peter McGregor, ANU RSAA.

Key result area: AAO resources

Key outcome: AAO funds to be used optimally and to have stimulated, 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 9.5 full time equivalents (FTE) on fixed term contracts, one of them part-time, and 60.65 FTE on indefinite appointments, six 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.

Table 3.5 Staff numbers by tenure

At 30 June 2003 the staff positions were:

	Full time	Part time	FTE
Director	1		
Research astronomers (fixed term)	3		
Instrument scientists (fixed term)	1		
Other fixed term	4	1	0.50
Research astronomers (indefinite)	3	1	0.50
Instrument scientists (indefinite)	7	1	0.75
Other indefinite	47	4	2.40
Total	66	7	4.15

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. The Board reports annually to the Minister for Education, Science and Training.

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 two or 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.

Both the premium and compensation claims are well below levels of five or six years ago, though there was an increase in claims in 1999-2000 and a contingent rise in premium the following year. There have been no notifications of dangerous occurrences for the last four years.

Table 3.5 Worker's compensation and dangerous occurrences

	1998-99	1999-00	2000-01	2001-02	2002-03
Comcare premium	$28 770	$19 200	$23 751	$16 926	$15 612
No of claims	0	3	0	1	5
Payments made	0	$635	0	$75	$12 400
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.

Key result area: 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.'

World Wide Web and digital images

The AAO's primary conduit for external communication, the World Wide Web, 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.

The science web page has been revamped with the aim of attracting students towards collaborative work at the AAO either through vacation positions or thesis study. A "Recent Results" page is included which summarises the current AAO science stories and publications and is updated three times a year.

A wealth of more technical information is also available and is constantly being updated and developed. A newsletter is published three times a year on the web, and distributed as a hardcopy, to over 1000 subscribers and institutions. Abstracts from AAO publications are also sent to interested institutions.

"Science in the Pub": part of Coonabarabran's 2002 Festival of Astronomy.
L-R: Fred Watson (AAO), Michael Burton (UNSW), Lisa Hampshire (ABC), and John Sarkissian (CSIRO). Photo: Chris McCowage

Publicity and outreach

The AAO maintains good connections with the local Coonabarabran community, each year running events as part of Coonabarabran's "Festival of the Stars". The first of these, on 25 October, was a session of "Science in the Pub", compered by Fred Watson, Astronomer-in-Charge at the AAT, and Lisa Hampshire of ABC Radio. "Science in the Pub", which has been running in Australia since 1998, is a moderated discussion within a set format. This year, Michael Burton of UNSW and John Sarkissian from the Australia Telescope National Facility, tackled "The Cosmic Jigsaw: are there pieces missing?" This event was followed by Siding Spring Observatory's open day on 27 October, and then the annual Bok lecture, held in Coonabarabran on 3 November. The Bok lecture is a free talk given each year to commemorate Professor Bart Bok of the Australian National University, who oversaw the establishment of Siding Spring Observatory. The speaker for 2002 was Dr Brad Carter of the University of Southern Queensland, a member of the

Figure 3:14 Media Interviews

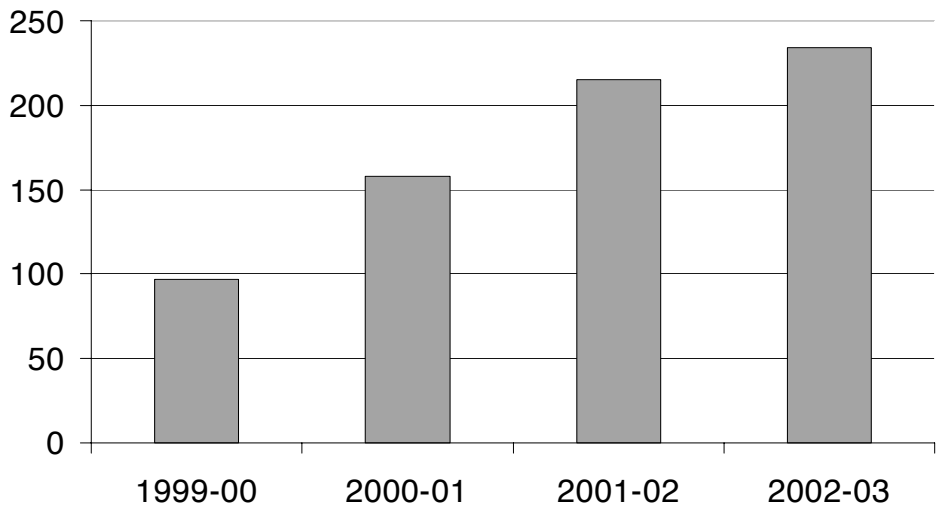
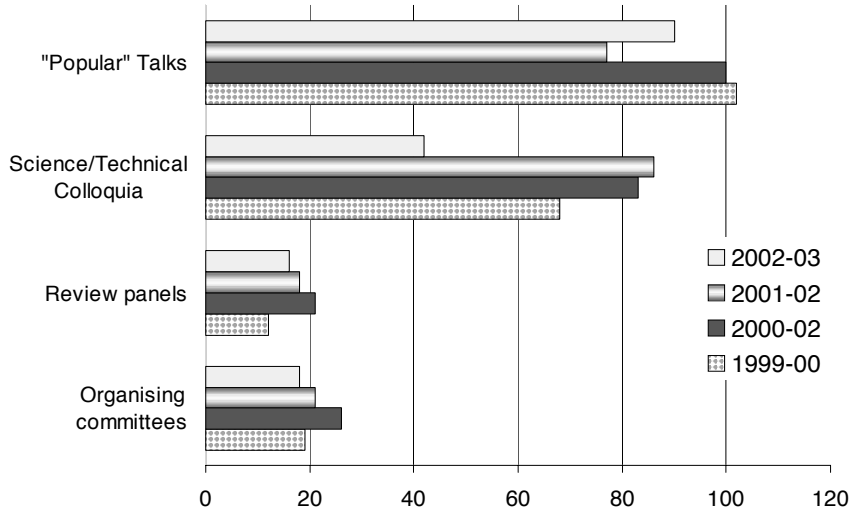


Figure 3.15 External Communications



Visitors at the Observatory open day in 2002. Photo: Chris McCowage

Anglo-Australian Planet Search team, who described how extrasolar planets are found and what we may learn about them in future.

