# APPENDICES

## APPENDIX 1 - Observatories and Institutes visited by Spigl during 1958/59 Gledden Travelling Fellowship travels.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Place</th>
<th>Aspects investigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seismological Station</td>
<td>Suva</td>
<td>Seismological</td>
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<tr>
<td>Geological Department</td>
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<tr>
<td>Coast &amp; Geodetic Survey</td>
<td>Honolulu</td>
<td>(Astronomical, Tidal, Seismological)</td>
</tr>
<tr>
<td>Lick Observatory</td>
<td>Hawaii (California)</td>
<td>(Astronomical)</td>
</tr>
<tr>
<td>University of California</td>
<td>Berkeley (California)</td>
<td>(Astronomical, Surveying)</td>
</tr>
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<td>Seismological Laboratory</td>
<td>Pasadena (California)</td>
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<tr>
<td>Caltech</td>
<td></td>
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<td>Mt. Wilson &amp; Palomar</td>
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<tr>
<td>Caltech</td>
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<td>U.S. Naval Observatory</td>
<td>Flagstaff (Arizona)</td>
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<td>Lowell Observatory</td>
<td>Flagstaff (Arizona)</td>
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<tr>
<td>McDonald Observatory</td>
<td>Fort Davis (Texas)</td>
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<td>Washington</td>
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<td>University of Maryland</td>
<td>Maryland</td>
<td>Surveying</td>
</tr>
<tr>
<td>Institution</td>
<td>Place</td>
<td>Aspects investigated</td>
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<td>National Bureau of Standards</td>
<td>Washington</td>
<td>Surveying</td>
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<td>Washington</td>
<td>Surveying, Tidal, Seismological</td>
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<td>1959 Annual Meeting of American Society of Photogrammetry and American Congress on Surveying and Mapping</td>
<td>Washington</td>
<td>Seismological, Surveying</td>
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<td>Lamont Observatory</td>
<td>Palisades, New York</td>
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<td>New Haven (Conn.)</td>
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<td>Royal Greenwich Observatory</td>
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<td>University College</td>
<td>London</td>
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<td>Kew Observatory</td>
<td>Richmond, Surrey</td>
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<td>Cambridge Observatory</td>
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<td>Ordnance Survey Office</td>
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<td>Imperial College of Science &amp; Technology</td>
<td>London</td>
<td>Surveying</td>
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<td>2nd Astrometric Conference</td>
<td>Cincinnati (Ohio)</td>
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<td>Synchronoscope Works</td>
<td>Alpertont (London)</td>
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<td>Liverpool Observatory &amp; Tidal Institute</td>
<td>Birkenhead</td>
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<td>International Training Centre</td>
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<td>Leiden Observatory</td>
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<td>Astronomische Rechen Institut</td>
<td>Heidelberg</td>
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<td>Wild Instrument Works</td>
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<td>Geological Survey</td>
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<tr>
<td>Israel Institute of Technology</td>
<td>Haifa, Israel</td>
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</table>
1.2 APPENDIX 2 - Report on Effects of Proposed Building Plans on the Work of the Perth Observatory.

THE UNDER SECRETARY
CHIEF SECRETARY'S DEPARTMENT

REPORT ON EFFECTS OF PROPOSED BUILDING PLANS ON THE WORK OF PERTH OBSERVATORY.

The work of the Perth Observatory is generally divided between three principal headings: 1 Scientific Observation, 2 Public Services, 3 Educational and Cultural. In considering the proposals for building an office block on the Observatory site, commencing during 1963, I will deal with each of these in turn.

1. Scientific Observations. These are performed by the Astrophotographic Telescope (dome building), the Transit Circles, and the Seismographs. Work on all three would immediately have to cease on commencement of demolitions and earthworks, the Astrophotographic Telescope and Seismograph Vault being scheduled for immediate demolition, and the Transit Circle would have to be dismantled and carefully stored for fear of adverse effects on its bearing surfaces and optical parts by dust.

The Astrophotographic Telescope is currently engaged in photography of selected areas of the southern sky. The preliminary work on this programme is half-completed and the taking of the first series of photographs has already commenced. Similar programmes by northern hemisphere observatories have been underway for some years but the observations in the south, being shared by Perth Observatory and Santiago Observatory, Chile, have barely commenced. To cease work now for a lengthy period will set us even further behind our northern colleagues.

This telescope is also used occasionally for observing positions of comets. Work of this nature has proved invaluable in recent years to those studying the motions of comets, since there are very few other observatories carrying out such observations in the southern hemisphere. If a gap occurs in the series of observations of a comet, for a period while it is far south, the determination of its orbit is consequently weakened. On average, two such comets are observed in a year for a period of about a couple of months each.

The Transit Circle, after years of neglect, has been undergoing a reconditioning process during the last year or so. This work has been appreciably assisted by a grant of nearly £5,000 from the American Academy of Sciences; the grant was given because there is urgent need for more such instruments in the Southern Hemisphere, to improve our knowledge of star positions. It is unsatisfactory that only one other southern observatory has been making observations of this kind systematically for some years. So far, our efforts have been concentrated on restoring the supporting pivots to the high degree of circularity that is required - to within 1 ppm. This is nearly completed and soon we shall be in a position to remove the eye-piece and commence test observations. It would be courting trouble, however, to leave the instrument in position once building operations on this site start. Dust would soon undo all the work of the last year.
The Seismograph Vault contains instruments which have been loaned to us by the Lamont Geological Observatory, so that Perth is one of a world-wide network of seismological stations operated on behalf of Lamont. Not only the instruments but also all materials used in connection with them are supplied by Lamont. Within the last 18 months, our original vertical seismograph has been augmented by two horizontal instruments so that we are now fully equipped with a set of seismographs of the "long-period" type; the provision of these additional instruments by an overseas observatory is indication of the value placed by it on the recordings obtained here.

While all of this work is of a purely "research" character, and has little direct connection with services to the public, it is nevertheless the primary function of the Observatory. The main job of an observatory is to observe. The result of the proposals to commence building work on this site before alternative accommodation for the Observatory's instruments is ready will be the immediate cessation of all observations. Not only will this mean delay in our astronomical programme and a serious gap in our seismological records — the longest continuous records in Australia — but the standing of Perth Observatory in the eyes of overseas scientists, which has been steadily increasing during the last few years, will suffer a decline.

Until comparatively recently, the State observatories of Australia have had a bad reputation overseas for being unreliable in fulfilling their promises to carry out research. Since the second world war, some progress in living down this reputation has been achieved by the only two still active, Sydney and Perth, and evidence of this is the material support we have recently received from America. Is it to be dissipated through thoughtless haste in appropriating the Observatory's grounds for another purpose?

In recent years the State Government has promised assistance to Commonwealth and overseas interests if a large observatory were to be established in W.A. What store will these interests set by such promises when the work of the State's own observatory is so lightly set aside?

2. Public Services. The principal public service performed by the Observatory is that of the provision of time. Shipping, G.P.O., railways, radio stations, power stations and others are all supplied with time signals in various forms by the Observatory; and chronometers and stop-watches used by shipping, surveyors, police, etc., are tested here for accuracy.

The apparatus for all of these functions is at present housed in the Astrographical dome building. In its basement is the battery room and the master clock room, where the highly accurate pendulum clocks are maintained on a firm pillar under controlled temperature conditions. In two other rooms in the same building are the slave clocks, controlled by the masters, from which all signals are sent, and the radio receiver and other apparatus for making comparisons and determining clock errors. All land-lines for emitting time signals, and also for all other telephone connections to the Observatory buildings, are routed through this building.

The centralising of all this apparatus in the one building was completed early this year after a year spent on rewiring and construction work. While another move would probably not take as long as this, because much of the planning of the wiring need not be repeated, I estimate that we could expect it to take at least
six months, since structural work would undoubtedly be necessary. But, apart from the time required, it would also be wasteful to make a temporary move now when a more permanent one will follow when a new observatory is built.

Also, there is no suitable place for this apparatus to be located in the Observatory building without more structural alterations. Formerly, one master-clock was housed in a small room adjoining the Government Astronomer's room, where the slave clock and comparison apparatus were kept. After the transfer this year, two walls were knocked out of the small room to combine it with two others as the present clerical office. Whatever else of a make-shift nature may be attempted, it is essential to have one small room, isolated and insulated, where a constant temperature can be maintained and where a solid pillar can be erected. No such room exists in the main building at present and to make one would involve not only structural work but also another complete overhaul of the telephone wiring.

The other Public Services of the Observatory are unlikely to be affected, since they are concerned only with office work.

2. Educational and Cultural. This is principally the holding of night or daytime visits to the Observatory and they will have to be discontinued since there will be no instruments to demonstrate.

To summarize these conclusions:

a. All observational work will have to cease before a start is made on any of the scheduled building operations on the site. All instruments will have to be dismantled and carefully stored, with adequate protection of all delicate portions; this is a job which alone will take several months — it is not just a matter of fetching in a crane to lift them out.

The establishment will thus become, for an indefinite period, an Observatory in name only and its prestige in the scientific world, so assiduously built up during the last 5 to 10 years by the late Government Astronomer, Mr. Spigl, will be dispersed in a very short time.

b. All time-service apparatus will need to be transferred; again, this will take several months and considerable expense, since it involves a lot of rewiring and the relaying of all Observatory telephone cables by the P.H.O. Department, and also structural work in the new (temporary) location. The Observatory's workshop will also have to be relocated.

c. Services to the public generally will be restricted to those of a purely clerical nature.

In all planning for the buildings on this site, the Observatory has been virtually ignored. It is apparent that the cost of the removal of the Observatory was not even considered until comparatively recently. Enquiries by the Observatory about intentions regarding this project have consistently been evaded with evasive replies. It is, perhaps, significant that public announcements have generally referred to this area as the "Hale School Site", without mentioning the Observatory although, in fact, it is on the Observatory site and not the Hale School site that the first work is planned.
Two years ago, an assurance was given that it would not become necessary for the Observatory to move for another five to ten years. Nevertheless, we began investigations then to select a suitable new location, and these investigations were intensified earlier this year. A reasonable site was chosen, but it has so far proved impossible to obtain a definite decision on whether that site will be allocated to the Observatory.

A rough, preliminary plan showing the proposed location of the new buildings here was obtained in May this year. Even that did not indicate the extent to which it was intended to demolish Observatory buildings. This information was supplied only on 7th September.

It is quite unrealistic to expect that the dismantling of instruments and reorganization of services can be effected in less than four months. It is also unrealistic to expect that a new Observatory can be planned and built in a hurry at negligible expense. Although a comparatively small staff is employed, the requirements are of a specialised nature and buildings must be planned with considerable care and thought, and with the utmost consultation with authorities elsewhere.

I have already protested, through the Under Secretary of the Chief Secretary's Department, at the procedure which has so far been adopted, and the lack of consideration shown in planning without reference to the Observatory until this late stage. I have also requested that all plans for work on this site be delayed until adequate provision has been made for the continuance of the work and services of the Observatory.
1.3 APPENDIX 3 – The Work of the Perth Observatory

THE WORK OF THE PERTH OBSERVATORY

(This material was prepared by the Observatory for use by visitors to the Commonwealth Games in Perth, November, 1962.)

This distribution to you has been undertaken by the Western Australian Division of the Australian and New Zealand Association for the Advancement of Science, in pursuance of its policy of maintaining an informed public and professional opinion on all matters of scientific interest.

( G.A. Bottomley )
Assistant Secretary/Treasurer.

NOVEMBER, 1962.
THE WORK OF THE PERTH OBSERVATORY.

The Perth Observatory was founded in 1896 with two principal telescopes, the 11-inch photographic refractor and the 6-inch meridian transit circle. Although over 60 years old, these two telescopes remain valuable instruments for research today.

The main field of activity of the Observatory has always been astrometry, that is the determination of positions and movements of stars and other heavenly bodies.

In this work, the meridian transit instrument is fundamental. With it, the positions of brighter stars are determined, and these are used as references for obtaining positions of other stars by photography.

THE ASTROGRAPHIC CATALOGUE.

In its earliest years, the Observatory's work was centred on the "Astrographic Catalogue", an international plan for cooperation by some 20-25 observatories throughout the world to chart the whole sky by photography.

All telescopes used for this work were of similar design, photographing on each plate an area of the sky a little over 2° square to a scale of 1 millimetre = 1 minute of arc. Each participating observatory was allocated a zone of the heavens; that for Perth was between 13° and 130° south declination - that is, the portion which passes directly overhead at our latitude of 32° south.

Nearly 1500 plates were required to complete the some allocated and the positions of over 500,000 star images were measured and the results published in catalogues. A third of the plates taken here were sent to Edinburgh Observatory for measurement. The remainder, measured here on the "Turner" plate-measuring machines, were finished by 1920; although the manuscript for the Edinburgh measure was ready by 1922, it was not printed until 1949-1952.

The "Astrographic Catalogue" project represents the first large-scale international cooperative programme in astronomy and its realisation has been subject to many hazards, including the two world wars and the depression of the 30s. It is now practically complete, the last volumes from two other observatories being expected within the year. The set of volumes provides astronomers with the positions of all stars down to a magnitude 100 times fainter than those just visible to the naked eye.
STELLAR MOTIONS.

The photographic plates for the Astrographic Catalogue were all taken about 40-60 years ago and they now can be utilised for further studies of the motions of the stars. By re-photographing the same areas, and measuring the change in positions we can detect movements to an accuracy of one thousandth of a second of arc per year.

Evaluation of star movements is needed to assist researches in many other fields in astronomy. Clusters of stars represent groups which are all at the same distance and at similar stages of their evolution; physical analysis of the light from such stars provides many clues to their life-histories. But for such information to be of value it is necessary to know which stars are truly members of the cluster and which are just background stars. Comparison of the motions provides a powerful method of making this differentiation.

Studies of the movements of particular types of stars are also of value in building up a picture of the general composition of our Milky Way Galaxy, of which the Sun is a member.

The acquisition of a new, very accurate plate-measuring machine, ordered last year and due to be delivered in about two months' time, will enable us to make use of the valuable store of material contained in our large collection of 50 year old plates.

At present, we can measure star movements only by reference to the more distant stars in the Milky Way Galaxy; these stars are themselves moving though, because of their great distances, comparatively slowly. To provide a more static reference system, Prof. A.N. Deutsch of Pulkovo Observatory proposed a programme of observations in which exposures of one hour were made on areas of the sky containing faint external galaxies, whose images were small enough to be measured accurately. About ten observatories, including Perth, agreed to take part in this work, and the first batch of plates for the Deutsch programme is now being obtained. In 40-50 years' time the same areas will be rephotographed.
Although not of the best design for the purpose, the astrophographic telescope is also used occasionally to photograph the brighter comets, to determine their positions. Such observations are communicated, through the International Astronomical Union, to other interested astronomers who utilize them for computing the comets' orbits.

In 1950, for the International Geophysical Year, the normal plate-carriage of the astrophographic telescope was removed and a special attachment, known as the Markowitz Moon Camera, was added. Designed by Dr. William Markowitz of the U.S. Naval Observatory, Washington, this camera enabled the bright, rapidly moving Moon and fainter, stationary stars to be photographed at the same time. A small dark-glass filter cut down the Moon's light and, by rotating, held the image still on the photographic plate. As a result, a series of very accurate measures of the position of the Moon were obtained. In conjunction with similar observations made at a number of other observatories at the same time, the Perth observations are now being analyzed at Washington to secure much valuable data of geophysical, geodetic and astronomical significance. Following completion of these observations early in 1960, the telescope was restored to its normal condition.

Accurately timed observations of occultations are made regularly with the visual guiding telescope attached to the astrophographic. Occultations are the disappearances or reappearances of stars as the Moon passes in front of them in the course of its monthly circuit of the heavens. Such observations are used for similar purposes to those obtained by the Markowitz Camera.

TRANSIT TELESCOPE

During the first 15 years of its existence, the Observatory's meridian transit circle telescope was used to determine the positions of stars which served as reference standards for the plates of the Astrophographic Catalogue. The results of these observations were published in a series of six catalogues between 1907 and 1923 which listed 10,000 star positions.
It was intended that such observations should continue at regular intervals, with subsequent catalogues providing more accurate positions and motions for these standard stars, but shortages of staff and pressure of other work prevented the realization of this project, formulated by W.E. Cooke, the first Government Astronomer.

During the following years, the staff assisted with much of the survey work for this State, including the delineation of inter-State boundaries. In all this work, the transit telescope served as the fundamental reference point for all surveying in W.A., a position it still occupies today.

In recent years, positional observations with transit telescopes have assumed considerable importance in astronomical research. At present, only one observatory in the southern hemisphere is working regularly in this field and for some time Perth Observatory has been pressed by the International Astronomical Union to resume transit observations. With the assistance of a grant from the National Science Foundation of America, we are now working to renovate and modernize the telescope. The supporting pivots are being smoothed to make them truly circular to within a very high degree of accuracy, and the method of recording the observations is being improved. Although the instrument is not yet ready for serious observations, it is possible to make "dummy runs" to check the observing routine.

TIME SERVICE.

The transit telescope can also be utilized for time determination; by timing the transits of certain stars whose positions are known to a high degree of accuracy, the errors of clocks may be determined and corrected. From its inception the Observatory has provided the time service for W.A., supplying accurate time signals for shipping, telegraph stations, radio stations and others. Until 1941, the clocks were regulated by transit observations, but since then it has been found more convenient to compare the clocks with short-wave radio time signals sent out by the larger observatories, notably those at Washington and Canberra.

At present the time service is controlled by free-pendulum clocks. The "master clocks" are housed in tubes mounted on a pillar in the basement of the astrophysical telescope building, where they are kept in a near-vacuum at constant temperature. The "masters" control "slaves" which are in a ground-floor room, and electrical contacts on the "slave" send out the second "pips" to radio stations and others.
These signals are kept accurate to within 1/300 second; a quartz crystal clock, now on order, and needed for transit telescope observations, will improve this accuracy to better than 1/1000 second.

SEISMOLOGY.

