QUEST

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QUEST

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contents

cover *Mute testimony to an English Summer. Sensibly clothed spectators at the first sports day*

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profile

Professor Sir Bernard Lovell, OBE, FRS

Chairman of the ASR Board

Who's Who devotes forty-eight lines to a catalogue of places, dates and distinctions awarded to Bernard Lovell the Scientist, but gives no hint at all as to the nature of the man. He has been described as an academic, detached, and severe, but these impressions are quickly disproved by his latest book 'The Story of Jodrell Bank'. This fascinating account of the agonising, sometimes desperate struggle to build the famous radio telescope is based on his diaries, so that the reader is quickly caught up in the excitement of the project. It is impossible to read this book without it creating a great feeling of admiration for his determination to succeed despite overwhelming odds and sympathy for the periods of utter dejection he experienced during some of the many setbacks.

No-one in the world had any experience of building such a colossus, so the engineering problems, financial guesstimations and the sheer magnitude of the project forced the small group of scientist, engineer and university Council to 'play it by ear'. Unfortunately they were playing with public money and the keepers of the public purse were highly sceptical of the soaring costs. The project floundered in a financial morass, with debts piling up and criticisms being fired from all directions. At one time, Sir Bernard lived under the shadow of being personally responsible for debts totalling a quarter of a million pounds, with a very real threat of imprisonment and the end to his career.

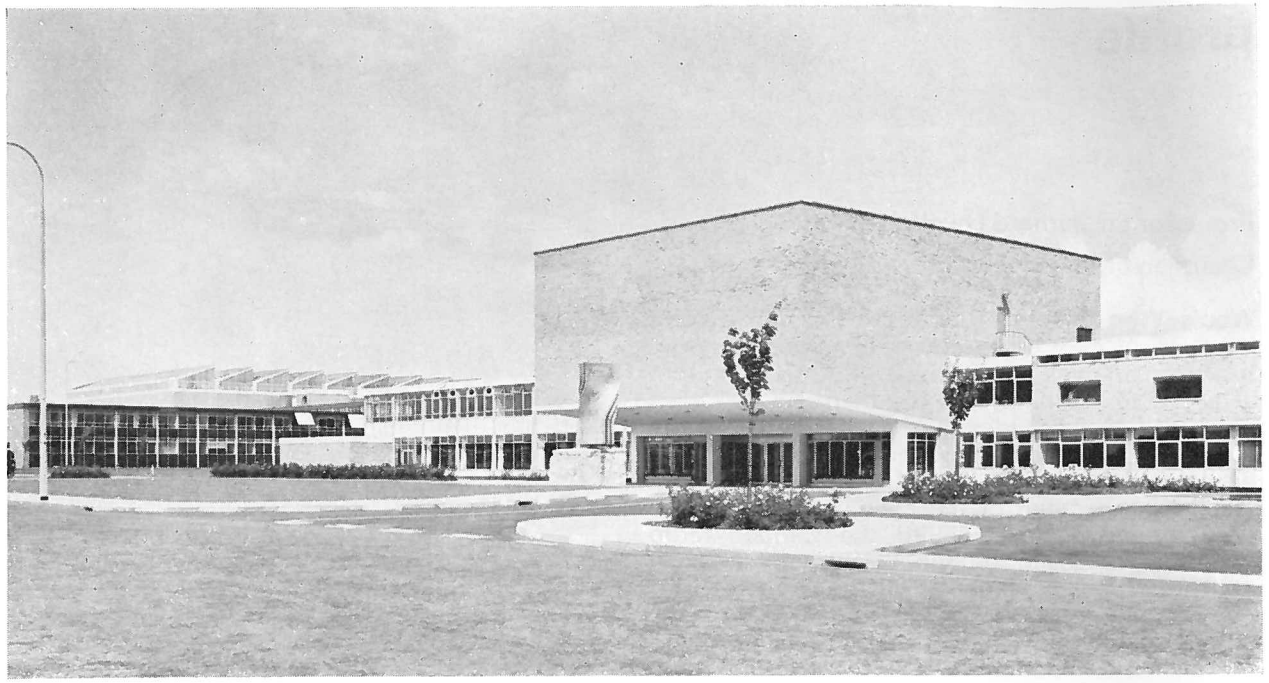
The result, as we all know justified the faith of the group and the instrument enjoys a unique position in the minds of the general public and in the scientific world. One book reviewer called it 'Our National Dish', if this be so, then assuredly Sir Bernard Lovell is the Chef de Cuisine.