Planets were also the topic of two of the five media releases issued about the AAO's work this year (one by PPARC). The second story, released in late June and embargoed to 3 July, concerned the discovery of the most solar-system-like planetary system found to date. This gained widespread coverage, appearing in outlets such as the New York Times, The Guardian, the BBC, and the Discovery Channel and Space.com websites. Coverage was also gained from releases about work using AAO facilities but issued by other

institutions - for instance, the discovery of “ultra-compact dwarf galaxies” by Michael Drinkwater et al. (Nature 423, 519-521 (2003)). Fewer AAO releases were issued than in the last couple of years, partly because much of the AAO press officer’s time this year was diverted to promoting the International Astronomical Union’s 25th General Assembly, held in Sydney in July 2003. AAO images were used in materials to advertise the meeting to the astronomical community world-wide.

As mentioned on page 35, the AAO’s new IRIS2 instrument was a winner at the 2002 Engineering Excellence Awards of the Sydney Division of Engineering Australia, both topping its category of ‘Innovations and Inventions’ and receiving the JJ Bradfield Award for outstanding engineering. IRIS2 and the five other Awards category winners are now the subject of an exhibition at Sydney’s Powerhouse Museum. The exhibition runs for 12 months from December 2002. In May, AAO staff Chris Tinney and John Dawson gave a public talk on IRIS2 at the Museum, as part of its annual Australian Innovation Festival.

Australian television coverage was low this year. In February, a local network covered the dedication of IRIS2 by Science Minister Peter McGauran (see photo page 19); in May ABC TV’s ‘New Dimensions’ program profiled the AAO’s Head of Astronomy, Chris Tinney in his role as IRIS2 Project Scientist and as a planet hunter. Staff gave only three other TV interviews during the year. However, activity increased in other areas, with staff giving 90 popular talks (up from 77 the previous year) and 231 other media interviews (up from 215 the previous year). Fred Watson continued his regular thrice-weekly radio segments.

The AAO values opportunities for direct contact with political stakeholders. In February this year the Minister for Science, Peter McGauran, visited the AAT to dedicate the award-winning IRIS2 instrument. In March, Deputy Prime Minster John Anderson visited Siding Spring Observatory, accompanied by the British High Commissioner Sir Alastair Goodlad and his wife Lady Goodlad, and the Mayor of Coonabarabran, Fred Clancy.

Australian National
Audit Office

INDEPENDENT AUDIT REPORT

To the Minister for Education, Science and Training

Matters relating to the Electronic Presentation of the Audited Financial Report

This audit report relates to the financial report of the Anglo-Australian Telescope Board for the year ended 30 June 2003 included on the Anglo-Australian Telescope Board's web site. The Members of the Board are responsible for the integrity of the Anglo-Australian Telescope Board's web site.

The audit report refers only to the statements named below. It does not provide an opinion on any other information which may have been hyperlinked to/from the audited financial report.

If the users of this report are concerned with the inherent risks arising from electronic data communications they are advised to refer to the hard copy of the audited financial report to confirm the information included in the audited financial report presented on this web site.

Scope

I have audited the financial statements of the Anglo-Australian Telescope Board for the year ended 30 June 2003. The financial statements comprise:

- Statement by Directors;
- Statements of Financial Performance, Financial Position and Cash Flows;
- Schedules of Commitments and Contingencies; and
- Notes to and forming part of the Financial Statements.

The Members of the Board are responsible for the preparation and presentation of the financial statements and the information they contain. I have conducted an independent audit of the financial statements in order to express an opinion on them to you.

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

The audit has been conducted in accordance with Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards, to provide reasonable assurance as to whether the financial statements are free of material misstatement. Audit procedures included examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial statements, and the evaluation of accounting policies and significant accounting estimates. These procedures have been undertaken to form an opinion as to whether, in all material respects, the financial statements are presented fairly in accordance with Accounting Standards and other mandatory professional reporting requirements in Australia and statutory requirements so as to present a view which is consistent with my understanding of the Anglo-Australian Telescope Board's financial position, its financial performance and its cash flows.

The audit opinion expressed in this report has been formed on the above basis.

Audit Opinion

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

(i) the financial statements are based on proper accounts and records;

(ii) the financial statements give a true and fair view, in accordance with applicable Accounting Standards and other mandatory professional reporting requirements in Australia and the Finance Minister's Orders, of the financial position of the Anglo-Australian Telescope Board as at 30 June 2003, and its financial performance and cash flows for the year then ended;

(iii) the receipt, expenditure and investment of moneys, and the acquisition and disposal of assets, by the Board during the year have been in accordance with the *Anglo-Australian Telescope Agreement Act 1970*; and

(iv) the financial statements have been prepared in accordance with the Finance Minister's Orders made under the *Commonwealth Authorities and Companies Act 1997*.

Australian National Audit Office

P Hinchey
Senior Director

Delegate of the Auditor-General

Sydney

10 October 2003

Appendix B
Staff, Client Service Charter & OH&S

AAO Staff at 30 June 2003

Director:	B J Boyle, PhD
Executive Officer & AAT Board Secretary:	J E Wilcox, MSc (Econ)
Head of Instrumentation:	S C Barden, PhD
Head of Astronomy:	C G Tinney, PhD
Head of Instrument Science:	J Bland-Hawthorn, PhD
Operations Manager:	C J McCowage§
Astronomer-in-Charge:	F G Watson, PhD§
Astronomy & Instrument Science:	J A Bailey, PhD; T J Bridges, PhD; S M Croom, PhD; P R Gillingham, BE; R Haynes, PhD; A J McGrath, PhD; A M Moore, PhD; M Oestreich, BE; S D Ryder, PhD; W Saunders, PhD; R A Stathakis, PhD
Project Management:	G Frost, BE; C J Evans, MIEAust CPEng
Administration:	D Hewawitharana; D R Kingston, CPA; R L Martin§; K Powell, BA; G C Simms; H M Woods, MLitt
Library:	S D Ricketts, BSc
Computing Group:	H Davies, MEngSc: R G Dean§; T J Farrell, BSc; R Heald, BSc; P Innes, BA; D M James, BSc (App); G J Kitley; C Ramage BSc; K Shortridge, PhD; S Smedley, BApp Sc; K M Tapia-Sealey, PhD; M Vuong, BE, B App Sc
Electronics Group:	J A Collins§; D B Correll, BE; S M James§; D J Mayfield; R Muller; R G Patterson§; E J Penny; J H Stevenson§; L G Waller, BE
Optical and Mechanical:	J K Brzeski, BE; V Churilov, MSc; J P Dawson, BE; M E Hilliard; D Horiuchi; M M Kanonczuk§; U Klauser; A F Lankshear, BSc§; S Miziarski, DipME; N A Schirmer; G A Smith, BE BSc; D J Stafford§; J D Whittard
Telescope Operations & Maintenance:	UKST: C J P Cass, BA§; J Dawe, PhD§; M Hartley, BSc§; K S Russell§ AAT: W C Clarke§; K Fiegert§; F F Freeman§; B Jones§;S Lee§; J Pogson§;
AAO Associates:	R D Cannon PhD; D F Malin, DSc; W Orchiston, BSc PhD

§ denotes staff at Siding Spring

Client Service Charter

Who We Are

The Anglo-Australian Observatory consists of the 3.9-metre Anglo-Australian Telescope (AAT) and the 1.2-metre UK Schmidt Telescope (UKST) on Siding Spring Mountain, outside Coonabarabran, NSW, and a laboratory in the Sydney suburb of Epping.