A "Milne" seismograph was installed at the Perth Observatory in 1659 and continuous records, with only intermittent breaks through mechanical failure, have been kept ever since, thus making the Observatory the oldest seismograph station still operating in Australia. The modified "Milne-Shaw" seismograph was installed in 1923. In 1954 the Lamont Geological Observatory supplied, on loan, a vertical component long-period instrument, and in 1961 two horizontal component instruments were added to complete the set of long-period instruments. The "Milne-Shaw" instrument was then taken out of service.

The recordings of earth-tremors obtained here are analysed and the data distributed throughout the world in quarterly bulletins.

TIDE TABLES.

Analysis of tide gauge records for Port Hedland was carried out at the Perth Observatory in 1913, and from that date, an annual publication giving tidal predictions for Port Hedland has been prepared on behalf of the Harbour and Light Department. The latest book of tide tables, for 1961, has extended their scope to cover the whole North and North West Coasts from Darwin to Learmonth. With improved facilities elsewhere it is no longer necessary for the computing work to be carried out at the Observatory, and the predictions are supplied now by Liverpool Tidal Institute, but the form of the tide tables is still prepared here for local use.

OTHER WORK.

This revision outlines the main work performed at the Observatory. Many smaller tasks are undertaken from time to time. The Observatory is a recognised laboratory of the Australian National Association of Testing Authorities for checking the accuracy of chronometers and stop watches. Notes on astronomical matters of general interest are supplied to the press, and enquiries from the public on subjects ranging from sunrise and sunset times to the nature of the universe are answered. Members of the staff are often called on to
give lectures to local organisations and night visits to
the Observatory by appointment are a regular feature.

Most of the work of this Observatory is of an un-
spectacular nature. The staff is very small and throughout
its 56 years it has been hampered by financial considera-
tions; several times it has come close to closing down altogether.
Nevertheless, much work of value to this State and to
the scientific world has been performed here and we antici-
patc a continuation of this service - probably on a new
site away from the City - for many years to come.

W.A. GOVERNMENT ASTRONOMERS.

1896 - 1912  W.E. Cooks.
1912 - 1940  H.B. Curlewis.
1940 - 1962  H.S. Spig1.
1.4 APPENDIX 4 – Notes for the Hon Premier at the opening of the new Perth Observatory.

OFFICIAL OPENING OF NEW
PETH OSEVATORY.
2.30 p.m. Friday, Sept. 30, 1966.
at MACKAY

NOTES FOR HON. PREMIER.

1.

In the great rush of progress these days it may seem that we are pre-occupied entirely with the immediate problems of the day — and perhaps we are more than we should be.

BUT, behind the scenes, we all recognise the need to go deeper in our search for knowledge, and to make a worthwhile contribution to this search which is world-wide.

However, I think it will be readily agreed, that it is relatively easy to overlook this need when immediate problems seem to be pressing — and easier still when money is difficult to find.

2.

It is therefore rather significant I think, that in gathering here today to lay the foundation stone for a new Observatory, we are repeating some history made in other historic times in the State's development.

The stone commemorating this new building lies on the left of its entrance. On the right we have preserved as you can see, the stone that was laid to commemorate the building of the original Observatory in Perth.

Exactly 70 years and one day have passed since Sir John Forrest laid the first stone during a period of enormous growth.

3.

It is remarkable when we think back to remember that between 1890 and 1900 the Kalgoorlie gold rush multiplied the population of this State by four.

One could easily imagine the problems thrust upon the Government by this development.

It was during this period that work was started on the Goldfields Water Scheme (one of the wonders of the world in its day), Fremantle Harbour (which was built for sailing ships but planned big enough for today's 65,000 ton liners), and many other important projects were undertaken.

Yet the Government of the day found time to realise the importance of scientific research.
In fact, Sir John Forrest said on the occasion when he laid the foundation stone of the first Observatory, that it demonstrated that in a time of prosperity, as he said, "we are trying to do something for the encouragement of the Arts and Sciences."

TODAY we are facing the same problems of rapid growth and development.

AND we are trying to show the same concern for the encouragement of the Arts and Sciences.

AND I do not think there can be any doubt that this Observatory can be regarded as a very serious approach to the encouragement of a special branch of science.

PRECISION AND ACCURACY

As you all know, the observation of the stars requires extreme precision and accuracy. When you are photographing the stars — millions of light years away — the very tiniest error could throw out your calculations by thousands of miles. AND the problem of error is made still more serious by the time needed to record an observation on a photographic plate.

Anyone who has tried to take a time exposure with his camera by hand, will know only too well the kind of "slip" results he can get.

In the design of these buildings, enormous care has been taken to reduce the possibility of what you might call "hand shake" in the telescopic equipment.

For example, all the excavations were made by drilling because blasting would have created a situation that would have made telescope mountings unstable from an astronomer's point of view.

In the transit circle telescope building, the pillars supporting the telescope and its instruments rest on a big block of bricks — bricks which were salvaged from a demolished wall at the Claremont Mental Hospital.

These bricks were used, not to save money, but because they were 50 years old, and can therefore be regarded as relatively static material.

By this means we hope to avoid any minute shifting of the support pillars due to the effects of aging in the base bricks.

I'm also told that another form of what we may call "hand shake" is caused by the atmosphere which in fast shimmers due to heat and cold and turbulence. This has the effect of making the stars seem unsteady to an astronomer.

So we have carefully chosen this site to cut these effects to a minimum.

I am assured that the stars look a lot steadier here than they did at the old Observatory site.
VISTING SCIENTISTS.

Of course, there is a lot more to an observatory than the things I have told you — and I don't pretend to be competent to explain these things properly.

BUT I believe we have reason to feel fairly proud of the way this project has been carried out.

We have special provision here for computer equipment when required, and a very substantial air-conditioning plant has been installed to minimize changes in delicate measuring instruments and other equipment.

We also have provision for visiting scientists, and I am able to say that in a few months time, three German astronomers will come here to spend two-and-a-half years — making observations on more than 20,000 stars.

I am told they will bring a fully automatic telescope and computer equipment with them to speed up their work.

CONCLUSION

The new Perth Observatory is in a good location to make a worthwhile contribution to scientific knowledge, and I am sure we are all hoping the basic facilities created here will pave the way for this work to be developed even further in the future.

When a man becomes an astronomer he gives his life to the work. He is in explorer in a very real sense. Yet he may want himself fortunate to make even one substantial discovery in his lifetime.

In the years ahead, man will penetrate further into space, and enlarge our knowledge by physical contact we doubt at least with the moon, and — who knows — may be, one of the stars.

BUT it seems very likely that only the eye and the mind of the astronomer will ever be able to reach out into the Universe and satisfy the unending curiosity of all thinking people — not only about the world in which they live — but about every tangible aspect of creation.

I think we have made a sound investment here — even though the outcome cannot be foreseen.

It therefore gives me very great pleasure to declare this new Perth Observatory officially opened.
1.5 APPENDIX 6 – IAU Notes on Symposia and Colloquia.

Some notes on the Organization of IAU Symposia and Colloquia, and their publication

In its 35th Meeting (September 1971) the Executive Committee of the IAU discussed the Format of IAU Meetings and the Publication of the Proceedings.

General Information on the organization of IAU Scientific Meetings is found in IAU Transactions XIV B, p. 284 to 288. Reference is also made to the IAU Style Book (Transactions XIV B, p. 254 to 264) regarding the editing of IAU publications.

The attention of the Organizers of IAU Scientific Meetings is drawn, further, to the following suggestions:

Format of IAU Scientific Meetings

The true motivation of a conference is not the presentation of results (these should normally go to the scientific journals), but:

1) to review the actual situation and recognize the present problems;
2) to discuss methods towards a possible solution of these problems.

Therefore it is clear that the presentation of a sequence of contributed papers should be avoided as much as possible. There should be ample time for discussions on specific topics and there should be sufficient breaks enabling informal talks. Room should be provided for separate small group sessions for discussions on selected topics.

It is also suggested to distribute to participants abstracts of the papers well in advance of the Meeting, and copies of the texts at the Meeting itself. In this way the discussions can be more fruitful.

Publication of Symposium Proceedings. As stated in the "Rules for Scientific Meetings" normally only the invited review papers should be published in the Symposium Proceedings. The reasons for this resolution are:

1) This measure prevents double publications a number of contributed papers in Symposia appear to be published later in the regular journals and this is: to be opposed in all cases.

2) The quality of contributed papers to Symposia is sometimes below the standard of papers published in regular journals. (For this reason it has been decided to introduce the refereeing of all contributed papers that are submitted for publication).

3) The prices of many of the Symposium Proceedings appear to be high, and can be reduced by a reduction of the size of each volume without reducing its scientific value. Also the publication of a smaller volume will be faster.

As regards the discussions the Editor should edit them in order to include only the essentials. A verbatim record of the discussions is to be avoided.
1.6 APPENDIX 7 – IAU Symposium No. 61 – First Announcement.

Draft

IAU Symposium No. 61 “New Problems of Astrometry”
Perth, Western Australia; 13 - 17 August 1973

First Announcement
May 1972

At the invitation of B. J. Harris, Government Astronomer, Perth, Western Australia, IAU Symposium No. 61 “New Problems of Astrometry” will be held in Perth from 13 to 17 August 1973. The IAU Executive Committee has charged the following Committees with the organization of the Symposium.

Local Organizing Committee (LOC)
B. J. Harris (Chairman), M. P. Candy, D. N. Harwood, I. Nikoloff, S. E. Williams

Scientific Organizing Committee (SOC)
W. Fricke (Chairman), S. Vasilevskis (Vice-Chairman), W. Gliese (Secretary), C. A. Murray (Secretary), B. G. Clark, S. W. McCuskey, J. L. Schombert, J. R. Shakeshaft, R. H. Stoy, G. van Herk, H. Wood, M. S. Zverev.

1. PURPOSE OF THE SYMPOSIUM

The purpose of the Symposium is the discussion of recent progress in some areas of astrometry given below and the delineation of desiderata for future work. In order to achieve a deeper discussion into some new problems, the number of subject areas has been limited and selected such that researchers are brought together from specific fields of positional astronomy, photographic astrometry, radio astrometry, and galactic research. The Symposium is not intended to cover the total field of astrometry with all its applications.

Subject areas of the symposium will be

a) Reference systems,
(Report on IAU Colloquium No. 20 “Meridian Astronomy”, improvement and extension of the fundamental system, reference systems for photographic catalogues of positions, photographic catalogues, Organizers: J. L. Schombert, W. Fricke.)

c) Radio astrometry.

d) Astrometry with large telescopes.
(Positions of optical counterparts of radio sources, positions and proper motions of faint stars). Organizers: C.A. Murray, S.W. McCuskey.

e) Galactic problems.
(Proper motions with respect to galaxies, proper motions in general and of special objects, problems of stellar kinematics and galactic structure closely related to astrometry). Organizers: S. Vasilevskis, G. van Herk.

f) Astrometric Techniques.
(Optical instrumentation, measuring, refraction, etc.) Organizers: R.H. Stoy, K.Aa. Strand.

g) Miscellanea.

h) Recommendations, summary.

The organizers of sessions whose names are given in parentheses will take the responsibility for the preparation of the programme in their respective areas and will act as chairmen of the sessions. The programme will include invited review papers (maximum 20 minutes) and other submitted contributions (papers) whose speakers will be allowed 5 minutes (or up to 10 minutes on request). It is hoped that there will be ample time for discussion of invited papers and other contributions. The detailed presentation of results will not be possible. Participants who wish to make known their results in detail are invited to distribute preprints of their papers (in press or to be presented to journals) at the beginning of the Symposium.

4. HOTEL ACCOMMODATION

2. PARTICIPATION

Participation in the Symposium will be by invitation only. Since it will not be possible to invite all those astronomers whose interests are relevant to the Symposium, written contributions are welcomed from non-participants.

All persons on the attached "Preliminary List of Participants" are invited and are requested to return the "Participation Form" at their earliest convenience (one copy to B.J. Harris, Perth, and the other one to W. Giese, Heidelberg) but not later than 15 September 1972.
3. GENERAL PROGRAMME

The Symposium will be held in the Institute of Technology in Perth. The scientific programme will start 14 August 1973, at 9.00 A.M., and end 17 August 1973 at noon. Except for a visit to the Perth Observatory (situated about 20 miles from Perth) and the Closing Dinner, no other arrangements are being planned in addition to the scientific programme. The LOC will, however, assist the ladies accompanied by participants in the planning of sightseeing, etc.

<table>
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<tr>
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4. HOTEL ACCOMMODATION

(This section will be completed by the LOC)

5. VISA, CUSTOMS, VACCINATION, MONEY EXCHANGE

Participants are referred to information given in the Preliminary Announcement of the 15th General Assembly of the International Astronomical Union, University of Sydney, Australia, and to more information on the General Assembly following at a later date.
8. PUBLICATION OF SYMPOSIUM PROCEEDINGS

Proceedings of the Symposium will be published following the rules laid down in IAU Transactions XIV B, p. 287. According to these rules, the Symposium volume may contain (a) invited papers, (b) short contributed papers presenting new material not to be published elsewhere, (c) summaries of papers to be published elsewhere, (d) results of the discussion on (a) to (c), (e) recommendations, (f) a summarizing report of the Symposium.

The Secretaries of the Symposium will act as Editors. The Editors are responsible for the preparation and publication of the Proceedings and may ask members of the Scientific Organizing Committee and others to serve as referees for contributed papers.

7. ASSISTANCE FOR TRAVEL EXPENSES

Application for assistance for travel expenses should be made in the blank space of the "Participation Form". Please keep in mind that because of the very small amount of travel funds that can be expected from the IAU and Australian authorities, it will scarcely be possible to grant more than US $ 50. - and that only in urgent cases. Under these circumstances you are urged to explore all possible local sources of travel funds that may be available to you.
1.7 APPENDIX 8 – Final list of Participants.

Participants

Anguita, C.A. Chile
Beaars, J.W.H. Netherlands
Blanco, V.M. Chile
Bok, B.J. U.S.A.
Bok, P.F. U.S.A.
Broeche, P. Germany
Brouw, W.M. Australia
Carrasco, G. Chile
Clube, S.W.M. Scotland
Counselman, C.C. U.S.A.
Débrazat, S. France
Dieckvoss, W. Germany
Douglas, J.N. U.S.A.
Edmondson, P.K. U.S.A.
Fichhorn-von-Wuern, H.K. U.S.A.
Elsmore, B. England
Fracastoro, M.G. Italy
Franz, O.G. U.S.A.
Fricke, W. Germany
Gliese, W. Germany
Gubbin, J. Australia
Heintz, W.D. U.S.A.
Hoffleit, E.D. U.S.A.
Hunstead, R.W. Australia
Klemola, A.R. U.S.A.
Klock, B.L. U.S.A.
Kowalevsky, J. France
Lacroute, P. France
Lederle, T. Germany
Legg, A.J. Australia
Luck, J.McK. Australia
Luyten, W.J. U.S.A.
Matsunami, K. Japan
Moffet, A.T. U.S.A.
Moutsoulas, M. Greece
Mulholland, J.D. U.S.A.
Muller, P. France
Murray, C.A. England
Oja, T. Sweden
Palmer, H.P. U.S.A.
Prochazka, P. Austria
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New Problems in Astrometry

BART J. BOK, Steward Observatory, University of Arizona

ONE of the most venerable and fundamental areas of research, the astrometry of precision stellar positions and proper motions, is on the move. During the week of August 13, 1973, an astrometry symposium was held in Perth, Western Australia, preceding the sessions of the International Astronomical Union later in the month at Sydney.

The 65 symposium participants were much concerned with problems of strategy, which is basic to a field in which the work of one man or observatory must be integrated into an overall pattern. Men like P losey, Kepl er and Tycho Brahe, Halley and Bradley, Bessel, Airy, and Newcomb were concerned first with fundamental star positions and later with accurate proper motions of stars. In addition to reviewing these subjects, the astronomers at Perth examined new approaches developed during the past five years or so. The most spectacular of these is radio astrometry, which burst full-grown upon the scene!

Why have a symposium on star positions? Do we not know the right ascensions and declinations of the stars with sufficient precision already? The answer is definitely no. We need a dependable fundamental reference system, which must have a well-defined celestial pole and a firmly fixed celestial equator with the versal equinox marked precisely on it. As a result of the precision of the equinoxes, which keeps the versal equinox moving westward along the celestial equator, we must refer each star position to the positions of the pole, equator, and equinox at a given time or epoch.

Therefore, to ascertain the constantly changing locations of the celestial poles and equator requires continuously high-precision measurements of right ascensions and declinations for a carefully selected list of fundamental stars. Unfortunately, these do not stay put either. They have sizable proper motions that must be taken into account. A further complicating factor is the general rotation of the Milky Way galaxy around its distant center in Sagittarius; this produces a pattern of motion in which all stars participate.

Thus, even if we were to succeed at a specific epoch, in defining a perfect fundamental reference system in 10 or 15 years deficits would begin to show up due to our constantly changing sky. It is not surprising that every decade or two, i.e., 60 years, we must take a comprehensive look at the fundamental system, as was done at Perth.

**The Fundamental Catalogues**

The Star Observatory at Heidelberg, West Germany, is directed by Walter Fröbe, who was chairman of the scientific organizing committee for the Perth symposium. Ten years ago, this observatory published the fourth (FK4) in a series of fundamental catalogues begun in Germany in 1785. It contains positions and proper motions for 1,355 fundamental stars, mostly brighter than visual magnitude 7.5 and fairly uniformly distributed over the sky. Its coordinates are based on the most reliable star observations made up to about 1900.

One of Fröbe's associates, W. Giese, indicated that 1980 is the present target date for publication of a fifth catalogue, the FK5. Since 1950, some 130 dependable new catalogues of position have been published, and these must obviously be incorporated in the FK5.

All observations that become available before the end of 1975 will be included, with large numbers coming from the Southern Hemisphere.