Sir Bernard was born in a small village near Bristol and at grammar school devoted far more energy to proficiency at the wicket than to gaining academic kudos and was quite ready to leave after taking his School Certificate. It wasn't until he entered the Physics Department of Bristol University in 1930 that he settled into a routine of serious study. It was during that crucial six year period that he became enthralled by the new discoveries in physics and the revolutionary advances being made in astronomy due to the introduction of the 100 inch telescope.

He left Bristol in 1936 and went to Manchester as an assistant lecturer in the Department of Physics. A year later he married and was invited to join a team headed by Professor Blackett to study cosmic rays. The advent of war took him to the Air Ministry and to the Telecommunications Research Establishment where he worked on microwave radar.

He returned to Manchester in 1945 in an army truck towing a gun laying radar set, with which he eventually began his studies of large cosmic rays at a site in Jodrell Bank which belonged to the Botany Department of Manchester University.

The Professor is very fond of music and gardening and still finds time to play cricket, which he takes quite seriously as illustrated by a passage in his book: in September 1959 when the Russians telephoned to inform him of the launch of Lunik II which was aimed to land on the moon, the Professor was preparing to skipper the local cricket team; the American contingent based at Jodrell were being pressed by Washington to track the moon probe, but when they asked what the Professor intended to do, he replied 'play cricket'. It is part of history now of course, but he returned to set the telescope in motion and actually recorded the moment of impact on the moon . . . in the excitement of the moment he evidently forgot to record in his diary the result of the cricket match.



an SRC astrophysics research unit at Culham Laboratory

W. G. Griffen

The formation of an astrophysics research unit at the Culham Laboratory under SRC funding and control was announced in December 1967. The new unit is directed by Dr. R. Wilson and was formed from the Spectroscopy Division of the Culham Laboratory of the UKAEA. It takes over the programme of research of the Spectroscopy Division with some changes to align it to astrophysical aims rather than those of controlled thermonuclear fusion. The staff transferred to the new unit total about 30, mainly scientists, engineers and technical support staff, and they continue to enjoy the support of services and facilities from the Culham Laboratory. The annual scientific budget of the new unit (excluding salaries and overheads) amounts to about £100,000. Control of the scientific programme was transferred to SRC in April 1968 and transfer of staff and administration is planned for April 1969.

The laboratory, which is situated in pleasant country near Abingdon in Berkshire, was built during 1962–1964 to create a centre for controlled thermonuclear research in the United Kingdom. The staff was formed by the amalgamation of separate groups working at Harwell and Aldermaston and, in 1967, about 800 were employed at Culham, about 250 being professional scientists or engineers. In July 1967, following a re-appraisal of the progress towards and the potentialities of thermonuclear fusion for the generation of electric power in the UK, the UKAEA announced a run-down in the scale of fusion research by about 50% over a five year period. This decision led to a review of programmes of research at Culham including the work of the Spectroscopy Division; this work although undoubtedly of considerable scientific value had become of less significance to the fusion programme, partly because of the progress already made in the spectroscopic field but essentially because the immediate problem of fusion had resolved into one of plasma containment.

The main entrance at the Culham Laboratory. The large block above the entrance proper houses the lecture hall. The sculpture opposite the entrance is by Jeffrey Clarke and is symbolic of sheared magnetic surfaces in a plasma.

The part which spectroscopic observation had played in the study of high temperature plasmas for fusion research, developing from the work on ZETA in 1956–58, was a considerable one. This was a consequence of the basic nature of the spectroscopic method but also of the limitations of other methods of investigation imposed by the physical conditions within the plasma, for example a temperature of about 1 million °K and a density of 10^{14} particles per c.c.

Emission spectroscopy in the vacuum ultraviolet (VUV) region with wavelengths of 300Å to 3,000Å and in the soft X-ray region (XUV) with wavelengths of 3Å to 300Å have been the most useful for plasma investigations. Because the techniques, methods and the data available for these regions were at first inadequate, some research and development was necessary before spectra of adequate quality were obtained and satisfactorily interpreted. A series of papers on various aspects of spectroscopy at these wavelengths including instrumental developments, intensity calibration techniques, measurements of cross sections and the production and identification of new spectra were published between 1958–1968; these papers provided the basis of the international reputation now established in the field.