Our Purpose

The main purpose of the Anglo-Australian Observatory is to facilitate the best possible science through the provision of world-class optical and infrared observing facilities for British and Australian astronomers.

Our Clients

Our clients are the astronomers who are awarded, by independent time allocation committees in the United Kingdom and Australia, time to observe on Anglo-Australian Observatory telescopes.

About This Charter

This Charter sets out our commitments towards the service we will provide to you. It also sets out what you can do to make sure you get the best possible outcome from your observing run.

The Observatory is committed to maintaining and improving the quality of its services. We will monitor our performance in meeting the commitments set out in this Charter and change it as necessary. Your suggestions for improvement would be valued.

The AAO will report on its performance in its Annual Report.

If You Have a Complaint

If you have a problem or a complaint, please let the Director know of your concerns and, if possible, how you think improvements might be made. You can phone him on +61 2 9372 4811, fax on +61 2 9372 4880 or email Director@aaoepp.aao.gov.au

What You Can Expect From Us

Courtesy

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

Telescope Operations

- The AAT and UKST will be fully operational at the start of each night
- A technician will be on duty during the first part of the night to respond immediately to any technical problems

- At other times there will be a two-hour response time by the afternoon shift technician
- An AAT night assistant will be on duty all night and will operate the telescope. If there are any problems during the night, the night assistant will take immediate action either to fix the problem or arrange for someone else to fix it.

Instrumentation

- An AAO support astronomer will get in touch with you at least four weeks before your observing run to confirm the details of your run
- We will provide the instrumentation at the start of the evening that will enable you to undertake your scientific program as specified
- If requested, a support astronomer will be present for the first night to facilitate your obtaining the best possible data
- We will make available full documentation to guide you in carrying out your observations.

Data Exploitation

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

General Working Environment

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

Administration

- We will respond by the next working day to your inquiries
- We will make your Lodge bookings for you
- We will make bookings on the airline between Sydney and Dubbo for you and arrange a taxi to meet the plane at Dubbo.

What We Would Like You To Do

- Arrive properly prepared for your observing run
- Make yourself familiar with and follow the safety guidelines
- Be thoughtful and considerate in the demands you make of AAO staff
- Make sure your data is recorded on a suitable backup medium at the end of your observing run
- Give us constructive feedback on how we may improve our service, using the observer report form
- If we do particularly well, let us know.

Occupational health and safety

AATB Policy

The overall aim of the Anglo-Australian Telescope Board's safety policy is that managers and employees at every level and working visitors are provided with a safe and healthy working environment, and every practicable measure is taken to ensure this. In establishing detailed Anglo-Australian Telescope Board safety and health policies the recommendations of bodies such as the National Occupational Health and Safety Commission are followed.

The mechanism for continuing consultation between management and the employees on occupational health and safety issues and for reviewing the effectiveness of the measures taken to ensure the health and safety of the Board's employees are Health and Safety Committees established at Coonabarabran and Epping. The Executive Officer, together with one representative of management at each site nominated by the AAO Director, are members of the Coonabarabran and Epping Health and Safety committees. The health and safety representative and one other elected staff member comprise the remaining membership of each safety committee.

The Safety Committees act as foci for safety issues but their existence does not absolve each employee of the responsibility for safe working consistent with the extent of the employee's control over, or influence upon, working conditions and methods.

It is also each employee's responsibility to report or recommend to the Safety Committee measures which, in the employee's view, are necessary to avoid, eliminate, or minimise safety and health hazards in the workplace of which he or she is aware.

Each employee must observe all instructions issued by supervisors in the course of a job, or written instructions issued by the Director or the Director's nominee, which relate to the health and safety of the employee and others and must make proper use, or to the extent of his or her responsibility, ensure that proper use is made of all safeguards, safety devices, personal protective equipment and other appliances provided for health or safety purposes.

No employee shall, or cause another employee to, interfere with, remove, displace, or render ineffective any safeguard, safety device, personal protective equipment or other appliance provided for safety purposes except when necessary as part of an approved maintenance or repair procedure. The names of the members of each Health and Safety Committee are posted on notice boards at Coonabarabran and Epping.

Appendix C
AAT Board members & committees

Board members

The AAT Board has six members, three appointed by each country, and the role of Chair alternates between the two countries. Professor R D Ekers is Chair and Professor Mark Birkinshaw is Deputy Chair..

At 30 June 2003 the Board members were:

Australia
Professor R D Ekers, (Chair), Director, Australia Telescope National Facility
Professor K C Freeman, Research School of Astronomy and Astrophysics, Australian National University
Professor L Cram, Program Director, Australian Research Council

United Kingdom
Professor M Birkinshaw, (Deputy Chair), William P Coldrick Professor of Cosmology and Astrophysics, University of Bristol
Dr P Roche, Department of Astrophysics, University of Oxford
Mr G Brooks, Head of Astronomy Division, Particle Physics and Astronomy Research Council

Special responsibilities

Professor Cram and Mr Brooks have been nominated by the Designated Agencies, DEST and PPARC respectively, to represent their agencies on all matters in relation to the operation of the Agreement.

Board meetings

The AAT Board usually meets twice each year. All members attended both meetings.

In September 2002, the meeting was hosted by the University of Bristol. In April 2003, the Board meeting was held at Siding Spring and at Mt Stromlo. The associated symposium was held jointly with the Australia Telescope National Facility (ATNF), at Mt Stromlo. These joint symposia help to maintain the strong links which exist between the radio and optical communities in Australia.

AAO Director

The AAO Director, Professor B J Boyle, is responsible for the successful operation of the telescopes, for providing the best possible facilities for all telescope users and for ensuring that the Observatory maintains its high standing in the international scientific community. The Director also actively pursues his own scientific research.