When the FK5 was prepared, the positions and proper motions of stars south of declination —35° were in a bad way. Only the Cape Observatory in South Africa contributed effectively to the FK4. However, at Bickley Observatory in Perth, director B. J. Hors and his associates, notably I. Nelligan, have collaborated with German astronomers who brought a precision transit circle to the western part of Australia in the late 1960's. We learned that the 110,000 observations of southern stars obtained with this instrument have all been reduced and analyzed in detail. In addition, 45,000 absolute positions have been determined by Catalina and Soviet astronomers working jointly at Catalina Observatory near San Miguel, where C. A. Augusta is director. Finally, the U. S. Naval Observatory has made 125,000 transit-circle observations at El
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<th>Mag.</th>
<th>Sp.</th>
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<th>(d_{\delta} / \text{yr})</th>
<th>(p)</th>
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Above is part of a page from the Fourth Fundamental Catalogue of 1,555 stars, showing data for Gamma Lyrae, Epsilon and Zeta Aql. The numbers in the column headed are each stars' right ascensions for 1964.0 and 1975.0, followed by the apparent variation in right ascension. Under \(p\) is given the proper motion per century in right ascension, with its centennial rate of change. The last three columns indicate, for Gamma Lyrae, that the average epoch of observation was 29.61 centur and the mean error of the right ascension then was 0.004, and the mean error of the proper motion is 0.000.007.

Retains for Polaris, the FK5 lists right ascensions and centennial variations every five years from 1950.0 to 1975.0.

Leo site station in Argentina. It is encouraging that these two groups limit very comparable values for the large corrections in right ascensions needed for the southern stars positions given in the FK5.

However, we cannot yet see our laurels. We now possess a good set of basic positions of southern reference stars for the epoch 1900, but to obtain their proper motions calls for a continuing major observing effort. As an aid to Perth, continued emphasis on southern hemisphere positional research is essential. To assist in this work, an extensive catalogue of southern reference stars is being prepared at the Cape Observatory in South Africa and the Royal Greenwich Observatory in England.

Much discussion at Perth centered on the constants that describe the effects of precession, in which the north and south celestial poles move once in 23,800 years around the pole of the ecliptic. The adopted values of these constants must be those derived by Simon Newcomb about 1897. If he might be pleased to know how long his results have been basic, but would surely not be surprised that slightly different ones must be adopted for the new FK5. Especially in need of revision is the constant of lunisolar precession, caused by the effect that our moon and sun have on the earth's equatorial bulge. There is much less need now to change planetary precession values, determined by the gravitational actions of other planets on the earth's rotational axis.

A Supplementary Catalogue. The Perth symposium has called for a supplement to the FK5 that would contain 3,000 to 5,000 stars, with special attention to the requirements of radio astronomy and the positions and motions of faint stars that can be measured precisely with reference to faint galaxies.

At present, systematic uncertainties in reference-star proper motions are considerable, and errors of 0.005 to 0.007 of a second of arc per year may well be present. But with continuing effort, such errors may be reduced to a third of their present amount for the FK5, such improvement is absolutely essential for calibrating the distance scale of our Milky Way system, for the basic data of the Hertzsprung-Russell diagram, and for all sorts of problems relating to the absolute magnitudes of stars. The astrophysicist, the student of galactic structure, and astronomers studying distances of distant galaxies all require the fundamental data that the supplementary catalogue would provide.

Radio Astronomy

At Perth, for the first time radio and optical astronomers considered how the results of radio position measurements can be incorporated into our researches on the fundamental systems of positions and proper motions. Three of the dozen radio astronomers attending presented major reviews papers: C. M. Wade of the National Radio Astronomy Observatory in West Virginia, B. Einotho of the Mullard Radio Astronomy Observatory at Cambridge England, and C. C. Groux of the Massachusetts Institute of Technology. They explained in detail the observational techniques of radio astronomy.

Chairman Fricke noted that a year ago the methods of determining absolute radio position were not as good as those used by traditional fundamental astronomy. New, he added, "radio methods have been developed to such a perfection that even a higher accuracy can be reached than in optical absolute measurements."

The most impressive result to date have been obtained with a combination of radio interferometers that have moderate baselines of a few kilometers. From the rate at which a cosmic radio source moves through the interferometer pattern from east to west, a very precise determination can be made of the radius of the source's orbital circle. This, in turn, yields an absolute value for the deuterium, with no optical measurement of position needed for reference. Thus, with the extremely precise time-measuring systems that are available at the present day, radio astronomers are finding that absolute declinations of excellent quality can be obtained automatically from their data.

Since large arcs can be measured by radio as easily as small ones, the differences in right ascension among radio sources can be very precisely observed. However, the sun and planets cannot be measured as exactly as radio stars and galaxies, and astrometry are not as good as basic reference points. The radio sources are not yet far enough away for the use of the quasar quasars directly to the zero point of his system of right ascension, and he must turn to his optical colleagues for zero-point determinations. Hence, emphasis must be given to getting precise optical positions for radio sources that have been identified optically. Such sources are all radio galaxies, quasars, and all radio stars.

Uncertainties in radio positions range from 0.1 to 0.2 second of arc for nearly 100 radio sources spread evenly over the sky from the north pole to about -40° declination. The optical positions of compact galaxies and quasars that emit radio radiation should be precisely determined with minimum delay. These real radio stars are already Algalp, Beta Lyrae, and P Cygni—and so on.

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their optical positions in the FK5 (and FK3) systems must be observed with high precision; also the Crab nebula pulsar. Much interest was expressed in J. N. Douglas’s report in the University of Texas radio aeronautics survey with its 120-channel radio interferometer, positions have already been found to within one second of arc for 2,000 radio sources, and comparable precision is possible for the 30,000 more such sources within reach of this equipment.

While moderate baselines already yield first-class results, even greater precision is ultimately promised by interferometers with very long baselines; some of them intercontinental and involving radio telescopes thousands of miles apart. Cremelam believes that eventually precisions of the order of 0.005 second of arc may be obtainable. But this is still in the future. It became clear at Perth that for effective use of radio positions already measured, or about to become available, the optical supplements to the fundamental catalogues must provide high-quality positions for all radio stars and most optimally identified radio galaxies. Furthermore, there is need for many good standards for 16th to 15th-magnitude stars that are situated in the sky near radio galaxies.

Unfortunately, the radio interferometers that have been the most effective so far have all been in the Northern Hemisphere. Thus, the Perth symposium unanimously passed a resolution urging the extension of radio astronomy to the Southern Hemisphere. If this is not done soon, we shall have to live for the next 20 years or so with a bipartite fundamental system of reference for positions and proper motions. The Northern Hemisphere will be in good shape, but with the Southern lagging behind, all astronomy and astrophysics will suffer.

Photographic Astrometry
For a full day at the symposium, optical astronomers discussed astrometry with large telescopes and related problems in measuring the proper motions of faint stars—data needed in Milky Way research. Since the late 1940's, there has been a remarkably concerted effort to obtain proper motions of faint stars relative to faint galaxies, since the latter periods ideal reference points. On the average, a 16th-magnitude galaxy is so very distant that it cannot be expected to show a proper-motion displacement as great as 0.00002 second of arc annually.

Since neither projection nor galactic rotation affects these galaxies, they are the true hitching posts of the universe! About 30 years ago, two major projects involving them were initiated, one by W.H. Wright at Lick Observatory in California, the other by A. N. Deutsch of Pullkovo Observatory in the U.S.S.R. The present state of the art was summarized succinctly in a joint statement by Deutsch and L. R. Kleinos of Lick, where the program is well on its way toward completion. The Lick method consists of measuring the positions of a considerable number of stars and all suitable faint galaxies on plates of 15- by 17-inch twin-focus plates taken with the twin 20-inch photographic and photovisual refractors on Mount Hamilton. The separation between first- and second epoch plates is usually about 30 years. During the seven years following in April, 1947, 124 pairs of first-epoch plates were taken. It was found that stars as faint as magnitude 15.5 could be measured to ±0.09 second of arc for comparing their positions to galaxies with well-defined nuclei, which could be measured to ±0.15 second.

The taking of second-epoch plates began in the late 1950's, and now the positions of 60,000 stars and faint galaxies are being measured at Lick. Some 30,000 of them have "special interest" (including 2,460 R Lyrae stars), and 25,000 possess good reference positions in the system of FK5. There will ultimately be related directly to the FK5 system. At Pullkovo, Deutsch and his associates have completed measurements of star positions relative to star-like knot in 85 spirals and other external galaxies. Unfortunately, we learned at Perth that intercomparisons of the Lick and Pullkovo results indicate systematic differences (occasionally as great as 0.30 second of arc) between annual proper motions determined by the two batches different methods. Further study of this problem will be forthcoming soon, since the Lick and Pullkovo programs are important for firm tying-in of bright star data with those for faint stars and galaxies.

Analysis of the Lick results may bring many new rewards. V. M. Clube of Edinburgh Observatory seems to have detected very unexpected local streaming tendencies of stars within 500 parsecs of the sun on the basis of his analysis of the first list of 8,000 Lick proper motions. We heard a good deal at Perth about three related projects. Angular astrometry announced that a survey similar in principle to the one at Lick was being under taken by the National Radio Astronomy Observatories at Socorro, the USRA, and the Florida Institute of Technology. Coupled with the work done in Pullkovo and the Radio-Columbia project at El Leoncito may not even be able to complete the vital first-epoch plates in a southern star program that follows closely the precepts of the
Lick survey. The initiation of second-
epoch plates can be postponed for a
while, since the interval should be of
least 15 years, but it would be desir-
able if the first-epoch program were not
fully completed now. Hence, both the Paris
symposium and IAU Commission 24 at
Sydney pressed resolutions in support of
the Lick-Cambridge project's continuance.

Minnesota astronomer W. J. Layton
describes how he locates and studies faint
stars of large proper motion with his fully
automated and computerized plate scan-
er and measuring engine. He proceeded
with a list of 11,000 stars with proper
motions of more than 0.18 second of arc per
year and another list of 800 new stars
with proper motions in excess of half a
second. He now sees the maximum at the
general luminosity function at abso-
lute photographic magnitude +15.6, in-
stead of his earlier +12.7. The general
luminosity function is the number at
stars of different absolute magnitudes per
unit volume of space in the vicinity of the
sun. The stars with absolute magnitudes
two the maximum frequency are dwarfes,
and are the components in our part of
the Milky Way system.

Automatons need access to large re-
flectors and Schmidt telescopes, especially
for such research as determining the faint
stellar membership of open and globular
druses. Unless such access is provided,
the first-epoch plates for work on faint
cluster proper motions will not be avail-
able 20 years hence. On which occasion
will be asked about such faint membership?

In a way, the most satisfactory solution
to have specially designed automatic
reflectors, like the extremely successful
41-inch of the U. S. Naval Observatory
at Flagstaff, Arizona. Harley Wood, the
government astronomer for New South
Wales, has presented a case for such an instru-
ment in the Southern Hemisphere. Moreov-
er, C. A. Murray reported on
some photographic positions and proper
motions obtained with the 102-inch Isaac
Newton telescope at Herstmonceux Castle
in England. Very encouraging results
were also presented by W. F. van Altena
with the good old Yerkes 40-inch refrac-
tor in Wisconsin.

Trigonometric Parallaxes

Measuring star distances by direct tri-
angulars, with the earth's orbit as the
baseline, is of great importance in astrom-
y. In the past it has been done mostly
through long-continued photographic
programs with large refractors. However,
the 41-inch reflector at Flagstaff has made
good progress in the field, as reported by
K. A. Sandel at Perth, 209 trigonometric
parallaxes have already been published.
But this work is so time-consuming that
great care must be taken in advance
of selecting stars that are suitable for the
measurements of their parallaxes with
such a large instrument. Proper motion is
in a first criterion, but every star selected
tentatively for such work should be ex-
amined carefully for photometric and
spectroscopic clues to its relative near-
to us.

The Perth delegates paid much atten-
tion to cutting down the accidental error
in measured trigonometric parallaxes. In
spite of our best efforts, most of the fin-
ished values are uncertain by ±0.001 in
the 15th magnitude (at Vega's distance of
26.5 light-years). Hence, this may be a good place to note that space research holds great promise. For example, as it orbits outside the at-
mosphere that plagues Earth-based ob-
servations, the Large Space Telescope
should reduce to show unclouded the errors
of our present-day trigonometric parallaxes.

Truly spectacular results may be ex-
pected when space missions with astro-
metric equipment extend the baselines
out into the solar system, perhaps with
one space observing platform in the vicin-
ity of Jupiter and another working
motion in the opposite direction!

Trigonometric parallaxes obtained
from Earth-based stations now yield reason-
ably reliable intrinsic brightnesses of stars
with distances up to 90 light-years. The
Large Space Telescope should extend
this limit to 500 light-years. And, with a
Jupiter-orbit baseline, the precision of
derived parallaxes would increase five
times, giving astrophysicists study on
1,500 light-years. O and B stars. Cepheid
variables, and fine-type supergiants could
all then be included in trigonometric parallax programs.

Instrumentation Advances

During the final days at Perth, we
considered improvements in observation-
techniques and heard about new and
ingenious measuring engines for obtain-
ing photographic positions. The basic
instrument for the absolute measurement
of stellar positions is still the old meri-
dian or transit circle. Its future was ex-
amined in a year ago at an international
colloquium in Denmark. Whereas earlier
astronomers were proud to measure stars
of 11th apparent magnitude by simple
visual techniques and recordings, they
are now able to obtain comparable ac-
curacy down to the 15th magnitude with
electric techniques and automation of the
recordings. This highly important develop-
ment may assist greatly in relating
faint-star data to the traditional bright stars.

One instrument coming to the fore is
the Dvinon pnumatic automatic, which
is noted for freedom from the systematic
errors that affect meridian-circle observa-
tions. Unlike astronomers reporting that
an automobile will be one of the basic in-
struments at a new astronomical observa-
tory near Gossau, in the south of France.
And several telescopes are being geared
for research in the neglected Southern
Hemisphere.

Several high-speed automatic measur-
ing instruments were described, in addi-
tion to Layton's. The "Galaxy" machine at
Edinburgh and other similar devices
in Great Britain promise to be exceed-
ingly useful for positional work. A new
version of the Naval Observatory auto-
matic measuring machine, which has op-
erated for seven years, will incorporate
laser interferometry. Lick Observatory
has obtained a completely new version of
its measuring engine, to handle the gal-
axy reference places in the 2-Micron tele-
scope survey.

All told, IAU Symposium 51 was a very
effective event at which 1 learned a great
deal that was completely new to me. My
horizons in astronomy were truly en-
larged. May astrometry flourish as a re-
sult of this fine effort by the symposium's
organizers, local and international.
The Comet Hunter Telescope

Its Conception and Development

For more than 30 years I have hunted for comets as my limited time and resources permitted. The main impediment to this pursuit apart from light pollution is that the sky is full of objects, galaxies and globular clusters, that mimic comets and one may well spend more time looking over star charts and catalogues than actually looking through the telescope.

The development in the area of computers have provided a solution to this problem. The original concept was to locate a suspicious object and have computer readable circles on the telescope which could be used to locate permanent objects, like galaxies and globular clusters, within a computer data base. Thus one will achieve in 10 seconds or less, what might otherwise take 10 minutes or more.

In addition to this a permanent record could be used to supplement the data base and to check objects for movement - the ultimate test for a comet. Also it would be possible to include known comets so that time is not wasted chasing somebody else's comet. Further, it is possible, by taking many readings to achieve a precision of comet position suitable for orbit determination.

I have developed strategies for locating lost comets and calculate that if the comets are there it should be possible to find about 4 comets a year. One comet a year would be an acceptable success rate. Discovering comets would be good publicity for Perth Observatory - any scientific institution thrives on discoveries - and in addition the addition of new comets to the statistic's should help to solve some of the problems of these mysterious objects and possibly the origin of the Solar System in which they are found.

The concept outlined above would have been useless without technical input. This is probably the place to compliment Arie Verveer, the Observatory's Technical Manager, for his design, construction and development of the telescope, together with John Pearse, the Observatory's Mechanical Technician, as it nears completion.

It should be said that this system is unique and for its successful operation requires a carefully chosen site.

Michael Candy
1993 May 10
July 2, 1987

The Honorable Peter Dowding
Minister for Labour, Productivity
and Employment
Capita Centre
157 St. George’s Terrace
Perth
6000 Western Australia

Dear Minister Dowding:

Thank you for your letter of 9 June 1987 in response to my telex with Dr. Michael C. J. Putnam, which expressed the Lowell Observatory’s concern about the possible closure of Perth Observatory.

As you know, Lowell Observatory owns the 24-inch telescope that was installed at Perth Observatory in 1971. The telescope has been scientifically very productive at Perth—the Rings of Uranus and Comet Halley’s molecular jets are among the major discoveries made with this instrument. We are convinced that Perth continues to be the best possible location for this telescope. We would be truly distressed if it were to be necessary to remove the 24-inch from Western Australia.

While we agree with your assessment of the international importance of Perth Observatory, we do take issue with your conclusion that the Observatory is then of limited value to the citizens of Western Australia. Many of the international programs carried out at Perth Observatory are cooperative in nature, and therefore directly involve the staff of the Observatory. Such cooperative programs bring benefits to all of the involved institutions; e.g., scientific publications resulting from research at Perth Observatory have certainly served as positive advertisements for Perth and Western Australia among a significant segment of the world scientific community. Such connections between world scientific activity and Perth can benefit your citizens by making it easier to stay in tune with
scientific and technological developments which now often have important economic implications. Enclosed are a few publications—by no means a complete sample—which illustrate the success of cooperative scientific research at Perth Observatory.

The reasons for international interest in Perth Observatory perhaps also need to be clarified. While the 24-inch diameter research telescope is small by modern standards, its location in Western Australia allows it to be used in combination with other telescopes to carry out unique research programs where time coverage on celestial objects is of primary importance. Thus, since the Perth Observatory is nearly one-half of the way around the world from major North and South American observatories, it is feasible to obtain nearly continuous time coverage of celestial objects by combining resources. Recently, most of this type of work has centered on solar system studies, but there is now increasing interest in obtaining long data strings on variable stars. Furthermore, improvements in detector technology are greatly increasing the scope of astronomical research that can be carried out at Perth Observatory. The research philosophy at Perth Observatory, which has included collaborative studies as a significant component of the research program, thus has led to a productive mode of operation.