Because of the considerable physical similarity between the plasmas produced in fusion devices such as ZETA, and those occurring naturally in the atmosphere of the Sun and stars, comparisons between the spectra and the conditions producing them were instructive and occasionally even remarkable. The valuable interplay between fusion and astrophysics led, in 1961, to a proposal to the UKAEA and the British National Space Committee for Space Research to use the expertise and experience gained in the study of fusion type plasmas to carry out studies of the vacuum ultraviolet and soft X-ray spectra of the Sun from above the earth's atmosphere. It was expected that the improved understanding of the physics of the solar atmosphere which might result from these studies could well have a significant bearing on the problems of plasma heating and containment which were so vitally important for the fusion programme.

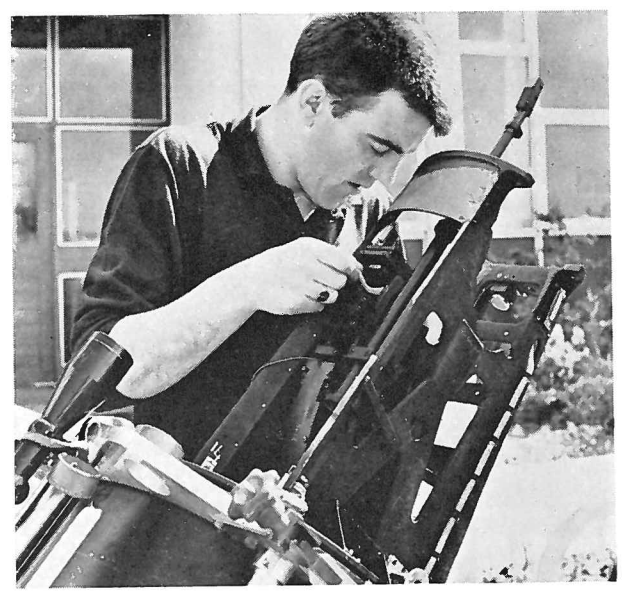
The Skylark rocket already used in the UK space research programme was ideally suited to this proposal but an essential requirement for such a programme was the development of a stabilised platform for the scientific package which would enable the spectrographs to be pointed accurately towards the Sun.

Proving flights of Skylark rockets with stabilised platforms instrumented by the Culham group were carried out from the Woomera range in Australia with considerable success, in August and December 1964; a pointing accuracy of about 5 arc sec was achieved, more than adequate to resolve spectra from the solar limb region. Spectra were obtained in the VUV region down to 950Å but the altitude was insufficient to record soft X-ray spectra. In the following year two Skylark flights with rockets equipped with the higher performance Raven VIA motor were made achieving altitudes of 210 km; these flights afforded excellent spectra in both VUV and soft X-ray regions. Further flights in this programme have since been made and have provided high quality spectra in the VUV and soft X-rays regions for different limb and disc positions on the Sun. These spectra have provided new data for the development of theoretical models of the solar atmosphere and this work is proceeding both at Culham and elsewhere.

In May 1965, ESRO commissioned a detailed study of a scientific payload of a Large Astronomical Satellite (LAS) to make VUV observations of the spectra of stars. This study, which was carried out by a UKAEA sponsored team led by Dr. R. Wilson and including several members of the Spectroscopy Division, was completed in January 1966. The report was adopted by ESRO in July 1966 but financial difficulties have so far prevented its implementation.

Thus by 1967 the scientific programme of the Culham Spectroscopy Division had already developed a strong astrophysical interest. While such a programme might no longer be important in a curtailed fusion programme there was little doubt about its value and significance in an astrophysical context. Thus, in December 1967, the Science Research Council decided to take the responsibility for this work and to incorporate the scientific programme within that of the Astronomy Space and Radio Board.