Advisory committees

AAO Users' Committee

The AAO Users' Committee (AAOUC) consists of six members: three external members each from the UK and Australia.

Its terms of reference are:

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

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

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

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

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

At 30 June 2003 the six AAOUC members were:

Australia

Dr G Da Costa (ANU) (Chair)
Dr T Bedding (Sydney)
Dr M J Drinkwater (Queensland)

United Kingdom

Dr S J Warren (ICSTM)
Dr Mark Casali (ROE)
Dr S G Ryan (OU)

Time allocation committees

Under Article 5 of the Anglo-Australian Telescope Agreement, observing time and use of associated facilities and services is shared equally by Australia and Britain. The Board has chosen to exercise its responsibility for the allocation of time on the AAT and UKST through arrangements made with the two Designated Agencies. Under guidelines set by the Board, each agency operates through national committees—the Australian Time Assignment Committee (ATAC) and the UK Panel for the Allocation of Telescope Time (PATT) — which allocate time on the AAT on the basis of the scientific merit of proposals submitted by astronomers, including AAO staff.

At 30 June 2003, membership of the committees was:

ATAC

Dr B Gibson (Swinburne) *Chair*
Dr M Drinkwater (UQ) *Deputy Chair*
Dr P Francis (RSAA)
Dr D Forbes (Swinburne)
Dr B Schmidt (RSAA)
Dr M Burton (NSW)

PATT (AAT TAG)

Dr A Zijlstra (UMIST) *Chair*
Dr P Best (Edinburgh)
Dr J Liske (St Andrews)
Dr S Ryan(OU)

ANGLO-AUSTRALIAN TELESCOPE BOARD

STATEMENT OF FINANCIAL PERFORMANCE
for the year ended 30 June 2003

	Notes	**2003**	2002
		$'000	$'000
REVENUE			
Revenues from ordinary activities			
Revenue from Australian government	*4A*	**3,929**	3,807
United Kingdom government contribution	*4B*	**3,700**	3,550
Goods and services	*4C*	**1,694**	1,467
Interest	*4D*	**56**	42
Other	*4E*	**311**	354
Revenues from ordinary activities		**9,690**	9,220
EXPENSE			
Expenses from ordinary activities			
Employees	*5A*	**5,028**	5,307
Suppliers	*5B*	**2,913**	2,349
Depreciation and amortisation	*5C*	**2,739**	4,009
Write-off of assets	*5D*	**-**	401
Net foreign exchange loss	*5E*	**3**	-
Expenses from ordinary activities		**10,683**	12,066
Net (deficit)		**(993)**	(2,846)
Net credit to asset revaluation reserve	*10*	**1,379**	1,750
Total revenues, expenses and valuation adjustments recognised directly in equity.		**1,379**	1,750
Total changes in equity other than those resulting from transactions with owners as owners		**386**	(1,096)

ANGLO-AUSTRALIAN TELESCOPE BOARD

STATEMENT OF FINANCIAL POSITION
as at 30 June 2003

	Notes	**2003**	2002
		$'000	$'000
ASSETS			
Financial assets			
Cash	*6A*	**619**	1,032
Receivables	*6B*	**304**	624
Total financial assets		**923**	1,656
Non-financial assets			
Land and buildings	*7A*	**23,164**	22,282
Infrastructure, plant and equipment	*7B*	**24,272**	24,374
Other	*7D*	**80**	82
Total non-financial assets		**47,516**	46,738
TOTAL ASSETS		**48,439**	48,394
LIABILITIES			
Provisions			
Employees	*8A*	**1,684**	1,653
Total Provisions		**1,684**	1,653
Payables			
Suppliers	*9A*	**138**	100
Other	*9B*	**556**	966
Total Payables		**694**	1,066
TOTAL LIABILITIES		**2,378**	2,719
NET ASSETS		**46,061**	45,675
EQUITY			
Reserves	*10*	**35,975**	34,596
Retained surpluses	*10*	**10,086**	11,079
TOTAL EQUITY		**46,061**	45,675
Current liabilities		**1,495**	1,837
Non-current liabilities		**883**	882
Current assets		**1,003**	1,738
Non-current assets		**47,436**	46,656

ANGLO-AUSTRALIAN TELESCOPE BOARD

STATEMENT OF CASH FLOWS
for the year ended 30 June 2003

	Notes	**2003**	2002
		$'000	$'000
OPERATING ACTIVITIES			
Cash received			
Goods and services		**1,601**	1,710
Revenue from Australian Government		**3,929**	3,807
Contributions from UK Government		**3,700**	3,550
Interest		**57**	40
GST recovered from ATO		**363**	292
Other		**308**	354
Total cash received		**9,958**	9,753
Cash used			
Employees		**(4,997)**	(5,190)
Suppliers		**(3,234)**	(2,611)
Total cash used		**(8,231)**	(7,801)
Net cash from operating activities	*11*	**1,727**	1,952
INVESTING ACTIVITIES			
Cash used			
Purchase of property, plant and equipment		**(2,140)**	(1,341)
Total cash used		**(2,140)**	(1,341)
Net cash (used by) investing activities		**(2,140)**	(1,341)
Net increase/(decrease) in cash held		**(413)**	611
Cash at the beginning of the reporting period		**1,032**	421
Cash at the end of the reporting period	*6A*	**619**	1,032

ANGLO-AUSTRALIAN TELESCOPE BOARD

SCHEDULE OF COMMITMENTS
as at 30 June 2003

	2003	2002
	$'000	$'000
BY TYPE		
Capital Commitments	**-**	-
Other Commitments		
Operating Leases [1]	**97**	101
Total Other Commitments	**97**	101
Commitments Receivable	**(9)**	-
Net commitments	**88**	101
BY MATURITY		
All net commitments		
One year or less	**61**	70
From one to two years	**27**	31
Net Commitments	**88**	101

1.Operating leases exist in relation to motor vehicles. The leases are non-cancellable and for fixed terms of two or three years.

SCHEDULE OF CONTINGENCIES
as at 30 June 2003

	2003	**2002**
	$'000	**$'000**
Contingent liabilities and assets	**-**	**-**

Note 1. Summary of Significant Accounting Policies

1.1 Basis of Accounting

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

The statements have been prepared in accordance with:

- Finance Minister's Orders (being the *Commonwealth Authorities and Companies (Financial Statements for reporting periods ending on or after 30 June 2003) Orders);*
- Australian Accounting Standards and Accounting Interpretations issued by the Australian Accounting Standards Board; and
- Consensus Views of the Urgent Issues Group.