We understand that there are now serious budget difficulties on both the State and Commonwealth levels in Australia, and that the discussion of closure of Perth Observatory is being motivated by financial considerations. You can understand, I'm sure, that it is virtually impossible for us to deal with funding issues in a significant way on a short time scale. Lowell Observatory is a small, private institution and accordingly could not on its own provide substantial institutional funding for Perth Observatory (resources are also strained in the United States!).

However, we are prepared to immediately seek funding from NASA, the National Science Foundation, and other sources for research to be conducted, at least in part, with the 24-inch telescope at Perth Observatory. These proposals will include scientific programs in the areas
of studies of comets, Jupiter watch observations of "weather" patterns in the planet's deep atmosphere, measurements of stellar variability as a means to probe the interior structures of stars, and fundamental surveys of brightnesses and colors of southern stars and stellar systems. Funds would be budgeted in these proposals to cover an equitable share of the cost of operating and maintaining the telescope and other expenses directly related to conducting the research at Perth. We are also prepared, in cooperation with Dr. Michael A'Hearn of the University of Maryland, to seek funding for a modern CCD camera to reside at the 24-inch telescope. Such a camera would effectively increase the research power of the telescope, permitting it to compete with much larger instruments. We must caution you that there is no guarantee that our proposals will be successful and, in any case, the time scale for receipt of actual funding is one to one-and-a-half years. On the other hand, we believe that this approach offers the best hope of significant, long-term international support of research at Perth Observatory. We would be very interested in your comments about this plan.

Thank you again for your time in considering our comments on this issue.

Sincerely,

John S. Gallagher III
Director

Enclosures

CC: Hon. Bob Hawke, Prime Minister
Hon. Barry Jones, Minister for Science
Hon. Brian Burke, Premier, Western Australia
Dr. M. Candy, Director, Perth Observatory
Dr. M. Putnam, Sole Trustee, Lowell Observatory
Observing Prospects for Halley’s Comet

Robert G. Roosen, Joint Observatory for Cometary Research, NASA, and Brian G. Marsden, Harvard-Smithsonian Center for Astrophysics

Less than 10 years from now, toward the end of 1984, faint images of Halley’s comet will probably be recorded on plates exposed with one of the world’s large reflecting telescopes. Then still beyond the orbit of Jupiter, this celebrated object will be accelerating inward to its rendezvous with the sun on February 9, 1986.

How spectacular the comet will eventually appear depends to a considerable extent on how serious the problem of light pollution has become by 1986. We merely remark that, if you were disappointed by Comet Kohoutek in early 1974, don’t have high hopes for a fine display from Comet Halley.

Relatively few of the press items on Comet Kohoutek stressed the fact that twilight, and later moonlight, would interfere with attempts to observe it during the first week of January, 1974. Even fewer mentioned the desirability of making observations at sites far from city lights. It is true that Comet Kohoutek turned out to be fainter than any of the predictions, but with careful selection of a suitable location it was a rewarding sight. The second author had some difficulty detecting the comet using 7 x 50 binoculars amid the lights and smoke of Cambridge, Massachusetts, but in suburban skies eight miles away he glimpsed it with the naked eye.

Yet at the same time, at the Joint Observatory for Cometary Research, located on a 10,415-foot mountain near Socorro, New Mexico, Comet Kohoutek was an easy naked-eye object, with a tail that was 16 degrees long on January 15, 1974, for observer Bill Gates. He still saw a five-degree tail on January 17th and 26th, but on four intervening evenings, when he was on the western edge of Albuquerque, 90 miles away, the comet was invisible to the naked eye and had only a two-degree tail in binoculars.

The surface brightness of comets’ tails ranges from many times the sky background to much less than it. At the Joint Observatory, the mean visual sky brightness is approximately magnitude 21.7 per square second of arc. In a typical city, the sky is 10 to 100 times brighter. Thus, the Joint Observatory’s sky at full moon is comparably bright to that in a large city where there is no moon at all! Any increase in sky brightness washes out the fainter parts of a comet’s tail and can shorten it drastically.

K. Rieple of the University of California

June, 1975, SKY AND TELESCOPE 363
The track of Comet Halley from November, 1985, to May 1986, plotted from the Brady-Carpenter ephemeris in the Astronomical Journal for October, 1971. At perihelion on February 9, 1986, the comet will be on the far side of the sun from us, however, not entirely out of the question.) Halley’s comet will then move in toward the sun, becoming no brighter than magnitude 4 when it disappears in twilight around January 24th, a day or so before full moon. Since Comet Kohoutek was certainly of 3rd magnitude when it first became generally visible in January, 1974, evening observers are not going to find Comet Halley a particularly inspiring sight.

After perihelion, Halley’s comet will reappear in the morning sky. But by the time it has attained an elongation of 20 degrees from the sun, on February 19, 1986, it will already be south of the sun and more conveniently viewed from the Southern Hemisphere than from the Northern. It should be a little brighter and have a somewhat longer tail than when last seen before sunset in January. As the sun moves rapidly northward, the comet will continue southward and become a fairly striking object for Southern Hemisphere observers. In the United States we will have to be content with a view of the comet low in the southeastern sky before dawn. On March 7th, the comet will be a few degrees north of the waxing crescent moon.

An important characteristic of Halley’s comet is that its absolute brightness tends to be greater after perihelion than before (the main problem with Comet Kohoutek was that the converse was true). Consequently, the comet should hold at high magnitude throughout March, 1986, probably even brightening toward the end of the month as its decreasing distance from the earth counteracts the effect of its increasing distance from the sun. The tail can be expected to attain a length of perhaps 20 degrees and possibly even 40.

However, little of this tail will be visible from the United States, for the comet’s declination will be −27° on March 21st, −30° on the 31st, and −47° on April 10th. On this last date, Halley’s comet will be closest to the earth (0.42 astronomical unit away) and should still be of 3rd magnitude. It passes opposition a day or so later, and rapid northerly motion will soon bring the comet into view for most of the United States. Northern Hemisphere residents may well have their very best sight during the last few days of April, with the comet a late evening object at declination −20° in Crater, still perhaps of magnitude 4 or 5 with a few degree tail.

Halley’s comet will fade significantly in May, to about magnitude 7 by the end of the month. During June and July, the comet will remain relatively stationary in Scutum, fading to about magnitude 11 and eventually becoming lost in evening twilight. Further observations will undoubtedly be possible with large telescopes during late 1986 and the first half of 1987. It is just conceivable that the comet can be photographed again at its 1987-88 opposition by which time it will be almost eight astronomical units from the sun, well outside the orbit of Jupiter.

Thus, it is not unlikely that Comet Halley on its next return may disappoint much of the general public, as Comet Kohoutek did in 1974. But like Kohoutek, it should be highly gratifying to suitably located amateur astronomers with observing experience, and professional astronomers will have a rewarding opportunity to apply their latest methods and ideas to a large and famous comet that may give answers to important astronomical questions.

A NEARBY STAR

The latest addition to the list of the sun’s nearest stellar neighbors is the subluminous red dwarf VY Scuti, 767, a star of visual magnitude 10.1 in Draco, at right ascension 16h 24.2m, declination +54° 25′ (1950 coordinates). It is only 21.8 light-years distant, according to the determination of its parallax as 0.150 second of arc by A. R. Upgren and E. W. Weis, using the 20-inch refractor of Van Vleck Observatory. In Astrophysical Journal Letters they give its proper motion as 0.464 second per year.
The Perth Observatory, a Branch of the Technology Directorate will be playing a major role in the observation of Comet Halley later this year and next year, Michael Candy, the Acting Government Astronomer said today.

W.A. Premier, Brian Burke has given approval for Astronomer Peter Birch, of the Perth Observatory to go to the U.S.A. later this year. While there, he will observe Comet Halley, Comet Giacobini-Zinner and other objects with the 42-inch (107-cm) and 24-inch (61-cm) reflectors at the Lowell Observatory, and the 72-inch (183-cm) Perkins reflector at the outstation at Anderson Mesa. Observations of Comet Giacobini-Zinner are to support the U.S. spacecraft - International Cometary Explorer (I.C.E.), which will be the first spaceprobe to directly explore the comet.

Observations of Comet Halley will start in August this year, being the first time astronomers can compare this comet with others using modern techniques. About a dozen comets have already been intensively observed at Perth, over a wide range of wavelengths. Because Comet Halley is intrinsically brighter than most other comets, new techniques are being developed and this will be a golden opportunity to apply them.

In conjunction with detailed photometry, Professor M. A'Hearn of the University of Maryland will be observing the comet with a CCD (Charge Coupled Device) camera, fully computer controlled. He has developed this camera specifically for Comet Halley to give better detail than has previously been achieved. The camera will enable the structure of the comet to be examined and it is hoped to determine the molecular composition near the nucleus of the comet.
Press Release-Halley's Comet (cont'd.)

In mid-January next year Comet Halley will move behind the Sun and will be too close to be observable from the Earth. The Comet will pass through perihelion on February 9 and will reappear towards the end of February. At this time the comet will not be observable from the northern hemisphere, so Prof. A'Hearn will be bringing his CCD camera to the Perth Observatory to continue his series of observations, in conjunction with our photometry.

While Comet Halley moves across the sky it will occult some bright stars. From measurements made while the comet passes in front of these stars more can be found out about the comet's composition. An application has been made to the Department of Science and Technology in Canberra for Astronomer Ralph Martin also of the Perth Observatory to accompany Prof. A'Hearn to Chile where many of these occultations will occur in April 1986. After this expedition the CCD camera will be returned to Perth and follow Comet Halley as it fades, until the end of July.

When the comet becomes observable in the southern hemisphere, accurate positions will be obtained at the Perth Observatory. These positions will be immediately transmitted to the European Space Organization and the International Halley Watch in the U.S.A. so that last minute corrections can be made to the orbits of the five space probes heading for the comet. As well as providing these valuable precise positions of the comet the Perth Observatory will be photographing the head and the tail.

This famous comet, with a period of 76 years, was well observed in 1910 (see the accompanying photograph) from the Perth Observatory, which at that time was sited near the main entrance to King's Park. However, the comet is not expected to be as spectacular this time around as it is further from the Sun when we can see it in from Perth. According to ancient records, the comet has been observed at every return since 240 B.C. In 1695, Edmond Halley successfully predicted the reappearance in 1759, but he was not aware of this success as he died in 1742. This was the first time such a prediction had been made for a comet and that is the reason the comet now bears Halley's name.
Press Release-Halley's Comet (cont'd.)

The Perth Observatory is preparing a pamphlet, to be available later in the year, which will help anyone who wishes to find and observe the comet.
COMET HALLEY AND THE PERTH OBSERVATORY

BY MICHAEL CANDY

Comet Halley will be particularly easy to observe in 1986 from late February to the end of April. It will be fainter, but probably visible in binoculars, from early November. It will then get gradually brighter and will possibly be visible to the naked eye at the end of December this year and early January 1986. The comet's path amongst the stars is shown in the chart. The comet will be too close to the Sun, at perihelion on 9th February, and will be difficult to observe for a fortnight on either side of this date.

The photograph of Comet Halley was taken on 29th April 1910 at the Perth Observatory by the first Government Astronomer, Mr W Ernest Cooke. The comet is not expected to appear so bright this time, because the Earth is much further from the comet when it is at its brightest, but a tail at least ten degrees long may be expected.

Comet Halley has been seen at every return to the Sun since 240 BC, according to the ancient records of the Babylonians, Chinese, Koreans and others. Before 1758 the comet was discovered by chance at each return as a bright comet that happened to be "passing by".

Edmond Halley (1656-1742), who was elected a Fellow of the Royal Society at the tender age of 22, had remarkably diverse scientific interests. Posterity is probably most grateful to him because he persuaded Newton to publish
"Principia", incorporating his famous Laws of Gravitation, in 1686-1687. In 1695 Halley used these laws to calculate the orbits of 24 comets including the comets of 1531, 1607, 1682. Halley noticed the similarity of their orbital elements (see table) and for the first time saw that comets could move around the Sun in periodic orbits. In this case the period was obviously about 76 years so Halley confidently predicted a further return in 1758/9. When this prediction was fulfilled, sixteen years after Halley's death, the comet became universally known as Halley's Comet. Generally, comets receive the names of their discoverers.

<table>
<thead>
<tr>
<th>T</th>
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<th>(\omega)</th>
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<tbody>
<tr>
<td>1531</td>
<td>0.581</td>
<td>0.968</td>
<td>106.9</td>
<td>52.3</td>
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<tr>
<td>1607</td>
<td>0.583</td>
<td>0.968</td>
<td>107.5</td>
<td>53.0</td>
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<td>0.968</td>
<td>109.2</td>
<td>54.8</td>
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<tr>
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<td>0.584</td>
<td>0.968</td>
<td>110.7</td>
<td>56.5</td>
<td>162.4</td>
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<td>1986</td>
<td>0.587</td>
<td>0.967</td>
<td>111.8</td>
<td>58.1</td>
<td>162.2</td>
</tr>
</tbody>
</table>

T Perihelion time, when the comet is closest to the Sun.
q Perihelion distance, the shortest distance between comet and Sun
e Eccentricity. (For a circle \(e = 0\), for a parabola \(e = 1\))
i, \(\omega\), \(\Omega\) Are angles fixing the orbit in space with respect to the Earth's orbit.
3.
Changes in the orbital elements in the table are caused by the planets. A comet can be regarded as moving in a simple curve around the Sun, with small deviations from this curve caused by the attractions of the planets. Calculations can be made to take account of these planetary perturbations and these are much more quickly and reliably done nowadays, when large computers are available. However, when all known effects are included for Comet Halley, there remains a discrepancy of 3 or 4 days in a predicted return. These discrepancies, which also occur to a smaller degree for other comets, are ascribed to "Non-gravitational forces" - another way of saying it isn't known what causes them! They have been attributed to the comet's rotating while it sheds material, freed by the Sun's radiation. But until a comet's nucleus is examined closely, by a space probe for instance, its actual existence must be in doubt. Part of the charm of cometary astronomy is that there is so much still to find out about comets. Some other problems are:
i. The origin of comets.

ii. The chemistry and physics in a comet's head and tail, both of which change with time and distance from the Sun.

iii. The evolution of comets and their orbits.
The comet will be studied very closely by five space probes which will be maneuvered to pass very close to the comet, one "miss distance" is hoped to be 500km. The orbit of the
comet is not yet well determined and late adjustments to the probes' orbits will be necessary next year in March, when our knowledge of the comet's orbit is improved by observations in the southern hemisphere. The Perth Observatory has, over the years, developed considerable expertise in this field and will take plates every morning in late February and early March. The results will be telephoned immediately to international centres for the express purpose of determining the comet's orbit more precisely and making last minute adjustments to the probe orbits.

As well as continuing to provide accurate positions of the comet, the Perth Observatory will be studying Comet Halley in a number of other ways:

- **Photometry**, the measurement of the comet's brightness in different wavebands, will be carried out for as long as the comet is within reach of our instrumentation.
- **Large scale phenomena** will be recorded on medium-sized and small cameras.
- **Near-nuclear Studies** will be carried out using a CCD (Charge Coupled Device) camera in conjunction with a team from the University of Maryland.

In addition to its scientific work, the Perth Observatory will be keeping the media informed of the comet's progress and will endeavour to make sure that all those who want to see the comet, succeed. All that will be necessary is to
5.

get away from the bright lights of Perth and other places, to have a map of the comet's path amongst the stars and to have a pair of binoculars in case the comet is fainter than predicted.

1905 July 3
To commence the process, on 8 March 1971 Wood provided Harris with a “...skeleton programme of the I.A.U. Assembly in 1973...”, see Figure 5.6.1 (Archives-POBS October 1970 - June 1973).

Figure 5.6.1 – Faded duplicate copy of the IAU General Assembly 1973 draft of programme.

From the Perth Observatory archives, on 8 March 1971, Fricke wrote to Harris and enclosed a letter between himself and Contopoulos of 2 March 1971, see Figure 5.6.2 below.

Fricke first reiterated the change in name to what had been initially suggested. Fricke explained “I suggested the more generic title ’New Problems of Astrometry’ which was also favoured by Vasilevskis and Wood. This title would include optical and radio astronomy; the IUA Commissions 8, 24, 33 and 40 are interested in this field”. Fricke wrote, “It is hard to estimate how many IAU members would wish to attend a Symposium at Perth. My personal estimate would be a number of about 150 persons which should receive invitations, and it appears to me that more than 100 will be able to attend” and Fricke wrote that the IAU financial support would be US$1500.
It is not uncommon for symposia to be hosted at several locations in a country, based upon the different observatories expertise or specialist fields, Australia was no different. For Australia, distance between states and observatories was again to be a challenge. In this case, Wood made suggestions for some of the symposia to occur before the GA and some after.
Harris had been busy with other matters at the Observatory, which he reported in a letter to Fricke on 28 May 1971.

As reported earlier in this thesis, Chapter 5.3, the Perth Observatory was to host a new telescope from the USA. Harris apologised that this was the start of a busy period, “I am sorry that I have taken so long to answer your letters. During Easter, Lowell Observatory’s 24-inch telescope was installed here, following which we were starting on the observations for their Planet Patrol Program. Then, two weeks ago, we had the Jupiter occultation, with a visit by two astronomers from the University of Texas to observe it on the University’s telescope”. Harris then commenced answering most of Fricke’s questions from letters of the previous months. Harris explained that while he was happy to change from a small Colloquium to a larger Symposium “…I felt that the smaller number of participants in a Colloquium would result in more useful discussions, because they are less formal. Secondly, a Colloquium could be held in the Observatory, whereas we would have to look elsewhere for a meeting place for the Symposium”. What Fricke was not aware of was that a meeting of ANZAAS was also planned for Perth the week before the Sydney IAU GA meeting, with an estimated 1500 participants.