The account is now brought up to date. What of the future? The scientific programme of the unit has now been planned in outline for the



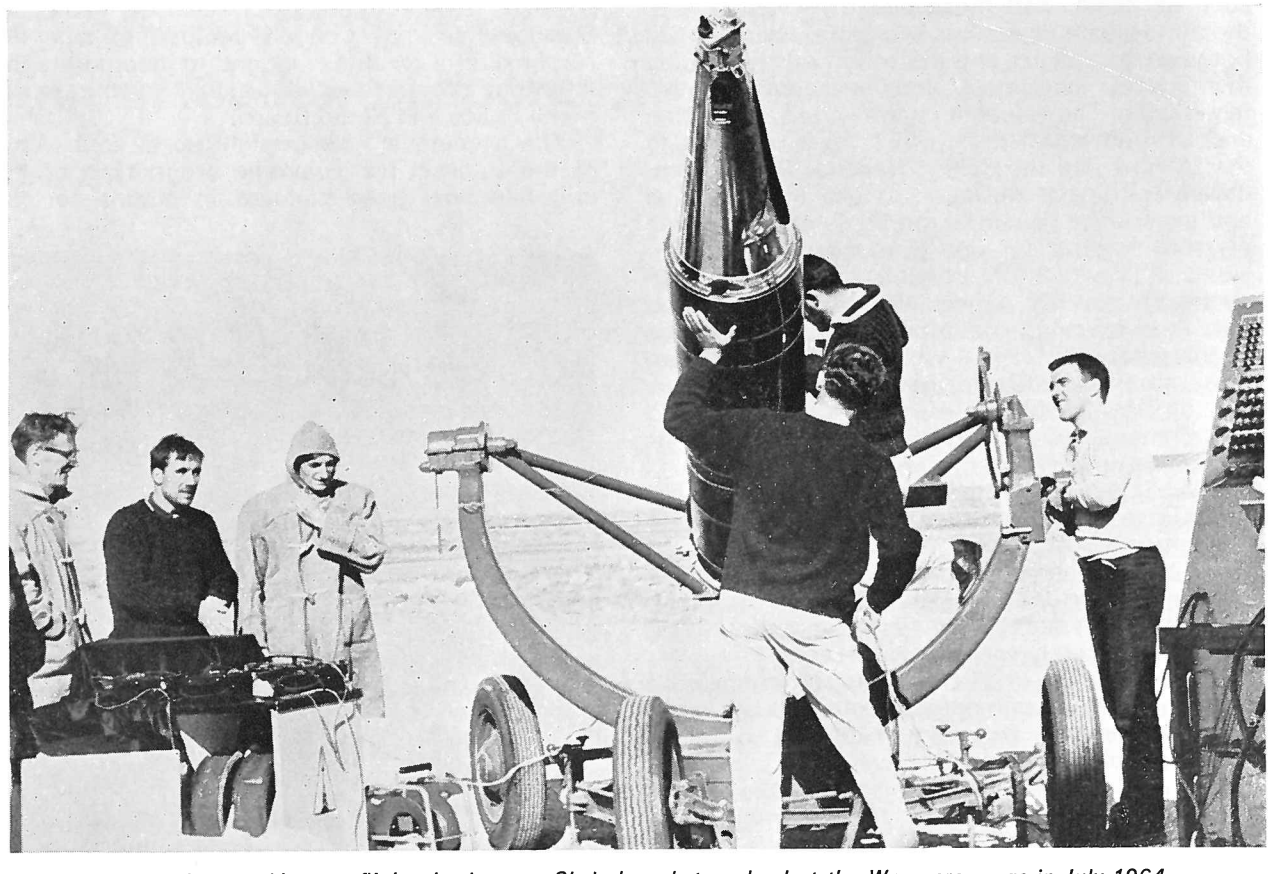
Sunlight testing of spectrographs of a Skylark rocket payload assembly.

next five years. Although the subjects to be covered and general distribution of effort will be similar to previous years, there will be expansion in some areas, particularly in the space research activities.