The Statements of Financial Performance and Financial Position have been prepared on an accrual basis and are in accordance with the historical cost convention, except for certain assets, which, as noted, are at valuation. Except where stated, no allowance is made for the effect of changing prices on the results or on the financial position.

Assets and liabilities are recognised in the Statement of Financial Position when and only when it is probable that future economic benefits will flow and the amounts of the assets or liabilities can be reliably measured. Assets and liabilities arising under agreements equally proportionately unperformed are however not recognised unless required by an accounting standard. Liabilities and assets that are unrecognised are reported in the Schedule of Commitments and the Schedule of Contingencies,

Revenues and expenses are recognised in the Statement of Financial Performance when and only when the flow or consumption or loss of economic benefits has occurred and can be reliably measured.

1.2 Changes in Accounting Policy

The accounting policies used in the preparation of these financial statements are consistent with those used in 2001-2002 except in respect of:

- Measurement of certain employee benefits at nominal amounts (refer to note 1.4); and
- The initial revaluation of property, plant and equipment on a fair value basis (refer to Note 1.8;

1.3 Revenue

Australian government and United Kingdom contributions are recognised at the time the Board receives the revenue.

The AAT Board also builds astronomical instrumentation for other observatories and recovers the full economic cost of so doing. Revenue from these activities is recognised at the time the Board raises the invoice.

Grants are received from the Australian Research Council (ARC) and the Particle Physics and Astronomy Research Council (PPARC) of the United Kingdom (UK) for the specific purpose of employing astronomers at the Observatory. Grants are recognised as revenue on receipt.

Resources Received Free of Charge

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

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

The following resources are received free of charge*:*

(i) Use of Land
At Siding Spring Observatory, the 3.9 metre Anglo-Australian Telescope (AAT) building and the 1.2 metre UK Schmidt Telescope (UKST) building are on land owned by the Australian National University (ANU). At Epping, New South Wales, the Board's buildings are on the site of the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The Board has entered into a permissive occupancy agreement with CSIRO covering its establishment at Epping. The value of this land is disclosed in Note 7A. The Board has also entered into a permissive occupancy agreement with the ANU for its establishment at Siding Spring, for which a "peppercorn rental" of one dollar is charged.

(ii) Use of the UK Schmidt Telescope
The UK Schmidt Telescope is owned by PPARC and operated by the Anglo Australian Observatory (AAO).

1.4 Employee Benefits

(a) Benefits

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

Liabilities for wages and salaries (including non-monetary benefits) and annual leave are measured at their nominal amounts. Other employee benefits expected to be settled within 12 months of their reporting date are also measured at their nominal amounts.

The nominal amount is calculated with regard to the rates expected to be paid on settlement of the liability. This is a change in accounting policy from last year required by initial application of a new Accounting Standard AASB 1028 from 1 July 2002. As the Anglo-Australian Telescope Board raises pay rates on 1 July each year, the financial effect of this change is not material.

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

(b) Leave

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

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

The non-current portion of the liability for long service leave is recognised and measured at the present value of the estimated future cash flows to be made in respect of all employees at 30 June 2003. In determining the present value of the liability, the Board has taken into account attrition rates and pay increases through promotion and inflation.

(c) Superannuation

The small number of employees left in the Anglo-Australian Telescope Board Staff Superannuation Scheme voted to transfer to PSS. The AAT Board decided, therefore, to close the scheme with effect from 31 December 2002.

Employees are members of the Commonwealth Superannuation Scheme and the Public Sector Superannuation Scheme. The liability for their superannuation benefits is recognised in the financial statements of the Commonwealth and is settled by the Commonwealth in due course.

The Anglo-Australian Telescope Board makes employer contributions to the Commonwealth at rates determined by the actuary to be sufficient to meet the cost to the Commonwealth of the superannuation entitlements of the Board's employees.

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

1.5 Leases

A distinction is made between finance leases, which effectively transfer from the lessors to the lessee substantially all the risk and benefits incidental to ownership of leased assets, and operating leases, under which the lessor effectively retains all such risks and benefits. The Board has no finance leases.

Operating lease payments are charged to expense on a basis which is representative of the pattern of benefits derived from the leased assets.

1.6 Insurance

The AAO has insured for risks through the Government insurable risk management fund, called Comcover. Workers' compensation is insured through Comcare Australia.

1.7 Financial Instruments

Accounting policies in relation to financial instruments are disclosed in note 17.

1.8 Acquisition of Assets

Assets are recorded at cost on acquisition except as stated below. The cost of acquisition includes fair value of assets transferred in exchange and liabilities undertaken.

Asset Recognition Threshold

Purchases of property, plant and equipment are recognised initially at cost in the Statement of Financial Position, except for purchases costing less than $3000, which are expensed in the year of acquisition (other than where they form part of a group of similar items which are significant in total). The $3000 threshold was selected because it facilitates efficient asset management and recording without materially affecting asset values recognised.

Revaluations

Land, buildings, infrastructure, plant and equipment are carried at valuation. Revaluations undertaken up to 30 June 2002 were done on a deprival basis; revaluations since that date are at fair value. This change in accounting policy is required by Australian Accounting Standard AASB 1041 *Revaluations of Non-Current Assets.*

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

Asset class	Fair value measured at:	Deprival value measured at:
Land	Market selling price	Market selling price
Buildings	Depreciated replacement cost	Depreciated replacement cost
Telescope and ancillary equipment	Depreciated replacement cost	Depreciated replacement cost
Telescope instrumentation	Depreciated replacement cost	Depreciated replacement cost
Plant and equipment	Market selling price	Depreciated replacement cost

Under both deprival and fair value, assets that are surplus to requirements are measured at their net realisable value. At 30 June 2003, the Anglo-Australian Telescope Board held no surplus assets.

The financial effect for 2002-2003 of this change in policy related to those assets to be recognised at fair value at 30 June 2003. The financial effect of the change is given by the difference between the carrying amount at 30 June 2002 of these assets and their fair values as at 1 July 2002. The financial effect is as follows:

Asset class	Adjustment	Contra account
Land	$3,000	Asset revaluation reserve
Buildings	$1,376,000	Asset revaluation reserve

Total financial effect was a net credit to the asset revaluation reserve of $1,379,000.

Accounting Standard AAS 6 Accounting Policies requires, where practicable, presentation that would have been disclosed in the 2001-2002 Statements had the new accounting policy always been applied. It is impracticable to present this information.

Frequency

Assets are revalued progressively in successive three-year cycles, so that no asset has a value greater than three years old. In order to adjust the revaluation cycle to better meet operational requirements, the revaluation of computers has been delayed by a year and will be revalued in 2003-2004.