Harris explained that this meeting “…would undoubtedly occupy the University and much of the hotel and motel accommodation in Perth and near the University”; Harris was also concerned that financial support from the Government would have to shared in this situation. Based upon this, Harris wrote that, after discussions with the LOC and a suggestion from Wood and Contopoulos, the number of participants would indeed exceed their initial estimate of 30.

Harris noted that they had discussed other venues and accommodation apart from the University (of Western Australia). Specifically on this matter Harris wrote, “We believe we that we can find a suitable meeting place in the Western Australian Institute of Technology, which is the other side of Perth from the University (of Western Australia), and has the advantage over the Observatory of catering for meals. We think that we should find a motel in that area which will not be booked by ANZAAS”. Harris then addressed the travel concerns for the overseas participants of the GA meeting being in Sydney and the Symposium in Perth. “The IAU grant will not go very far on travel expenses. The return air fare between Perth and Sydney is $244 (Economy Class) and for travellers from the United States, the extension from Sydney to Perth costs the same. However, for those coming from Europe to Sydney, or on a round-the-world flight, there is no extra expense in passing though Perth”. Harris closed the letter by writing that the initial date range set for the Perth Symposium was “…between Monday 13th and Friday 17th August…” the week preceding the Sydney GA meeting (Archives-POBS October 1970 - June 1973).
On 10 June 1971, Harris wrote to Wood providing details of the Perth Observatory to be used in the announcement by the IAU of the Symposium, see Figure 5.6.3 (Archives-POBS October 1970 - June 1973).

Figure 5.6.3 – Harris letter to Wood on the current Perth Observatory.
With the hectic schedule at the Perth Observatory as a result of the arrival, installation and commissioning of the Lowell telescope, Harris was unable to keep up with his correspondence. The situation left Wood to make some decisions, but still based upon discussions he and Harris had previously had.

On 1 October 1971, Wood advised Harris “...that the executive committee has accepted the recommendation for the Symposium on ‘New Problems of Astrometry’ and given it the number 61”. In the same letter, Wood wrote that Prof Bart Bok had raised some concerns regarding the overlapping of the dates for the Perth Symposium No. 61 with that of the Symposium on ‘The Formation and Dynamics of Galaxies’ scheduled for 12-15 August in Canberra, Australia.

Harris took the opportunity to write to Fricke and cc Wood on 15 November 1971. Harris reiterated the situation with the ANZAAS meeting being held in Perth and the limited venues, other than the University of Western Australia, however, he added that he “…therefore obtained informal agreement to our meeting at the Institute of Technology” (Archives-POBS October 1970 - June 1973).
Request for approval of an IAU Symposium on "New Problems of Astrometry" to be held from 13 to 17 August 1973 in Perth, Western Australia

Dear Dr. Contopoulos:

Thank you for your letter of 2 March and your reminder in May concerning the progress in the planning of a Colloquium or Symposium on "New Problems of Astrometry" to be held in Perth, Australia, in 1973. I apologize for the delay of my answer. The delay is due to the fact that I was collecting information and suggestions from quite a number of members of various Commissions and that I was recently away from Heidelberg for a 5 week trip to Japan.

The following proposal is the result of consultations with Mr. B.J. Harris, Perth, Dr. Harley Wood, Sydney, Dr. S. Vassilevski and quite a number of members of IAU Commissions 8 (Positional Astronomy), 24 (Photographic Astrometry), 33 (Structure and Dynamics of the Galactic System), and 40 (Radio Astronomy). Agreement has been reached that the title "New Problems of Astrometry" is the most appropriate one, and that a Meeting under this title is broad enough to be called an IAU Symposium.

For the information of the IAU Executive Committee I summarize the proposal as follows.

Title of IAU Symposium No. ..; New Problems of Astrometry

Date and duration: 13 to 17 August 1973
(Arrivals and Registration: Monday, 13 August;
Scientific Sessions: Tuesday, 14 August to Friday, 17 August)

Place: Perth, Western Australia

Suggested: On the invitation by B.J. Harris, Perth, suggested by the Presidents of IAU Commissions 8 and 24 and to be held in cooperation with IAU Commissions 33 and 40.
Local Contact Address: B.J. Harris, Government Astronomer, Perth Observatory, Bickley, Western Australia 6076

Suggested Scientific Organising Committee:
- W. Fricke, Heidelberg, Chairman
- S. Vasilyevskia, Santa Cruz, Vice-Chairman
- W. Gliese, Heidelberg, Secretary
- C.A. Murray, Herstmonceux
- D.S. Heschen, Charlottesville, Virginia, (and/or another member of Com. 40)
- S.W. McCuskey, Cleveland, Ohio, (and/or another member of Com. 33)
- R.H. Stoy, Edinburgh
- G. Van Herk, Leiden
- H. Wood, Sydney
- M.S. Zverev, Leningrad

Local Organising Committee:
- B.J. Harris, Perth, Chairman
- M.P. Candy
- D.N. Harwood
- L. Nikoloff
- S.E. Williams

Participants: About 75 persons (on invitation only)

Financial Support: A contribution of US $1,500 is requested from the IAU. A contribution of US $1,000 is expected from the State Government of Australia, and expenses for the meeting place will be met from local funds in Perth.

Suggested Editors of the Symposium Proceedings:
- W. Gliese, and C.A. Murray.

Preliminary Scientific Programme (Topics covered):
New astrometric techniques; desiderata for the improvement and extension of the fundamental system (FK4); positions and proper motions of faint objects; proper motions with respect to galaxies; radio positions.
Figure 5.6.4 – Fricke’s letter specifying the name and dates of the Perth Symposium.

With Harris’ comments to Fricke the previous day, Harris wrote to his contact at the Western Australian Institute of Technology (WAIT), Dr John de Laeter1, “This letter is to confirm our previous conversations, regarding the IAU Symposium No. 61, ‘New Problems of Astrometry’”.

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1 Head, Department of Physics, WAIT.
In this letter Harris advised de Laeter that he requested facilities to accommodate between 75 and 100 participants for the week of 13 to 17 August 1973 (Archives-POBS October 1970 - June 1973).

It is apparent from the Perth Observatory archives that Harris had been in verbal contact with the organisers of the ANZAAS Congress meeting as; on 30 November 1971 Harris received a letter from Prof Martyn J Webb, Hon. Organising Secretary of the 45th ANZAAS Congress. Webb thanked Harris for his hospitality during his visit to the Perth Observatory. Webb then detailed his wish for there to be some collaborative effort between the IAU Symposium and the ANZAAS conference (Archives-POBS October 1970 - June 1973).

Working on the basis that the Symposium would proceed at WAIT, Harris wrote to the Western Australian Tourist Bureau on 1 February 1972. Harris detailed the dates, location and numbers for the Symposium and requested whatever assistance the Bureau could provide. Harris assisted by providing information on the ANZAAS Congress meeting, which would be in progress at the University of Western Australia, as to the reason he had selected WAIT for the IAU meeting. Harris further enquired about what services might be provided for the transport of participants between their lodgings and WAIT. Harris closed his letter by alluding to the fact that this Symposium was International in nature and attended by specialists from throughout the world arriving via Sydney and Europe (Archives-POBS October 1970 - June 1973).

The archives of the Perth Observatory contain a letter from Mr K M Johns; Manager of the Tourist Bureau dated 5 April 1972. The letter contained locations, the types of rooms and the tariffs as well as a map of their locations with respect to WAIT (Archives-POBS October 1970 - June 1973).

The Circular letter was followed by the official ‘First Announcement’, which can be found in APPENDIX 7 – IAU Symposium No. 61 – First Announcement.

While there appeared to be little movement on information regarding the ANZAAS Congress scheduled for the same time as the IAU Symposium in Perth, the Perth Observatory archives contain a letter from Dr H S Williams, Director of WAIT on 26 April 1972, to Professor Webb and cc’ing de Laeter that provided a list of accommodation at WAIT for the ANZAAS Congress meeting. This information would have been a complete surprise to Harris, who had been of the opinion that all of the ANZAAS Congress meetings would be held at the University of Western Australia. On 17 May 1972, de Laeter wrote to Harris. In his letter, de Laeter apologised for not writing earlier and explained he had been absent, as well as awaiting a decision on whether the academic year semester system would be changed at WAIT. Based upon that, de Laeter advised Harris that the period allocated to the IAU Symposium would not fall within a holiday
period, the result de Laeter advised was “there would be no accommodation for this period for your Symposium”. De Laeter continued by suggesting “If your group were part of the ANZAAS organisation we could guarantee you accommodation...” (Archives-POBS October 1970 - June 1973).
The organizers will receive from Dr. Gielse (Secretary) the appropriate copies of "Participation Forms" on which participants have indicated their desire to present a "contributed paper".

It is suggested that the organizers act as chairmen of the sessions in their respective areas; in this way preparation of an effective conference is guaranteed. I would hereby like to ask you whether you are willing to accept the commitment requested of you.

Finally I wish to draw your attention to our task of setting up a list of "invited participants". Attached is an incomplete draft of a "Preliminary List of Invited Participants". The list contains the names of 46 persons which have already been suggested by members of the SOC. You are requested to examine this list and to suggest additional names, in particular, from the fields in which you will have some responsibility. May I suggest that you also favorably consider for addition some younger astronomers who may be expected to become active contributors of research in your areas. Please keep in mind that our "Preliminary List of Invited Participants" to be sent out with the "First Announcement" cannot contain more than 75 names. Therefore, you are requested to communicate to me additional names in the order of priority.

The "First Announcement" will have to be distributed to all persons on the list of participants in the first half of June. I would therefore appreciate receiving your answers as soon as possible but not later than 20 May 1972.

Yours sincerely,

W. Frische
Chairman,
IAU-Symposium No. 61

The archives of the Perth Observatory contain an undated record of the "Draft Announcement on IAU Symposium No. 61 'New Problems of Astrometry" see Figure 5.6.6 (Archives-POBS October 1970 - June 1973).
Excerpts from Draft Announcement.

IAU Symposium No. 61 "New Problems in Astronomy"
Parth, Western Australia; 13-17 August 1973

The IAU Executive Committee has charged the following Committee with the organization of the Symposium:

Local Organizing Committee. E.J. Harris (Chairman), N.P. Candy, D.N. Harwood, I. Nikiforoff, B.H. Williams.

Scientific Organizing Committee. W. Trice (Heidelberg - Chairman), S. Vasilevskis (Lick Obs. - Vice Chairman), W. Giese (Heidelberg - Secretary), C.A. Murray (Harvonsseaux - Secretary), S.G. Clark (Greenbank, U.S.A.), B.W. Morgan (Warner and Swasey Obs.), J.L. Schombart (U.S. Naval Obs.), J.R. Shakeshaft (Mallard Radio Obs., UK), C.K. Stoy (Edinburgh), G. van Hek (Leiden), S. Wood (Sydney Obs.), M.S. Evered (London).

The purpose of the Symposium is the discussion of recent progress in some areas of astronomy given below and the delineation of desiderata for future work. ... the number of subject areas has been limited and selected such that researchers are brought together from specific fields of positional astronomy, photographic/astrometry, radio astronomy and galactic research. The Symposium is not intended to cover the total field of astronomy with all its applications.

Subject areas of the Symposium will be:

a) Reference systems. (Improvement and extension of the fundamental system; reference systems for photographic catalogues.)

b) Current and future projects for reference systems in the southern hemisphere.

c) Radio astronomy. (Absolute and relative positions of radio sources.)

d) Astrometry with large telescopes. (Positions of optical counterparts of radio sources; positions and proper motions of faint stars.)

e) Galactic problems. (Proper motions with respect to galaxies; proper motions in general and of special objects; problems of stellar kinematics and galactic structure closely related to astrometry.)

f) Astrometric techniques. (Optical instrumentation; measuring atmospheric refraction.)

g) Miscellaneous

h) Recommendation; summary.

The programmes will include invited review papers (maximum 20 minutes) and other submitted contributions whose speakers will be allowed 5 minutes. It is hoped that there will be ample time for discussion. The detailed presentation of results will not be possible. Participants who wish to make known their results in detail are invited to distribute preprints.
On 18 May 1972 Harris received de Laeter’s letter and immediately put pen to paper commencing it with “Your letter of 17th May leaves me in a most unsatisfactory situation”. With the amount of preparatory work that Harris and his team had done to date, and committed to with the IAU, de Laeter’s letter must have concerned Harris. Not only was the University of Western Australia the venue for the ANZAAS Congress meeting, but WAIT was now being suggested as well, not to mention the issue with the term and vacation situation. Harris was keen to indicate that previous discussions in 1970 between both parties had, he thought, been an indication of the requirements. Harris wrote “To recapitulate, I originally approached you last July concerning the IAU symposium. I did so, knowing that the dates for the Symposium coincided with the ANZAAS Congress, and anticipating that ANZAAS would probably occupy all suitable accommodation at the University (of Western Australia). It therefore seemed that WAIT would be the most appropriate venue for the Symposium to avoid clashing with ANZAAS…” Harris continued, “…it appears now that our requirements are being subordinated to those of ANZAAS”.

Harris then moved to the second point of de Laeter’s letter, that of the vacation period as a result of the changes to the academic term system at WAIT and its impact on the availability of venues. “You told me then of the proposal to introduce a semester system at WAIT…” but irrespective of that Harris continued “…but I did understand from you that – whatever the system might be – the period 13th – 17th August would be during a vacation”. Harris continued expressing his disappointment to de Laeter writing “I also understood, informally, from you that there would be no barrier to holding the Symposium at WAIT. As a result I wrote to you in 16th November, 1971, to confirm this arrangement. There has been no reply to that letter until now but, in subsequent conversations with you, I have never had any indication that there would be any problems in proceeding with the arrangements. In fact, only a few weeks ago I discussed with you, by phone, the possibility of alternative dates (because of the overlap in the dates of the Symposia of the International Astronomical Union) and concluded that it was best to keep the dates originally decided”. Harris was keen to emphasise that the IAU was of a “…highly specialised nature, quite inappropriate to the interdisciplinary character of ANZAAS…” and saw de Laeter’s suggestion it be under ANZAAS as inappropriate, writing, “…The IAU is certainly not going to be absorbed into a section of ANZAAS”.

Harris closed his letter with two final points for de Laeter to consider the situation Harris was now in, “The scientific organising committee has drafted an announcement notice, excepts from which are attached, for the Symposium; the dates, locations and general programme information in that announcement are based upon the results of my conversations with you. I have been asked to get this announcement printed and sent out during the first half of June,
and am therefore on the point of making the arrangements for printing”, and “I have also submitted information on hotel accommodations convenient to WAIT; in fact, I have suggested that a particular hotel should be reserved for Symposium participants, because its accommodation is adequate and it is at a reasonable distance from WAIT, and the organising committee has concurred”. Harris signed off the letter with a final paragraph, “Your letter now throws all of these arrangements into confusion. It is quite unacceptable now that I should wait on the pleasure of the ANZAAS organisers” (Archives-POBS October 1970 - June 1973).

With the unfortunate news that was delivered by de Laeter’s letter of 17 May 1972, Harris had been frantically searching for a new venue. On 27 June 1972, Harris wrote to the Manager of the Westos Motor Inn in Kensington, a suburb south east of Perth, following up on a recent telephone conversation between the two. It is apparent that the discussions were fruitful as, while there is no other correspondence in the Symposium file, entry ‘4. Hotel Accommodation’ in the final ‘First Announcement’ stated “...It is hoped that the majority of the participants can be accommodated at one motel, which is about 4.5 km from the centre of Perth” (Archives-POBS October 1970 - June 1973).

With the issue of the original plans for the IAU meeting apparently behind him, Harris wrote to Bok on 6 September 1972. However, Harris then highlighted to Bok the issues he had encountered earlier by initially writing, “...We don’t yet have a place for the meeting”. Harris then continued to reiterate the content of his “...quite strong...” letter to de Laeter, which still must have been sour in its taste, and adding, “I have so far had no answer”. While Harris had advised that he still needed a conference room, he did write “There is a conference room at the motel...” but wrote that he had been put off the idea of the venue and conference room being in the same location by an article he had read in Nature magazine. The article indicated that such arrangements “...makes things too easy and one gets a conference suffering from sleepiness and – in the later stages – from indigestion and liver because it has not enough exercise and fresh air and has too much food and alcohol. Having to organise some things themselves keeps delegates awake and fit”. Harris closed his letter to Bok advising that to date, he had had no success in finding another venue for the conference (Archives-POBS October 1970 - June 1973).

Harris was not the only person that had taken affront to the suggestions of ANZAAS as to the positioning of the IAU under ANZAAS or a section of it. On 15 September 1972, Bok replied to a letter that Harris had sent him earlier on the situation. Bok suggested that Harris should “...not hesitate to throw your weight around with regard to this particular Symposium”. Bok continued by providing a paragraph with his thoughts on the importance of the Perth
Symposium as well as where it sat in comparison to ANZAAS meetings (Archives-POBS October 1970 - June 1973), see Figure 5.6.7.

Figure 5.6.7 – Extract from Bok’s letter regarding the ANZAAS Congress meeting.

Bok closed his “...pep letter...” to Harris by empowering Harris with a final statement “...be sure to throw your weight around, for you are a big-shot representing an important International event” (Archives-POBS October 1970 - June 1973). The records of Symposium No. 61 detail Bok, as described by Fricke as “…an eminent Astronomer...” as the speaker that was to summarise the Symposium, as well as report the outcomes to the IAU Commission 33 and writing a report for Sky and Telescope, see APPENDIX 9 – New Problems in Astrometry – Sky & Telescope 1973.

On 6 November 1972, Harris wrote to Fricke that approximately 50% of the invitations had been replied to of which 20 were definite attendances, 37 possible, but he wrote he would retain the booking for the Westos Motor Inn at 75 people. Based upon the numbers, Harris wrote to the Manager of the Westos Motor Inn on 7 November 1972 providing the same estimates and indications “…receipt of further replies is likely to be spread over several months”. Harris wrote again the following day based upon a telephone conversation with the Manager confirming “…your charge for a single room would be $6.00 per night, but that this could be reduced to $4.50 per night for those willing to share a room” (Archives-POBS October 1970 - June 1973).