The revaluation cycle is as follows:

- land and buildings were revalued as at 1 July 2002.
- the telescopes and instrumentation were revalued as at 1 July 2001
- personal computers were revalued as at 1 July 1999
- other computing facilities were revalued as at 1 July 1999
- plant and equipment were revalued as at 1 July 2001

Assets in each class acquired after the commencement of the progressive revaluation cycle are not captured by the progressive revaluation then in progress.

Recoverable Amount Test

From 1 July 2002, Schedule 1 no longer requires the application of the recoverable amount test in AAS 10 *Recoverable Amount of Non-Current Assets* to the assets of authorities when the primary purpose of the asset is not the generation of net cash inflows. No property, plant or equipment assets have been written to recoverable amount per AAS 10. Accordingly the change in policy has had no financial effect.

Depreciation and Amortisation

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

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

Depreciation rates applying to each class of depreciable assets are as follows:

	2003	2002
Buildings	**50 years**	50 years
Telescope and Ancillary Equipment	**50 years**	50 years
Telescope Instrumentation	**20 years**	20 years
Personal Computers	**3 years**	3 years
Other Computers	**5 years**	5 years
Other Plant and Equipment	**20 years**	20 years

The aggregate amount of depreciation allocated for each class of asset during the reporting period is disclosed in Note 5C.

1.9 Taxation

The Board is exempt from all forms of taxation except for the goods and services tax.

1.10 Capital Use Charge

The Anglo-Australian Telescope Board is not subject to the Commonwealth Government's capital use charge.

1.11 Foreign Currency Transactions

The contributions from the United Kingdom are converted to Australian dollars at the selling rate quoted by the Bank of England at the time each contribution is made. All other foreign currency transactions are converted at the ruling exchange rate at the time of the transaction. Foreign currency receivables and payables are translated at the exchange rate as at balance date. Associated currency gains or losses are brought to account in the Statement of Financial Performance.

1.12 Cash

Cash means notes and coins held and any deposits held at call with a bank or financial institution.

1.13 Agreements

Under an agreement between the Board and the PPARC, the Board is responsible for the management, care and maintenance, operation and development of the UK Schmidt Telescope. PPARC, the owner of the UK Schmidt Telescope, has entered into a lease with the ANU in respect of use of land for the UK Schmidt Telescope. The revenues, expenses and asset values in respect of the UK Schmidt Telescope form part of the financial statements.

1.14 External Projects

The Anglo-Australian Telescope Board has, in recent years, been invited to build telescope instrumentation for other Australian and international telescope bodies. Sometimes these non-profit contracts are on a time and materials basis, other times on a fixed price basis. The projects are costed to result in break-even results on completion. In the event of a surplus or over-run arising, it is the policy of the Board to absorb these.

1.15 Accrual Budgeting Framework

The Anglo-Australian Telescope Board is not part of the Commonwealth Government's accrual budgeting framework**.**

1.16 Comparative Figures

Where appropriate, comparative figures have been restated to conform to changes in the presentation of the financial statements.

1.17 Rounding

Amounts have been rounded to the nearest $1 000 except in relation to the following:

- remuneration of directors;
- remuneration of executive officers (other than directors); and
- remuneration of auditors.

Note 2. Financial Reporting by Segments

The Board operates solely in Australia and in one industry by operating and maintaining research facilities in Australia.

Note 3. Economic Dependency

The Anglo-Australian Telescope Board was established by the Anglo-Australian Telescope Board Agreement Act 1970. The Board is dependent upon Australian government revenue and contributions from the United Kingdom government for its continued existence and ability to carry out its normal activities.

Note 4. Operating revenues	**2003 $'000**	2002 $'000
4A Australian Government revenues		
Australian government revenue	**3,929**	3,807
Total	**3,929**	3,807
4B United Kingdom Government contribution		
The Board received the following contribution during the year from the United Kingdom government	**3,700**	3,550
4C Goods and services		
Goods - external entities	**1,384**	1,425
Services - external entities	**310**	42
Total	**1,694**	1,467
Cost of sales of goods	**1,540**	1,202
4D Interest Revenue		
Interest on deposits	**56**	42
4E Other Revenues		
Grants Revenue	**121**	94
Other Revenue	**190**	260
Total	**311**	354
Note 5. Operating Expenses		
5A Employee Expenses		
Wages and salaries	**3,816**	3,951
Superannuation	**710**	698
Leave and other benefits	**459**	621
Other employee expenses	**29**	20
Total employee benefits expenses	**5,014**	5,290
Workers' compensation premiums	**14**	17
Total employee expenses	**5,028**	5,307

5B Suppliers' Expenses

	2003	2002
	$'000	$'000
Goods - external entities	**589**	532
Services - external entities	**1,554**	1,405
Motor vehicle lease costs	**82**	82
External projects, goods - external entities	**688**	330
Total	**2,913**	2,349

5C Depreciation

Property, plant and equipment	**2,739**	**4,009**

The aggregate amounts of depreciation expensed during the reporting period for each class of depreciable asset are:

Buildings	**995**	939
Telescopes	**704**	701
Instruments	**667**	2,141
Plant and equipment	**373**	228
Total depreciation	**2,739**	4,009

5D Write-off of Assets

Non-financial assets

Plant and equipment - write off on disposal	**-**	401
Total write-off of assets	**-**	401

5E Net Foreign Exchange Loss

Non-speculative	**3**	-

Note 6 Financial assets

6A Cash

Cash at bank and on hand	**619**	1,032
Balance of cash as at 30 June shown in the Statement of Cash Flows	**619**	1,032

6B Receivables

Goods and services	**25**	-
Other receivables	**239**	570
GST Receivable	**40**	54
Total receivables net	**304**	624

All receivables are current assets.