As is the case in most IAU Symposia arrangements, not all invited parties are able to attend based upon financial restrictions and, in some cases, health. In this situation, members of the IAU Scientific Organising Committee for that Symposium, normally propose additional participants to the Preliminary List of Invited Participants. In a letter dated 29 November 1972, Fricke also advised Harris that he would have to formally approach the IAU before the end of the year to obtain their contribution of US$1500 for the Symposium costs. Based upon Fricke’s
advice, Harris wrote immediately to Contopoulos formally requesting from the IAU US$1500 “...towards the expenses of Symposium No. 61, New Problems of Astrometry, to be held in Perth during 13-17th August 1973” (Archives-POBS October 1970 - June 1973).

The New Year arrived and Harris wrote to Fricke on 22 January 1973, updating him on the slow progress of more attendance acceptances. In the same letter, Harris alluded to the issue with the German contingent that was being funded by the German Scientific Foundation not being able to stop in Perth on their way to the GA. Harris wrote “The fare situation does seem to be difficult: I did not imagine that the recent introduction of cheaper fares from Europe to Australia could cause problems. On receiving your letter, I telephoned Mr Leonhardt, of Lufthansa. He confirmed that the cheapest fare (apart from the excursion which requires a minimum stay in Australia of 45 days) is the ‘one-way fare’ of $419 single Frankfurt to Sydney, which does not allow any stopover on the way” (Archives-POBS October 1970 - June 1973).
Circular Letter

to the Chairman of the Local Organizing Committee (LOC)
and all members of the Scientific Organizing Committee (SOC)
of IAU Symposium No. 61 "New Problems of Astrometry"

Dear Colleague:

The purpose of this letter is to inform you on the situation regarding replies received to the "First Announcement" of the Symposium and to request your further cooperation in the final preparation of the programme. About 90 persons have been invited for participation (all names were suggested by members of the SOC): 12 persons have reported that they will not attend and about 35 persons have not yet replied. The following preliminary programme contains information so far received from members of the SOC and from invited participants:

(a) Reference systems. (J. L. Schombert, W. Fricke).

Invited Review Papers:

G. van Herk, Report on IAU Colloquium No. 20 "Meridian Astronomy".

W. Fricke, Plans for the improvement and extension of the FK4.

J. L. Schombert, Experiences with the AGK3R and SRS-Programme.

Submitted contributions:

W. Glaess, Observations relevant to the improvement of the fundamental system.

R. Bougu, Mouvements propres des étoiles de repère (Catalogue photographique).

B. L. Klock, The Washington W50 catalogue system.

(b) Current and future projects for southern hemisphere reference systems. (H. Wood, M. S. Zverev).

Invited Review Papers:

...
Submitted contributions:

G. Carrasco, Preliminary results in declination of the SRS and BS program in the zone -25° to -35°.

S. Débarbat, Contributions of astrolabes to the reference system in the southern hemisphere.

A. J. Wesselink, The Yale-Columbia southern proper motion program.

(c) Radio astrometry. (B. G. Clark, B. Elsmore).
Invited review papers:
B. Elsmore, ....
C. C. Counselman, ....

Submitted contributions:

J. L. Fanseelow, Determination of an extragalactic radio source position catalog suitable for use in monitoring geophysical phenomena.
D. S. Robertson, Some source positions from Australian based V.L.B.I.

Other contributors: P. Brosche, Muhlemann, Malholland.

(d) Astrometry with large telescopes. (C. A. Murray, S. W. McCuskey).
Invited review papers:
J. L. Greenstein, ....
C. A. Murray, ....

Submitted contributions:

W. J. Layden, Results from the automated proper motion survey.

(e) Galactic problems. (S. Vasilievskis, G. van Herk).
Invited review papers:
S. Vasilievskis, Proper motions in general and of special objects.
A. N. Deutsch, Proper motions with respect to galaxies.
S. V. M. Clube, Stellar kinematics and galactic research involving proper motions.

Submitted contributions:

H. Yasuda, OB star proper motion program.
C. A. Murray, Proper motions in Kapteyn's northern selected areas.

A. Upgren, Kinematics of K and M dwarf stars.

Other contributors: A. R. Klemola.


Invited review papers:

....


Submitted contributions:

J. Kovalevsky, Projet de Centre de Recherches Astronomiques et Géodynamiques (CERGA) en France.

P. Lacroute, Use of the Schmidt telescope in astrometry.

W. F. van Altena, Observations with a photoelectric parallax scanner.

H. K. Eichhorn. Applications of the plate-overlap method and comparisons with the classical approach.

Other contributors: S. V. M. Clabes.

Miscellanea.

Contributors: A. Blaauw.

(h) Recommendations, Summary.

B. J. Bok, Concluding Review.

Invited participants who are planning to attend but have not yet specified their contribution are


May I remind you that the organizers of sessions whose names are given in parentheses have accepted the responsibility for the preparation of the programme in their respective areas, and that the organizers are expected to propose "invited papers" and to invite the speakers; the organizers may, however, present the invited review papers themselves.

I herewith request your final information on titles of invited papers and names of persons who have agreed to present the review papers. I would
On the same day, the Chairman of the Scientific Organising Committee for IAU Symposium No. 61, dispatched an additional circular letter to all providing a preliminary programme (Archives-POBS October 1970 - June 1973), see Figure 5.6.9.

On 26 March 1973 Harris wrote to Fricke “This letter is to bring you up to date on local arrangements for Symposium No. 61”. Harris provided Fricke with a précis on the issue that he had encountered with WAIT and the ANZAAS Congress meeting. Harris then provided the details on the Westos Motor Inn for accommodation as well as providing the meeting room.
Harris wrote “This is a large room with a screen divider in the middle. We propose to use half of the room for the full meeting, and the other half can be used for serving coffee, etc and, possibly, other informal gatherings. There is also a small foyer to the conference room where small groups can gather. For the symposium sessions, we propose to set up tables, probably in two concentric horseshoe arrangements, or on 3 sides of a square, with Chairman, speaker,
blackboards and screens on the open side. We plan to hire a small bus, which will meet incoming aircraft, and will be used to transport participants between the secondary accommodation (Flag Lodge Motel) and the Westos each day. An informal gathering will be held at the Westos on the Monday evening: this may possibly incorporate an official welcome”. Harris attached an updated acceptance list as well as providing a list of several participants proposed by invited attendees that were either not able to attend themselves, or based upon their belief they should be invited. Harris advised that the LOC were in disagreement over the closing dinner writing “I have suggested that it should be a small ‘theatre restaurant’, where an informal type of entertainment (which usually involves the customers) is served with the meal. Some members of the LOC think that the entertainment may not be to the taste of all the participants and suggest a semi-formal arrangement, perhaps with a buffet service, allowing for the usual speeches”. Harris was not in agreement as he believed there had been plenty of opportunity for talking during the previous three days and “…the theatre-restaurant will provide a change from the usual dinner”. Harris closed the letter providing the updated accommodation costs from both the Westos Motor Inn and the Flag Lodge Motel as well as advising he was approaching the Western Australian State Government for $4000 to assist with travel costs. (Archives-POBS October 1970 - June 1973).

On 29 March 1973, Harris wrote to the Secretary of the Chief Secretary’s Department providing a brief on the Symposium and requesting financial support (Archives-POBS October 1970 - June 1973), see Figure 5.6.10.
From 14th to 17th August this year, a symposium, "New Problems in Astronetry", will be held in Perth. This is No.61 in a series of specialist symposia organised by the International Astronomical Union.

Participation is to be by invitation only, and will involve the leading astronomers in the field of positional astronomy and in related research from around the world. The holding of this symposium in Perth is a recognition of the importance of this Observatory in astronomy, and an opportunity to improve our reputation internationally.

The organisation of the scientific programme is in the hands of an international committee, under the chairmanship of Prof. Prika, of Heidelberg, West Germany. A local organising committee is responsible for arrangements for accommodation, facilities for the symposium, entertainment, etc.

The symposium will be held in the conference room of the Westos Motor Inn, Canning Highway, South Perth, where the majority of participants will be accommodated; alternative accommodation has been reserved at Flag Lodge Hotel, Great Eastern Highway.

The purpose of this memo is to make two requests:

a. It is proposed to hold an informal reception for all participants on the evening of Monday 13th August, at the Westos Motor Inn. It is suggested that this could also be the opportunity for a formal welcome by a representative of the State Government.

b. The local organising committee requests a grant of $4000 from the State Government for the expenses involved. These have been estimated as follows: Symposium facilities (meeting room, projection equipment, etc.) $200; Secretarial assistance, stationery, etc. $350; Printing $150; Transport (meeting aircraft, hotel to symposium, visit to Observatory) $400; Entertainment (reception, lunches, etc.) $150. This gives a total of $2250.

The International Astronomical Union subsidises its symposia with a grant which, we propose, should be used entirely for assistance with travel expenses for the participants. We would also wish to augment this assistance from the balance of the State Government grant requested above.

All of the participants in the symposium will be coming to Australia to attend the General Assembly of the International Astronomical Union in Sydney which starts in the week following the Symposium. For many of these people, the travel assistance provided by their home institutions is the minimum air fare; the recent introduction of cheaper fares (from Europe to Australia, for instance) has also imposed restrictions on the itinerary,
The Perth Observatory archives contain a letter of 4 April 1973 from Fricke to Professor Dr C de Jager, General Secretary of the IAU confirming a recent letter between the two regarding financial support. Fricke’s letter confirms the increase from US$1500 to US$2000 for IAU Symposium No. 61. Additionally, Fricke provides written supporting information for the increase “…the IAU grant shall be distributed to applicants such that in each case not more than US$100 shall be given”. Fricke than proceeded to enlarge on the reason for allocating money to each participant, writing, “Many of the participants do not yet know whether they will receive sufficient grants for their home countries. They are asking for some support for the coverage of the costs arising from the extra-tour to Perth while they care themselves for the costs arising from the participation in the IAU General Assembly in Sydney” (Archives-POBS October 1970 - June 1973).

On 7 May 1973, the Chief Secretary’s Department wrote to Harris advising his request for $4000 towards funding the Symposium was not possible, “I am afraid that the present financial situation restricts the availability of funds for this kind of assistance. However, I have
approved a grant of $2000 which may be claimed by the organisers of the symposium by application to the Under Treasurer after 30th June". (Archives-POBS October 1970 - June 1973).

On 6 June 1973, Harris updated Bok in relation to the attendance numbers for the Symposium writing, “So far, we have 45 definite participants for the Symposium, 20 possible and 24 who have not yet replied to their invitations...so it looks as if though there will be about 60 taking part, and a dozen guests” (Archives-POBS 1 June 1973 to 13 August 1973).

The day-to-day political challenges around the world continued, as is indicated in a letter from Harris 8 June 1973, to “Participants resident in France” writing, “The Trade Unions of Workers in the Australian Post Office have placed a ban on all correspondence with France”. Harris advised the French participants that their letters would be routed via Fricke in Germany; Harris
provided an indication as to why in the last paragraph of the short letter to the Symposiums French participants\(^2\)，“Alternatively, perhaps you can persuade your Government to abandon the proposed nuclear tests in the Pacific!” (Archives-POBS 1 June 1973 to 13 August 1973).

The requests from many of the participants, for access to the IAU grant to assist with travel costs, are evident from the archives of the Perth Observatory, especially to travel to the Symposium in Perth; many citing the additional travel costs from the GA in Sydney. This was summarised by Fricke in a letter to Harris on 18 June 1973. Fricke proposed a process, from his previous Symposia experiences, whereby a small sub-committee would make the decision, however, not until the day before the commencement of the Symposium. Fricke continued that the sub committee should comprise of Harris, Wood and himself and that he would “...meet you on Monday, 13\(^{th}\) August, before the Meeting of the Scientific Organising Committee takes place in order to decide on applications”. Fricke closed his letter advising Harris of his absence between 25 June and 4 July while he was in the Soviet Union for “...a discussion of astrometric problems with the astronomers in Leningrad and Pulkovo”.

On the same day, Fricke wrote another letter to Harris confirming that Gliese, Lederle and himself had been able to arrange financial support, however, commenting, “...the result has not been entirely satisfactory”. In the author’s experience, this situation has never changed, with astronomers having to use their own funds and annual vacation leave to enable attendance at international events. An example of this situation was a letter from Haruo Yasuda, of the Tokyo Astronomical Observatory, on 25 June 1973 where he wrote, “...I applied for the travel grant expenses to our authorities, but I am sorry I failed to get the travel expenses to Australian (sic) from Japanese sources. However, I will attend the IAU Symposium at Perth at my own expenses” (Archives-POBS 1 June 1973 to 13 August 1973).

On 20 June 1973, Harris wrote to Fricke providing Fricke with an update on the Western Australian Government’s response to the request for funding assistance for the Symposium. Harris wrote, “The State Government has approved a grant of $2000, which will just cover our estimates of administrative expenses. But our request for extra money to augment the IAU grant for travel expenses has been refused” (Archives-POBS 1 June 1973 to 13 August 1973).

The final accommodation arrangements for the Symposium were placed with the Manager of the Westos Motor Inn (South Perth), Mr Cox, on 21 June 1973, see Figure 5.6.12.

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\(^2\) In 1973, both Australia and New Zealand took France to the International Court of Justice in an attempt to ban nuclear testing in the Pacific (Justice 1973).
With the accommodation arrangements finalised, and the number and departure location of participants becoming clearer, Harris turned to matters of transportation to the Symposium for those participants staying at the secondary accommodation, the Flag Motor Inn.

Figure 5.6.12 – Confirmation letter of the arrangements for Symposium No. 61 with the Westos Motor Inn.
On 2 July 1973, Harris wrote to the Special Hire Department of the Metropolitan Transport Trust (MTT), providing a précis of the Symposium. Harris was cautious, having been let down earlier by ANZAAAS and WAIT, and pointed out to the MTT that the Symposium was “...entirely separate from ANZAAAS...” (Archives-POBS 1 June 1973 to 13 August 1973). Harris suggested, that with the number of attendees, he believed that transport would be best facilitated by a bus for those accommodated at the Flag Motor Inn to be shuttled to the main venue at the Westos Motor Inn at set times. Harris also advised the MTT that there would also be a trip for all participants to the Perth Observatory, as well as two other trips for the opening reception and the closing dinner.

While initial indications were that many of the participants had requested access to the IAU US$100 travel grant for the trip to Western Australia, more had been successful through their own organisations funding. This became clearer in a letter from Harris to Fricke dated 11 July 1973. In this letter, Harris advised Fricke that he was in general agreement with Fricke’s process for selection of the successful recipients of the grant; he however believed that decisions should be made earlier. Harris also wrote that he believed that the sub-committee should be increased by one, as a result of Fricke being one of the applicants for the travel grant. In his letter, Harris wrote that there had only been six requests for the grant and wrote, “It is well past the deadline for the receipt of applications. And I therefore think we can consider that these six are all we shall have. We expect the State Government grant of $2000 (AU) will cover all administration expenses, and so the IAU grant of US$2000 = Aust $1400.26 can be used exclusively in meeting these applications”. Harris closed his letter by suggesting that this would expedite the meeting suggested by Fricke, set for 13 August 1973. The next day, Harris wrote to all those requesting the IAU travel grant, advising them of his proposal to the committee, but asking them to complete and return their travel budgets and the grant request as soon as possible. Fricke responded to Harris on 21 July 1973, accepting Harris’ suggestion on increasing the sub committee, adding, “It is quite clear that I will abstain from a vote concerning the allocation of grants to Gleise and myself”; he also suggested that the additional committee member could be Dr Stoy (of the Cape Observatory, South Africa). With regard to Harris’ suggestion, that six applicants may be the maximum requesting the grant, Fricke indicated that he was aware of several others from the Soviet Union and Portugal that would also be applying for the IAU travel grant and added “…There will also be requests for grants from participants after arrival...” (Archives-POBS 1 June 1973 to 13 August 1973).
Figure 5.6.13 - Telegram from Vanherk requesting Melbourne to Perth train booking.

As the workload for the Symposium increased, and Harris had already passed on some of the workload to Dr Nikoloff, it was now the responsibility of another of the Perth Observatory staff member on the Local Advisory Committee (LAC), Mr M Candy. While not documented, the LAC had obviously selected the Kings Park Garden Restaurant in Perth as the venue for the closing dinner. The restaurant was an excellent selection for visiting participants of the Symposium, showcasing Perth with the restaurant being located in the inner city park that looks over the CBD, with views to the hills in the east and adjacent to the old Perth Observatory site (Archives-POBS 1 June 1973 to 13 August 1973).

The month of the Symposium, August 1973, commenced with Harris writing to the Chairman of the Public Service Board (PSB) of the Western Australian Government 1 August 1973 seeking approval to engage casual staff for the Symposium. Harris provided a précis of the upcoming Symposium, its international nature and its link to the GA in Sydney. Harris, having spoken to a representative of the PSB the previous day, was formally requesting permission to “...hire 2 clerk-typists which will be necessary for this Symposium”, as this type of employment was outside the normal process required by the PSB (Archives-POBS 1 June 1973 to 13 August 1973).
News of the Symposium appeared to be increasing in Perth and the archives of the Perth Observatory contain many requests from Perth and local businesses. One such request, from the Perth branch of the Commercial Bank of Australia (CBA), was a request on information and pictures it could display in its window on the International Symposium. An undated, handwritten note can be found in the records (which I recognise as the hand writing of Peter Birch) providing the requested information, see Figure 5.6.14 (Archives-POBS 1 June 1973 to 13 August 1973).

On 22 August 1973, the Business Promotion and Public Relations Office of the CBA wrote to Dr Nikoloff and Birch advising that the provided display, including some photographs “…created a lot of interest to the public and of course our staff and we are very grateful to you for lending us the descriptive photographs to make the display complete” (Archives-POBS 1 June 1973 to 13 August 1973).

With the Symposium date approaching, on 6 August 1973, Harris set about inviting the required dignitaries, the first being the head of the Observatory’s Department, the Hon. Chief Secretary, Mr Stubbs (Archives-POBS 1 June 1973 to 13 August 1973). The final list of participants was compiled on 7 August 1973 and can be found in APPENDIX 8 – Final list of Participants.
The people of Western Australia extend a warm welcome to astronomers from all over the world, participating in I.A.U. Symposium No. 61 on ‘New Problems in Astronomy.

This Symposium, to be held in Perth between August 13 and 17, has been organized in association with the 15th General Assembly of the International Astronomical Union. The scientific meetings associated with the General Assembly are to be hosted by the Australian Academy of Science and will be held in Sydney, through the courtesy of the University of Sydney, from August 21 to 30. This is the first time a General Assembly has been held in Australia, and is indicative of the progress of astronomical achievement in this country.

This display has been prepared by the Commercial Bank of Australia Limited, in association with The Perth Observatory.

Figure 5.6.14 – Handwritten details by Birch for display in Commonwealth Bank window.
Figure 5.6.15 – Harris letter to Woods on the Symposium arrangements.

The Archives also contain another undated document, providing the ‘General Arrangements’ for the Symposium, see Figure 5.6.16 below (Archives-POBS 1 June 1973 to 13 August 1973). The print was produced using the predecessor to the photocopier, the spirit duplicator, whose mauve ink faded with time, if not stored properly.
1. **Administration.**

The following members of the Local Organizing Committee are responsible for the functions indicated:

- **E.J. Harris** General organisation
- **S.E. Williams** Presentation facilities (projectors, etc.)
- **L.Nikoloff** Hotel accommodation
- **M.P. Candy** Entertainment
- **D.N. Harwood** Transport

The administration office will be in Room 16, which is along the passage from the Panorama Room.

2. **Recording of Proceedings.**

As indicated in the Programme, participants must provide 2 copies of their papers to the Secretaries (Dr Giese and Mr Murray) before the end of the Symposium.

The record of the discussions will mainly be compiled from speakers' own account of their contribution. For this purpose, prepared sheets of paper will be provided. Participants are asked to write on one of these sheets their contribution to the discussion, and to hand it to the Secretaries immediately after the session. The identification number for the paper under discussion must be entered on the sheet.

3. **Registration.**

Registration of participants will be effected at the Wadley Motor Inn from 7 pm on Monday 13th, and from 8.30 am on Tuesday 14th August.
While many invited participants were unable to attend due to lack of support or funding, some were restricted by the politics of the post and cold war era, as was the case for Tavastsherna (of the Pulkovo Observatory). On 14 August 1973, he telegraphed Harris advising, “...there are no Australian visas”. The same appears to have been the case for Zverev, which prompted Fricke and Harris to write a generic telegram “TO ALL PARTICIPANTS IN I.A.U. SYMPOSIUM 61 SEND YOU AND YOUR COLLEAGUES THEIR GREETINGS AND GOOD WISHES”, a courtesy of the time in recognition of their standing in the scientific community (Archives-POBS 1 June 1973 to 13 August 1973).
With the Symposium over, the archives of the Perth Observatory record communications continuing, the first from Harris to the ‘Executive Assistant’ of the Westos Motor Inn. The letter, of 21 August 1973, provided Cox with extremely positive feedback on the success of the Symposium held at the Inn; which for Harris would have been a great relief after all the issues with the original plans for the Symposium at WAIT (Archives-POBS 1 June 1973 to 13 August 1973).

While Harris had been concerned earlier that the IAU grant for travel to Perth would not cover all those proposing to attend, his letter of 21 August 1973 indicated that there was still US$600.26 remaining out of the US$2000. Clearly most attendees had been ultimately successful in acquiring their own funding (Archives-POBS 1 June 1973 to 13 August 1973).

As has been reported in other sections of this thesis, Bart Bok was a very strong supporter of the Perth Observatory, and renown throughout the international astronomical community. On 28 September 1973, Bok wrote to Harris and enclosed a letter that he had also sent to the Chief Secretary, see Figure 5.6.17 below (Archives-POBS 1 June 1973 to 13 August 1973).

As the Perth Observatory closed out on the Symposium in Perth, Harris wrote to Bok on 16 January 1974 on his plans post the Symposium with regards the state of the Perth Observatory in terms of resources and equipment, see Figure 5.5.18 below (Archives-POBS 1 June 1973 to 13 August 1973).
The Hon. R.H.C. Stubbs, Chief Secretary
Oakleigh Building
22 St. George's Terrace
PERTH, 6000
Western Australia

Dear Mr. Stubbs:

Before the Perth Symposium on Astrometry becomes ancient history, I feel that I should write to you to thank you for all that you and the Government of Western Australia did to make our International Symposium a success.

Mr. Harris has told me how in all of his planning for the Symposium he had strong support from you and your associates, and I just want to write to thank you and your colleagues for everything that you did to help provide a wonderful setting for this particular Symposium. All of us who came to Perth for the occasion realize that one of the principal reasons for the holding of this symposium in Perth was that we wished to thank and congratulate John Harris and his staff and the people of Western Australia for the manner in which they have supported and executed the important basic research that has been done at the Bickley Observatory. You must feel very proud of the fact that your State found it possible to make such a thoroughly effective and basic contribution as you have made through the work at the Perth Observatory.

I hope to send you in a few months some copies of a Reprint of an article on the Symposium that I have written for the monthly magazine Sky and Telescope. However, the article will not appear in print until either the December or the January issue, and it occurred to me that you and your associates might want to read now already how I reported on the Perth Symposium. I shall therefore send a copy of my article along with the present letter.

It was a pleasure to have an opportunity of meeting you at the Opening Reception and talk with you directly about the good work at Bickley being done by Mr. Harris and his associates. I hope that we may meet again. Mrs. Bok and I were delighted to have had another opportunity of visiting Perth.

With every good wish,

Very sincerely yours,

BJB:gh
cc: Dr. Goldberg, Dr. Contopoulos,
Mr. Harris, Dr. Wood

Bart J. Bok
Professor of Astronomy
Vice President of the International Astronomical Union.

Figure 5.6.17 – Bok’s letter to the Chief Secretary on the IAU Symposium.
Prof. B. J. Bok,
Steward Observatory,
University of Arizona,
TUCSON,
Arizona 85721, U.S.A.

Dear Bart,

It is long since time that I wrote to thank you for your letter of 26th September and for the copies of your summary and of the Sky and Telescope article on the Perth Symposium. The batch of reprints arrived today and I think that these will come in very useful before very long. They help to emphasise the value of our work so that, besides being of help in supplying information on positional astronomy, they will also have propaganda applications.

In this connection, your letter to the Minister (Mr Stubbs) made a good impression in the right quarters.

My present plans are really ones of consolidation. Over the last few months I have been struggling to catch up on administrative work while intermittently planning observational programmes for the 24-inch, to start in a couple of weeks when the current session of the Lowell Planet Patrol work ends. Others are in much the same boat. Ivan Nikoloff has his work cut out, with inadequate staff, to maintain the routine of meridian observations and reductions at a reasonable level to complete his programmes within a year or two. Even so, several clear nights are unused on the meridian instrument because we do not have the staff to man it fully. Mike Candy is in much the same position on the astrophotographic telescope, especially with all the fuss over Comet Kohoutek: the publicity has generated more public interest than we can handle adequately. Apart from staff, we also need to upgrade our equipment to improve the efficiency of our working, and our current budget is inadequate to do more than just keep things running.

Progress is slow, but I’m optimistic now that I shall soon be able to devote more time to the necessary planning and lobbying to achieve our minimum needs. And to completing several partially finished investigations.

In September you were concerned about the situation in Chile. No news has filtered through to here, but I hope that the observatories there have now settled down again.

Please give our regards to Priscilla; we thoroughly enjoyed meeting you both here in August, and hope that we may have the chance to see you in Tucson within a year or two.

Yours sincerely,

(B.J. HARRIS)
GOVERNMENT ASTRONOMER.
Summary of the Symposium.

IAU Symposium No. 61 in Perth, Western Australia opened on Monday 13 August 1973, under the sponsorship of IAU Commissions 8 (Positional Astronomy), 24 (Photographic Astrometry), 33 (Structure & Dynamics of the Galactic System) and 40 (Radio Astronomy). The Government of Western Australia and the IAU financially sponsored and supported it and 67 participants attended from 16 different countries.

The Chairman of the Symposium’s Scientific Committee, Prof Walter Fricke (from the Astronomisches Rechen-Institut, Heidelberg, Federal Republic of Germany), presented the inaugural address. Fricke referred all participants to the 1964 IAU conference in Flagstaff, Arizona and talked about the advances since that conference, specifically in terms of new instrumental technologies, large international undertakings and recent unforeseen advances by radio astronomy on “...absolute measurement of positions of objects by means of radio techniques” (Archives-POBS 1 June 1973 to 13 August 1973). He then proceeded to discuss, in detail, the changes that had recently occurred in classical areas of astrometry. Fricke first addressed the improvements that had occurred in the FK4 system that was based upon observations pre-1950. Fricke stated that there had been a two-fold improvement in the errors of the system, as well as in the individual data, through improved techniques alone. Most importantly for the southern hemisphere, observations over and above those that existed, as a result of observations from the Cape Observatory, were now being taken at several other observatories, Perth being one of them. In addition to the method of improved techniques, Fricke stated that instrumentation improvements had also enabled the previously limiting magnitude of stars, fainter than had been previously targeted, to be reached. In recent years, improvements in the values of solar system planetary masses, as well as revisions on the impact of precession based upon the use of Newcomb’s tables, Fricke suggested, would drive a new revised reference frame to be called the FK5. As will be discussed in Chapter 6.3 of this thesis, the Perth meridian catalogues contributed significantly to the data for the southern hemisphere, especially the Nikoloff Perth 75 catalogue.

Fricke then moved on to the determination of proper motions. As has been discussed in Chapter 4 of this thesis, the use of photographic plates in Astrographic telescopes, taken many years apart, and supported by meridian transit circle observations of the reference stars, resulted in the AGK3R reference system of 1960. Fricke stated that this endeavour, by many observatories, is a true example of a “...large international undertaking...”. However, Fricke stated that this was the case for the Northern Hemisphere and “In the southern sky, the situation with respect to a photographic reference system of positions and proper motions is
not as favourable as north of the equator. The Southern Reference Star (SRS) program will supply the reference star positions for plates that are being taken at the Cape and Sydney observatories. In order to provide a useful reference system in the south, the SRS program can be considered as one step only; the observations of the program stars must be continued in the future with transit circle”. This must have been music to Harris and Nikoloff’s ears. Fricke continued, “They are not only required for providing the reference frame for photographic plates but also for the improvement of the fundamental system”.

Following on from this, Fricke indicated that observations towards the current, and new fundamental reference frames should include the use of galaxies as part of that reference frame. Specifically, Fricke cited work performed recently by the Lick and Pulkovo Observatories, and work by the Perth Observatory, which is mentioned in this thesis in section 5.4 on Deutsch’s program (Archives-POBS 1 June 1973 to 13 August 1973).

Fricke closed his inaugural speech by addressing an area that had only recently been introduced into astrometry, that of radio astrometry. Not only was this the first combined symposium on astrometry for optical and radio astronomers, it can be seen as the start of further progress in improving the quantity and quality of observations for compiling future catalogues; there was also the possibility of a common reference system for optical and radio observers.

Perth Symposium No. 61 was broken into seven ‘Sessions’ covering three of the broad areas discussed previously. The first session, ‘Session A’ covered ‘Reference Systems’. There were ten papers presented, of which two were invited papers by Dr G Van Herk (from the Leiden Observatory, Netherlands) and the second by Fricke. The first report related to a previous Colloquium, No. 20 on Meridian Astronomy, which addressed instrumentation, reference systems and various investigations that resulted in seven IAU resolutions being identified. Of these resolutions, the improvement of the FK4 system to fainter magnitudes, as well as the creation of a new FKS system, which has already been discussed as it involved the Perth Observatory in its Perth 70 and Perth 75 catalogues. In addition to this, the resolutions detailed the necessity, and importance, for ongoing observation of solar system objects. Nikoloff in his SRS Sup program was already addressing one of the final recommendations, ‘Recommendation Six’ regarding the inclusion of FKSZ stars.

The second invited paper was by Fricke on ‘Plans for the improvement and extension of the FK4’, another area where the Perth Observatory was a major contributor in the southern

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3 This thesis has reported the Perth Observatory acknowledged and pursued solar system object observations c.f Hog, Nikoloff and Harwood in Sections 5.4 and 6.2.
hemisphere, as detailed above. It is not surprising that several of Fricke’s suggested tasks for moving forward in this area, with respect to star selection, are almost identical to his earlier communications with Harris and Nikoloff mentioned in Section 5.4 of this thesis. In the last section of his paper, ‘Compilation of a Supplement to the FKS’, Fricke specifically referenced work by the Perth Observatory writing “From the reports by ....and Hog and Nikoloff...” (Archives-POBS 1 June 1973 to 13 August 1973).

The remaining presentations in the ‘Reference Systems’ session were updates and progress reports on the work being undertaken in this field. However, the Perth Observatory was directly referenced in the USNO SRS report, identifying its zone coverage of +5 to -90 degrees declination and its contribution of 20,495 stars, observed four times each, and having commenced in “...1969.7”. Fricke’s report also indicated a 100% completion of the Perth observations, and a 95% completion of the reductions, writing that they “...were to be completed by mid 1975” (Archives-POBS 1 June 1973 to 13 August 1973).

The afternoon of 14 August 1973 saw the commencement of ‘Session B’ entitled ‘Current and future projects for southern hemisphere reference systems’, a session that the Perth Observatory would follow keenly. The most significant presentation for the Perth Observatory would have been that presented by Høg and Dr Nikoloff, entitled ‘Observations by the Hamburg SRS-Expedition to Perth’. Høg and Nikoloff introduced the audience to the aim and results of the German expedition astronomers, as well as the work to complete it by Nikoloff once the Germans had left in December 1971. Høg continued the presentation advising that the telescope had remained in Perth, through agreement with the Hamburg Observatory, with Nikoloff engaged in further work that would contribute to the new proposed FKS system. The most important statement for the Perth Observatory by Fricke, in the session discussions, was to indicate the performance of the Perth telescope and team by writing “I may draw the attention of the audience to the fact that the results obtained in Perth are in marvellous agreement with those by the Santiago-Pulkovo team in Santiago de Chile”, a paper presented at the start of day two (Archives-POBS 1 June 1973 to 13 August 1973).

The paper following Høg and Dr Nikoloff’s was an invited paper by Prof Zverev (Pulkovo Observatory in Leningrad, USSR) entitled ‘Some urgent programmes of meridian observations especially for the southern hemisphere’. Zverev’s paper followed on from recommendations of a previous IAU Commission 8 meeting, suggesting the observation of selected type stars not previously observed, as well as those of fainter magnitude. The request was also aligned with the observation of stars for the Deutsch programme that the Perth Observatory was already working on.
On 15 August 1973, for the first time at what would normally be an ‘optical based symposium’, presentations were made on ‘Radio Astronomy’, this was ‘Session C’ of the Symposium. The first few papers were on updating all participants, including the optical astronomers, with the recent advent of log baseline interferometry and its application to astrometric work. In the same Session, Prof C M Wade (National Radio Astronomy Observatory, Greenbank, USA) presented a thought-provoking invited paper on ‘Radio and Optical Astrometry’ best précised by the papers abstract, “Radio positional measurements have achieved an accuracy as high as that of optical astrometry, with uncertainties no greater than a few hundredths of an arc second in each coordinate...”. Wade continued by identifying the opportunity for optical astrometrists to benefit from radio work, by stating: “Since the principal sources of systematic error are different for radio and optical astrometry, radio measurements can be useful in the preparation of future fundamental catalogues”. In Addition, Wade pointed out that unlike his optical colleagues, radio astrometry did not suffer from atmospheric refraction issues and had the ability to measure absolute declinations (Archives-POBS 1 June 1973 to 13 August 1973). However, radio astrometry was not at the point of being able to determine the location of the vernal equinox as optical astronomy could, as there was not the resolution of a dish to observe minor planets.

‘Session C’ closed with discussions following on from the previous paper discussing how the optical and radio source positions for a particular star type (ie radio stars) should coincide. This thesis has already mentioned the work and discussions by Nikoloff, Høg and Deutsch on including radio stars in the FK5 catalogue, see Section 6.2.

‘Session D’ dealt with ‘Astrometry with large telescopes’, mostly those with apertures greater than 40-inches (100 cm) and twice the size of the largest telescope at the Perth Observatory. However, most papers reiterated the reliance on improving the accuracy of the existing reference systems by using new techniques while still utilising the existing smaller Astrographic and Meridian Circle telescopes.

As discussed earlier in this Section, an important aspect of securing and updating a reference system is the determination of Proper Motions (PM). As also discussed in Section 5.4, this was catered for by the re-observation of photographic plate areas, but only after a suitable amount of time between observations had passed. This programme was already in progress by the Perth Observatory after its relocation to Bickley through the re-observation of ‘second epoch’ plates on the Astrographic. Session E, ‘Proper motions and galactic problems’, on Thursday 16 August 1973, dealt with this PM requirement for both optical and radio participants, it would also cement the decision and involvement in other international collaborations in this area already made by the Perth Observatory, including the Deutsch and FK5 programmes.
The afternoon of the last full day of the Symposium saw ‘Session G’ entitled ‘Astrometric techniques’. It is apparent from this last session that the progress in the preceding ten or more years in this field had led to significant improvements in accuracy. The improvements were not only through the introduction of computers, facilitating better and faster data handling, but also in the areas of instrument recording devices including those used at the Perth Observatory such as the photoelectric multi-slit micrometer on the meridian telescope. It is interesting to note that the only invited paper for this session was that of Prof Høg of the Hamburger Sternwarte and on a topic very well aligned with the Perth Observatory’s then current program. Its title was ‘Modern developments of the meridian circle’. Being significantly involved in the Perth Observatory’s programme, Høg’s paper addressed all aspects of the meridian circle telescope challenges including the micrometer, the declination circles, the telescope itself and the construction of the site. Høg’s paper provided an indication of the extent to which the use of the new photoelectric solution had improved observing results by stating, “…Perth has acquired observations with a statistical weight equivalent to 200000 visual observations...” during the 5 years of operation and how this compared to previous observations by stating “During the preceding 60 years in Bergedorf 130000 observations were obtained”. In addition, Høg provided data on the ability to observe fainter stars using these newer systems, thus providing more reference stars for use by the photographic surveys. Høg also discussed the advent of the computer as providing the meridian circle with an improved mechanism for determining circle division corrections, a task normally delayed due to the workload involved. Høg stated that the traditional visual reading and reductions would normally take a much as ten man-years to compute. With the introduction of the “…scanning micrometers…” now used, it had been done in “…one man year for two circles with 3’ divisions and in a man-month for one circle with 5’ divisions”. To ensure the audience were sure there had been proven advances, Høg added “This year it has been done in Brofelde with an on-line computer in one-man week” (Archives-POBS 1 June 1973 to 13 August 1973).