	2003 $'000	2002 $'000
Receivables (gross) are aged as follows:		
Not Overdue	**293**	74
Overdue by:		
-Less than 30 days	**-**	507
-30-60 days	**8**	42
-more than 60 days	**3**	1
Total receivables (gross)	**304**	624

Note 7: Non-Financial assets

7A Land and buildings

Land - at 30 June 2001 valuation (deprival)	**-**	15
Land - at 1 July 2002 valuation (fair value)	**18**	-
Land (the use of which is free of charge)		
at 30 June 2001 valuation (deprival)	**-**	2,350
at 1 July 2002 valuation (fair value)	**2,350**	-
	2,368	2,365
Buildings - at cost	**-**	29
Buildings - at 30 June 2001 valuation (deprival)	**-**	41,778
Buildings - at 1 July 2002 valuation (fair value)	**44,910**	-
Less accumulated depreciation	**(26,248)**	(23,799)
	18,662	18,008
Buildings (the use of which is free of charge)		
At 30 June 2001 valuation (deprival)	**-**	4,549
At 1 July 2002 valuation (fair value)	**5,340**	-
Less accumulated depreciation	**(3,206)**	(2,640)
	2,134	1,909
Total land and buildings	**23,164**	22,282

	2003	2002
	$'000	$'000
7B Plant and equipment		
Telescope & ancillary equipment at 1 July 2001 valuation (deprival)	**35,137**	35,137
Less accumulated depreciation	**(20,504)**	(19,801)
	14,633	15,336
Telescope and ancillary equipment at cost	**26**	25
Less accumulated depreciation	**(2)**	(1)
	24	24
Telescope instrumentation at 1 July 2001 valuation (deprival)	**13,251**	13,251
Less accumulated depreciation	**(7,786)**	(7,145)
	5,465	6,106
Telescope instrumentation at cost	**2,380**	946
Less accumulated depreciation	**(29)**	(3)
	2,351	943
Other plant and equipment at 1 July 2001 valuation (deprival)	**3,587**	3,587
Less accumulated depreciation	**(2,265)**	(1,941)
	1,322	1,646
Other plant and equipment at cost	**546**	339
Less accumulated depreciation	**(69)**	(20)
	477	319
Total plant and equipment	**24,272**	24,374
Total property, plant and equipment	**47,436**	46,656

7C. Analysis of Property, Plant and Equipment

TABLE A

Reconciliation of opening and closing balances of property, plant and equipment

Item	Land $'000	Buildings $'000	Total land and buildings $'000	Plant and equipment $'000	Total $'000
Gross value as at 1 July 2002	2,365	46,356	48,721	53,285	102,006
• Additions-purchase of assets	-	498	498	1,642	2,140
• Revaluations: write-ups (write downs)[1]	3	3,396	3,399	-	3,399
Gross value as at 30 June 2003	2,368	50,250	52,618	54,927	107,545
Accumulated depreciation as at 1 July 2002	-	26,439	26,439	28,911	55,350
• Depreciation charge for year	-	995	995	1,744	2,739
• Revaluation: write-ups (write downs)[1]	-	2,020	2,020	-	2,020
Accumulated depreciation as at 30 June 2003	**-**	**29,454**	**29,454**	**30,655**	**60,109**
Net book value as at 30 June 2003	**2,368**	**20,796**	**23,164**	**24,272**	**47,436**
Net book value as at 1 July 2002	2,365	19,917	22,282	24,374	46,656

[1] The net effect is an increase in the asset revaluation reserve of $1,379,000

TABLE B

Assets at valuation

Item	Land $'000	Buildings $'000	Telescope $'000	Instruments $'000	Plant & equipment $'000	Total $'000
As at 30 June 2003						
Gross value	**2,368**	**50,250**	**35,137**	**13,251**	**3,587**	**104,593**
Accumulated depreciation	**-**	**29,454**	**20,504**	**7,786**	**2,265**	**60,009**
Net book value	**2,368**	**20,796**	**14,633**	**5,465**	**1,322**	**44,584**
As at 30 June 2002						
Gross value	2,365	46,327	35,137	13,251	3,587	100,667
Accumulated depreciation	-	26,439	19,801	7,145	1,941	55,326
Net book value	2,365	19,888	15,336	6,106	1,646	45,341

	2003 $'000	2002 $'000
7D Other non-financial assets		
Prepayments for goods and services - includes insurance premiums, rentals in advance and subscriptions	**80**	82
All pre-payments are current		

Note 8. Provisions

8A Employees		
Salaries and wages	**159**	117
Leave	**1,305**	1,333
Superannuation	**220**	203
Aggregate employee benefits liability and related costs	**1,684**	1,653
Current	**801**	693
Non-current	**883**	960
	1,684	1,653

Note 9. Payables

9A Supplier Payables

	2003	2002
	$'000	$'000
Trade creditors	**138**	100

All suppliers' payables are current

9B Other Payables

Non Trade creditors	**55**	48
Institute of Astronomy (note 16D)	**13**	192
ECHIDNA (note 16B)	**488**	726
Total Other Payables	**556**	966

All other payables are current

Note 10. Equity

	Asset Revaluation Reserve $'000	**Accumulated Result $'000**	**Total Equity $'000**
Balance at 1 July 2002	**34,596**	**11,079**	**45,675**
Operating result	**-**	**(993)**	**(993)**
Net revaluation increase	**1,379**	**-**	**1,379**
Balance at 30 June 2003	**35,975**	**10,086**	**46,061**
Balance at 1 July 2001	32,846	13,925	46,771
Operating result	-	(2,846)	(2,846)
Net revaluation increase	1,750	-	1,750
Balance at 30 June 2002	34,596	11,079	45,675

Note 11. Cash Flow Reconciliation

Reconciliation of operating deficit to net cash from operating activities.

	2003 **$'000**	2002 $'000
Operating (deficit)	**(993)**	(2,846)
Depreciation/amortisation	**2,739**	4,009
Property plant & equipment written off	**-**	401
Changes in assets and liabilities:		
Increase/(decrease) in liabilities to employees	**31**	117
Decrease/(increase) in receivables	**320**	(513)
(Increase)/decrease in other current assets	**2**	29
Increase/(decrease) in creditors	**38**	48
Increase/(decrease) in other current liabilities	**(410)**	707
Net cash from operating activities	**1,727**	1,952

Note 12. Related Party Disclosures and Remuneration of Directors

Members of the Board during the year were:

Professor M Barlow (to 30 December 2002), Professor M Birkinshaw, Mr G Brooks, Professor L Cram Professor R D Ekers, Professor K Freeman, Dr P Roche (from 1 January 2003).

The Directors do not receive remuneration.

Professor K Freeman is also an employee of the ANU Research School of Astronomy and Astrophysics (RSAA). RSAA provides site services to the AAO at Siding Spring. Professor R D Ekers is the Director of the Australian Telescope National Facility, a Division of CSIRO; CSIRO provides site services to the AAO at Epping.

Note 13. Remuneration of Officers

The number of Officers who receive or were due to receive total remuneration of $100,000 or more

	2003 **Number**	2002 Number
$100 000 - $109 999	**-**	-
$110 000 - $119,999	**1**	1
$120 000 - $129 999	**1**	1
$130 000 - $139 999	**1**	1
$140 000 - $149 999	**-**	1
$150 000 - $159 999	**-**	-
$160 000 - $169 999	**1**	1
	$	$
Aggregate amount of total remuneration of officers shown above	**552,539**	670,124

Note 14. Remuneration of Auditors

	2003	2002
	$	$
Remuneration to the Auditor-General for auditing the financial statements for the reporting period	**26,550**	25,000

No other services were provided by the Auditor-General during the reporting period.

Note 15. Average Staffing Levels

	2003	2002
The average staffing levels for the AAO during the year were:	**70**	70

Note 16. External Projects

A. In May 1999, the Observatory entered into an agreement with the European Southern Observatory (ESO) to build a positioner for the Very Large Telescope in Chile. This was a natural extension of the work the AAO had done on its own instruments and provided an opportunity for the AAO to enhance its instrumentation building skills. The instrument was delivered to Chile in February 2002 and fully commissioned by April 2003.

ESO has made a series of staged payments. The position at 30 June 2003 was as follows:

	2003	2002
	$'000	$'000
Instalments received	**285**	100
Suppliers expenses	**(32)**	(142)
Employee expenses	**(216)**	(388)
Balance from prior year	**(285)**	(49)
Project loss absorbed by AAO	**152**	194
Instalments receivable	**(96)**	(285)

B. The Japanese Telescope Subaru contracted the AAO to design and evaluate a prototype positioner, the Echidna. The contract began just before the end of the 1998-99 year and will be completed in 2004. The position at 30 June 2003 was as follows:

Instalments received	**1,050**	1,476
Suppliers' expenses	**(546)**	(150)
Employee expenses	**(450)**	(364)
Balance from prior year	**726**	-
On cost credited to other revenue	**(292)**	(236)
Instalments unexpended- included in Other Liabilities	**488**	726

C. Institute of Astronomy

The AAT Board is contracted to provide a preliminary design for an instrument for the Institute of Astronomy, University of Cambridge. The project will finish in July 2003.

	2003	2002
	$'000	$'000
Instalments received	**255**	180
Suppliers expenses	**(8)**	(10)
Employee expenses	**(161)**	(119)
On cost credited to other revenue	**(85)**	(39)
Balance from prior year	**12**	-
Instalment unexpended - included in Other Liabilities	**13**	12

D. MOMFOS

The AAT Board is contracted to provide a concept design study for AURA. The project began in late 2002-2003 and will finish in mid 2003-2004.

Instalment received	-	-
Suppliers expenses	**(1)**	-
Employee expenses	**(13)**	-
On cost credited to other revenue	**(11)**	-
Instalments receivable, included in debtors	**25**	-

E. WiFES

The AAT Board contracted to provide ANU with a concept design for an instrument called WiFES. The contract was started and finished within the financial year.

Instalment Received	-	-
Suppliers Expenses	**(1)**	-
Employee Expenses	**(12)**	-
On cost credited to other revenue	**(12)**	-
Surplus transferred to AAO budget	**5**	-
Instalments receivable, included in debtors	**30**	-

ANGLO-AUSTRALIAN TELESCOPE BOARD

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
for the year ended 30 June 2003

Note 17. Financial Instruments.

a) Terms, conditions and accounting policies.

Financial Instruments	Notes	Accounting Policies and Methods (including recognition criteria and measurement basis.)	Nature of Underlying Instrument (including significant terms and conditions affecting the amount, timing and certainty of cash flows.)
Financial Assets		Financial assets are recognised when control over future economic benefits is established and the amount of the benefit can be reliably measured.	
Cash at Bank	6A	Cash at Bank is recognised at the nominal amount. Interest is credited to revenue as it accrues.	Temporarily surplus funds on deposit with RBA have interest credited monthly.
Receivables	6B	These receivables are recognised at the nominal amount due less any provision for bad and doubtful debts. Provisions are made when collection of the debt is judged to be less rather than more likely.	Credit terms are net 30 days.
Financial Liabilities		Financial liabilities are recognised when a present obligation to another party is entered into and the amount of the liability can be reliably measured.	
Suppliers	9A	Creditors and accruals are recognised at their nominal amounts, being amounts at which the liabilities will be settled. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced)	Settlement is usually made net 30 days.
Other	9B	Amounts owing to external contracts, representing unspent contributions, are recognised at their nominal amounts.	Funds will be expended in the year ending 30 June 2004.

b) Interest rate risk

Financial Instrument	Note	Floating Interest Rate **2003 $'000**	Floating Interest Rate 2002 $'000	Non Interest Bearing **2003 $'000**	Non Interest Bearing 2002 $'000	**Total 2003 $'000**	Total 2002 $'000
Financial Assets							
Cash at Bank	6A	**588**	998	**-**	-	**588**	998
Cash on Hand	6A	**-**	-	**31**	34	**31**	34
Receivables	6B	**-**	-	**304**	624	**304**	624
Total Financial Assets		**588**	998	**335**	658	**923**	1,656
Total Assets						**48,439**	48,394
Financial Liabilities							
Suppliers	9A	**-**	-	**138**	100	**138**	100
Other	9B	**-**	-	**556**	966	**556**	966
Total Financial Liabilities		**-**	-	**694**	1,066	**694**	1,066
Total Liabilities						**2,379**	2,719

The weighted average effective interest rate for Cash at Bank is 3.65% (2001-2002 3.4%)

c) Net fair value of Financial Assets and Liabilities

	Note	**Total Carrying Amount 2003 $'000**	**Aggregate Net Fair Value 2003 $'000**	Total Carrying Amount 2002 $'000	Aggregate Net Fair Value 2002 $'000
Financial Assets					
Cash at Bank	6A	**588**	**588**	998	998
Cash on Hand	6A	**31**	**31**	34	34
Receivables	6B	**304**	**304**	624	624
Total Financial Assets		**923**	**923**	1,656	1,656
Financial Liabilities (recognised)					
Suppliers	9A	**138**	**138**	100	100
Other	9B	**556**	**556**	966	966
Total Financial Liabilities (recognised)		**694**	**694**	1,066	1,066

Financial Assets

The net fair value of cash assets is their carrying value as shown.

Financial Liabilities

The net fair values of suppliers and other payables, all of which are short term in nature, are their carrying values as shown.

d) Credit risk exposures

The Anglo-Australian Telescope Board's maximum exposure to credit risk at reporting date in relation to each class of recognised financial assets is the carrying amount of those assets as indicated in the Statement of Financial Position.

The Anglo-Australian Telescope Board has no significant exposures to any concentration of credit risk.