Høg continued his presentation covering upcoming telescope changes that might also provide improvements, these being glass circles and horizontal and automated mirror meridian telescopes.

The session continued with presentations by the US Naval Observatory on the above mentioned automated transit circle as well as the Pulkovo horizontal meridian circle.

In that this and the preceding sessions had all worked towards several limiting factors of ground based telescopes and technology, the Perth Symposium saw a presentation by P Bacchus and P Lacroute (Strasbourg Observatory, France) on ‘Prospects of space astrometry’. This paper presented a proposal highlighting the advantages of astrometric observations from
space without the impact of gravity, removing flexure issues, and having no atmospheric refraction, diffusion or absorption issues.

With the Symposium at an end, the closing general discussion had by all the participants centred on the Symposium being the first Symposium where both optical and radio astronomers were gathered to discuss astrometry.
1.15 APPENDIX 16 – CANDY’S MOVE TO AUSTRALIA

Harris was quick to respond to Candy, not only to thank him for the copy of the BAA Handbook, but to suggest “…I’d have liked to offer you a job here – and might have, if I’d known earlier – but I’m a bit doubtful whether we could offer you what you want”. Harris went on to write in the letter of 4 December 1967 that they had had a vacancy for a graduate for some time and he was in the process of finalising the position, he was also unsure whether Candy had a degree that would be required by the Western Australian Public Service Commission (PSC) (Archives-POBS 1967 to July 1989).

Yet again, international politics (war) and funding took over and Candy wrote to Harris on 12 December 1967 advising that his move to the USA, specifically Tucson, Arizona, “…has become somewhat less likely – they are having financial trouble, due to the NASA cutback, due to Vietnam”. But, Candy wrote, “…I definitely want to move” and indicated that Perth could still be a consideration. Candy then provided Harris with his qualifications and work experience, see Figure 7.1.1 below.

Figure 7.1.1 – Faded extract from Candy’s letter on his qualifications and experience.

It is apparent from the four page foolscap reply Harris sent to Candy on 20 December 1967 that Harris was surprised that Candy would consider relocating to such a remote and isolated location. In his earlier letters, Candy had asked Harris for information on other opportunities in astronomy in Australia in general; Harris responded by providing his understanding of the situation elsewhere in Australia (Archives-POBS 1967 to July 1989), see Figure 7.1.2 below.

Figure 7.1.2 – Faded extract from Harris letter of astronomy in Australia.

Understanding what Candy was interested in, regarding furthering his comet work, Harris dismissed the Weapons Research Establishment at Woomera due to its mostly military and satellite work and the University of Tasmania, due to its weather which he wrote “The climate
there is poor for observations” as well as not being a wealthy State. This left Mt Stromlo and Sydney. Harris explained to Candy that while Mt Stromlo had a good selection of equipment and was part of the Australian National University, he believed the issue would be obtaining telescope time for his work. Sydney, Harris wrote that, “I doubt whether it can offer anything that is not better provided for in Perth...”. Harris wrote that Sydney Observatory was in the City centre, overlooking the Sydney Harbour Bridge and that light pollution was hampering it; Harris had not heard of any plans to relocate it (which could have been the case for the Perth Observatory as it was effectively in the same situation). So, Harris commenced his pitch to Candy writing, “So we come to Perth”. Harris proceeded to provide Candy with the situation at Perth with respect to staffing, computing, telescope and accommodation. Harris then moved to the current situation and the plans for the future of the Perth Observatory see Figure 7.1.3.

Figure 7.1.3 – Faded extract on from Harris letter on astronomy in Australia.
While not directly related to astronomy, Harris indicated in his letter that there had been “...huge mineral resources...” found in the North of Western Australia and he saw a possibility of tapping into a scientifically interested benefactor. Harris closed his letter by writing that he thought that there may be a way to offer Candy a position, but it would take at least a year based upon the financial processes as well as being dependent on what happened when the German expedition left. Harris’ last paragraph laid out the salary that he expected Candy would be offered, if all worked out (Archives-POBS 1967 to July 1989).

Candy, being eager to seize upon an opportunity to relocate, as he had mentioned in his earlier letters and aerograms, replied to Harris on 15 January 1968. Candy wrote that he had written to Mt Stromlo, and “...a dozen other places in USA...” but had not heard back, so requested Harris provide some more details on relocating to Perth, mostly in regard to expenses, and pensions (Archives-POBS 1967 to July 1989).

Harris, also keen to seize on the opportunity to advance the new Perth Observatory at Bickley, replied on 8 February 1968. Harris wrote his reply by reiterating firstly that his ability to employ Candy was based upon “Everything must be linked with our being able to resume meridian work when the Hamburg people leave”. Harris’ idea for Candy was for him to take over the Astrographic Section and Dr Nikoloff the new Meridian Section. Harris continued to provide, where he could, answers to Candy’s relocation, salary and other financial questions. While Candy had not requested any details about the weather in Perth, apart from a previous comment that he expected that it was better than the UK, Harris closed his reply to Candy by providing a detailed summary of the situation from Observatory records (Archives-POBS 1967 to July 1989), see Figure 7.1.4.

Candy replied to Harris on 22 February 1968 writing, “Many thanks for another excellent letter...I certainly would be interested in looking after the Astrographic section. This would fit in well with my RGO experience and of course with my interest in getting occasional plates for positions for orbit work”. On 17 March 1968, Candy, obviously happy with Harris’ information again wrote, this time a full foolscap long letter. Candy wrote that the map and papers that Harris had sent him had been of great help providing an indication that “...the cost of living is
not so very different in the two places”. Candy indicated that he had had a fifteen-minute telephone interview with the Smithsonian Astrophysical Observatory (SAO) in regard to an application he had made for a job “...to do with the orbital astronomical satellite”. He also wrote that another job he had applied for was with the Lowell Observatory in Arizona “...to do with photos of planetary surface features”; little would Candy have known that this program would end up happening at the Perth Observatory in the 70s. In his letter Candy reiterated his desire to take the Perth Observatory job, however “...obviously the timing is getting rather critical. If Perth were a certainty then I am pretty sure that I would let the US possibilities fade. Whereas, as things are, I feel I must pursue these possibilities simultaneously”. Candy closed his letter pointing out that he was agreeable to a situation where he accepted a short-term job in the USA until the Perth position was definite, however “It would be more disturbing to the children's education than a single move would be. Linda is just 9 and Bernard will be 8 in June” (Archives-POBS 1967 to July 1989).

On 31 March 1968, Candy wrote to Harris advising there had been no development on the query with the USA writing even after “…the transatlantic phonecall!”. Candy wrote “But my writing to Gascoigne has, I think, had a round-about effect. He and Eggen were here last week discussing the joint 150-inch. Ben had mentioned my enquiry to Eggen to find out what the situation was at Stromlo (in fact no good for me). Eggen must have said something to the AS about this – maybe the AR had not believed how serious I am about leaving - and the AR suggested out of the blue that I might like a tour of duty at the Cape” (Olin Jeuck Eggen was the chief assistant to the Astronomer Royal (AR) at the RGO). While Candy had indicated he was not happy at the RGO, a statement reiterated by his second wife Vikki (personal communication), he appeared to falter with his thoughts on the South African Cape of Good Hope observatory writing “It would be a very lucrative move – rent free house and a salary jump (due to foreign service allowance)...”, he also indicated that such a move may also have other consequences for his promotion prospects “…which is a very likely consequence of such a move”. His concern was that a refusal would potentially prejudice future promotion prospects, if he stayed at the RGO. Candy closed his letter asking Harris two questions to assist him in making his decision (Archives-POBS 1967 to July 1989):

1) “what is the earliest that you will know that I come to Perth?”; and
2) “Would it fit in better with your plans if I went to the Cape for three years and then came to Perth?”.

With Harris not in a position to offer Candy a position, but obviously keen to attract more astrometric staff, Harris replied to Candy on 5 April 1968. While Harris indicated that his short reply was as a result of rushing to set up for a Neptune occultation, he recommended Candy
“...accept the AR’s offer provisionally. It is possible that the idea of your doing 3 years at Cape before coming here would work out more easily, from the point of view of my getting Treasury approval for my plans, but I don’t want to wait that long. If I can get Treasury approval soon, then I’d like to get you here as quick as possible” (Archives-POBS 1967 to July 1989).

The communication between the two continued and on 1 May 1968 Harris again wrote to Candy advising he had not heard anything further from Treasury, regarding funding for the position. Harris continued by writing that he expected to “...eventually obtain what I'm after...” and if Candy took the Cape job there would be a position at the Perth Observatory during that time. However, Harris questioned whether Candy could, and would resign, if the Perth position did eventuate. It is clear from what Harris then wrote that a delay in engaging Candy would mean “...we would not be able to resume meridian work until some time after the Hamburg astronomers leave...” (Archives-POBS 1967 to July 1989), this being based upon Dr Nikoloff running the Perth Astrographic Section at that time.

Upon receipt of the letter from Harris, Candy wrote an aerogramme from his Hailsham home in Sussex, England on 17 May 1968. He was able to advise Harris that the Cape position decision would take approximately two weeks while funding for the continuation of “...British astronomy...” was finalised. With respect to Harris’ query as to whether Candy would be prepared to resign from the Cape and take up the position at Perth, Candy wrote “...It seems I don’t have to sign anything promising to stay there for the duration, but so far as I know nobody has resigned in midterm. Technically at least it could be done and I am prepared to do it” (Archives-POBS 1967 to July 1989). Harris had his answer.

Two months later on 16 July 1968, Harris again wrote to Candy, still with no news from Treasury. Harris wrote that changes to funding for Western Australia from the Federal Government, as a claimant State due to its large size and small population, might have been causing some issues. If the changes were such that this additional funding were to cease, and Western Australia was to have to fund ‘special grants’ for organisations such as the Observatory, there could be some cut backs, which may jeopardise the funding for changes at the Observatory. It is apparent from the letter that in an attempt to retain Candy’s interest, Harris then moved to providing answers on accommodation options should all progress positively, including an option for the three existing houses the Observatory had setup for the visiting German astronomers. In closing his letter, Harris provided Candy an update on the state of the Astrographic Telescope writing “We are gradually getting the astrographic working, but there is still mechanical work to be completed before we can have any routine observations on a full-time basis” (Archives-POBS 1967 to July 1989).
Candy replied on 19 July 1968 and advised Harris that the plans by the AR for Candy had changed from him going to the Cape Observatory in Cape Town, he would now be going to Pretoria and working on the 74-inch telescope. Candy wrote a second letter on 28 July 1968, in response to Harris’ 16 July 1968 letter, advising that he had assumed that the lack of communication indicated no decision on the Perth position. Candy then updated his previous letter response regarding being able to resign from the Cape, or Pretoria position writing “...I have found out that there may be some strong financial disadvantages in breaking into the middle of a three year tour”. Candy then moved on to querying the computing facilities of the Perth Observatory writing “You have mentioned the Gier computer, to which you have temporary access. Do you have the chance of getting time on any other computer in Perth – at the University perhaps? I would like to have the opportunity of continuing my interest in practical celestial mechanics. For the next few months I am helping the NAO develop a program to integrate numerically the motion of the Moon, with all possible effects included, relativity, figures of the Earth, and Moon etc” (Archives-POBS 1967 to July 1989).

After commencing discussions nearly a year previously, Harris was able to finally write to Candy in 22 August 1968 with some good news (Archives-POBS 1967 to July 1989), see Figure 7.1.5 below.
Candy took “...one day’s delay for thought” in answering Harris’ 22 August 1968 letter responding, “Yes, I would apply for the vacancy...”, the letter arrived at the Perth Observatory on 4 September 1968. Following its arrival, Harris replied the next day with a three-page foolscap letter. Having provided an opportunity for Candy to realise the opportunity, Harris tempered the first part of his letter regarding his previous commitments the starting salary and increments writing, “…I must stress that this is my personal promise that I will take action. I would have to wait until the time is opportune to recommend promotion, but there is no guarantee that it will be approved. I don’t always get what I want, though fortunately refusals are not frequent”. Harris continued “…While I’m very anxious to get you here, I don’t want to do so under false pretences” and continued “…my next communication will be to let you know that the advertisement has appeared and closing date for applications”. In the same letter, Harris turned to providing Candy with more information on some of Candy’s previous requests regarding accommodation and computing facilities. Harris provided Candy with a full account of the history of computing at the Perth Observatory, which has been covered in Section 7.1 and 5.4 of this Thesis. Harris closed his letter by providing some additional information, which he believed, would be of value to Candy after his 29 August 1968 letter. As had been the case for many people emigrating to Australia, the change can be quite daunting. Harris wrote, “I
would say the best time to emigrate is before you are 30. I was a little over this and I found the change a bit hard at times and Ethel (like most wives, it seems) even harder”. Harris continued by advising Candy that a trip “home” after a few years was advisable (Archives-POBS 1967 to July 1989).

Candy replied on 29 September 1968 in a letter, which appeared to bring Harris bad news. Candy wrote “The LUPT (sic) has met and informs me that I can go to Pretoria in April next year to start work from May 1”. The bad news continued for Harris, this time from a financial perspective. Candy wrote, “I have been given a strong (unofficial) hint that I can expect promotion soon”, obviously RGO was not keen to lose Candy’s skills and were offering incentives. Candy wrote that with that, “...we virtually have to go...” to South Africa and closed writing “I must apologise for reversing my decision at this stage – even if it is for the one reservation that I made – but I am sure you will understand”. The news was taken badly by Harris who replied to Candy 3 October 1968 writing “Your letter of 29th September came as a bit of a blow to me. Though it was not completely unexpected and I understand your reasons”. In the same letter Harris still provided Candy with the expected pay scales and suggested that the position in Perth would be advertised either that or the following Saturday. Harris was still intent on not giving up, but advised that the Perth Observatory could not “...compete...” with the allowances, salary and free housing offered by the South African position (Archives-POBS 1967 to July 1989).

A telegram was sent from Harris to Candy on 9 November 1968 advising him that the position at the Perth Observatory had been advertised, as expected, in the West Australian newspaper that day. Candy replied by aerogramme on 18 November 1968 advising Harris that he had decided to apply while other matters sorted themselves out (ie Pretoria and promotion). With the delay in international mail not uncommon, Harris wrote to Candy on 26 November 1968, advising “I went to the PSC’s office yesterday and was surprised to find your application among the others. I intended writing to you as soon as I got back to Bickley, and then your letter of 8th was among the day’s mail” (Archives-POBS 1967 to July 1989).

Communications continued between Candy and Harris leading up to Christmas, with the last letter from Candy on 19 December 1968. In this letter, Candy wrote that he would await a reply from the PSC, if he were to be successful in the application at Perth. Additionally, Candy wrote that he “...had become very worried about the children’s education in Pretoria. One of the staff, who went to be a teacher, has just returned from the Cape and reports that South African education is 18 months or so behind ours, from primary level right though to final degrees. This could set the children back a lot when they returned here and could easily affect the rest of their lives – and careers” (Archives-POBS 1967 to July 1989).
It was not long before the PSC wrote to Candy regarding his application for the Perth Observatory position. A letter of offer was sent to Candy for the position of ‘Assistant Astronomer’ on 7 January 1969. The letter also indicated that “Steamer passages for yourself, and if married, your dependent family, would be provided under the Migration scheme”. As part of the offer to Candy, being located in the United Kingdom, the PSC advised a reasonable amount of funding was available for the transport of personal effects as long as “…you entered into an Agreement to serve in its employ for a continuous period of one year” (Archives-POBS 1967 to July 1989).

The New Year arrived with good news. In an aerogramme dated 19 January 1969 to Harris, Candy wrote “I hope you will be pleased to hear that after a lot of discussion here about the advantages of Perth and Pretoria we have become 100% convinced that a move to Perth would be the best thing for the whole family”, Harris would have been very happy to expect a colleague of Candy’s calibre to extend the Perth Observatory’s skill set, considering the isolation of Australia experienced by scientists. Candy continued his letter by advising that they had been contacted by the “…Agent Secretary for WA…” in London, advising them that they were attempting to cut relocation costs by “…getting us to come under the normal migration scheme”. The appointment was confirmed in a letter from the Under Secretary to Harris on 22 January 1969 advising of Candy’s appointment. Harris, obviously happy that his plans had worked out, wrote to Candy on 24 January 1969, commencing “I was delighted to receive your letter of 19th, and surprised too because I really had very little hope that you would accept. Now I’m worried that we shan’t live up to your expectations!”. Harris then continued to provide some information on accommodation, transport and the children’s education. In the same letter, Harris wrote “I finally received, just before Christmas, a reply to my request for approval to start developments for our own meridian work”, the reply was negative, however, Harris wrote he was hopeful for the following financial year. This, with the pending arrival of Candy, would have also meant that Harris could now get Dr Nikoloff to totally focus on Meridian work and handover his Astrographic duties to Candy (Archives-POBS 1967 to July 1989).

Several months passed with a continual stream of letters and aerograms between Harris and Candy, discussing the move. On 30 March 1969, Candy wrote “We have got the date at last – it is May 6 – we should arrive in Perth May 8 or 9”; it was apparent from some of the letters that Candy and his family would fly to Australia with BOAC, as opposed the standard ship emigration solution that most were forced to endure (Archives-POBS 1967 to July 1989).