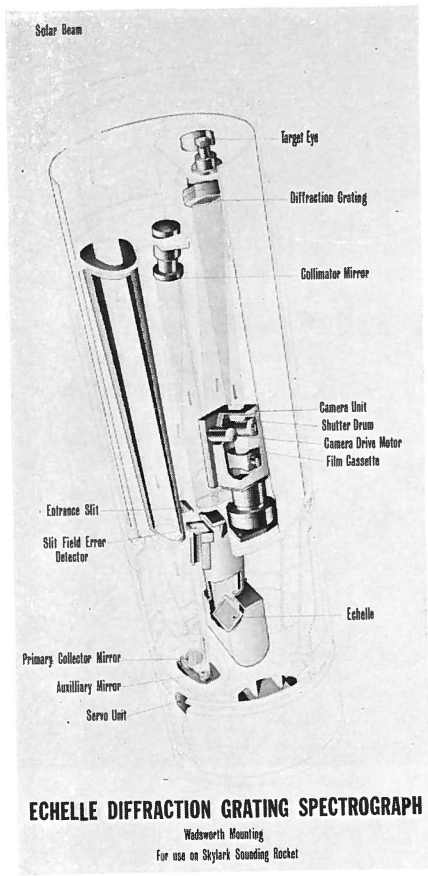
The programme of laboratory experiment will continue as before to obtain cross-sections and other data necessary for the understanding and evaluation of observed solar and stellar spectra. A new 40 kJ theta pinch device has been built which will provide a hot plasma ($T_e = 250$ ev), sufficiently well understood for useful studies of soft X-ray spectra of highly ionised atoms similar to those produced in solar flares. Theoretical work is in progress to try to improve our ability to calculate the basic features of complex spectra of this type. Further, in co-operation with physicists from Glasgow University it is hoped to make a substantial advance in our intensity calibration ability by employing the optical continuum emission from the Glasgow electron synchroton as a secondary light intensity standard. The synchroton continuum extends over a very wide spectral range from the soft X-ray region well into the visible and near infra-red regions and has the valuable feature that the spectral distribution of intensity is calculable from the synchroton parameters.

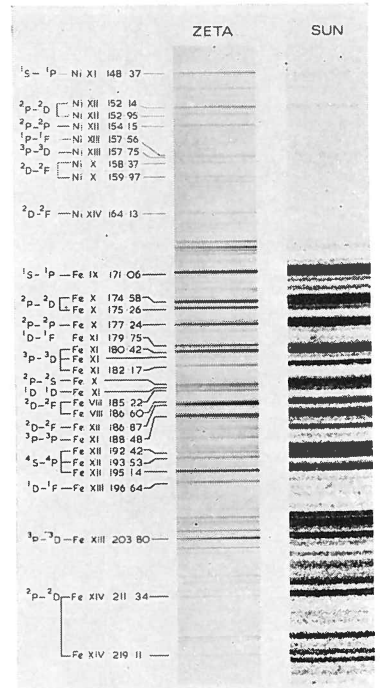
In the programme of studies of naturally occurring plasmas, the solar VUV observations from stabilised Skylark rockets will be extended with the emphasis on particular aspects of the coronal and chromospheric physics rather than with the broad surveys made hitherto. Flights early in 1969 are planned for payloads employing a crossed diffraction-grating and echelle spectrograph with high spectral resolution (0.02 Å) to make possible studies of the widths of solar spectral lines in the VUV region. The line profiles depend on opacity effects in the source region and also on broadening by Doppler motion of the emitting ions, so that study of the line widths (about 0.1 Å) could provide temperature measurements for different regions of the solar disc.

However in the future a large part of the space astrophysics work will be concentrated in a phased programme of studies of VUV spectra of stars and nebulae from Skylark rockets which received approval and funding during the year. This programme of stellar exploration will have access to an enormous range of observation, in a field hardly broached. It can look at stars differ-



ARU staff and others making pre-flight checks on a Skylark rocket payload at the Woomera range in July 1964.





Comparison of spectrograms of the Sun and ZETA showing notable simularities in the region 140Å—220Å.

ing very widely in physical constitution, with a choice from many hundreds bright enough for observation (brighter than 5th magnitude). Extended stellar sources and also the spectral absorption of the interstellar medium can be examined. The implication of such a programme in terms of our understanding of the physical nature of stars and of inter-stellar matter could be profound.

The first stage of this programme, which is a joint venture with University College, London, employs a simple slitless spectrograph with vehicle stabilisation requirements similar to that of the solar experiments; parachute recovery of the film is required as in the solar programme. The first flights are scheduled for early 1970. Later stages of the programme will employ telescopes to increase the light gathering power thereby making possible the viewing of stars down to 5th magnitude. These experiments will demand a high degree of platform stabilisation (about 1 arc sec) involving the development of more sensitive pointing systems. Later payloads may use photoelectric detection instead of photographic film to increase the sensitivity and more sophisticated spectrographs to increase the spectral resolution.

In addition to these experiments in the national programme, several scientific payloads are in preparation for VUV and soft X-ray observations of solar and stellar spectra from rockets to be fired in the ESRO programme.

The unit is also involved in several VUV space experiments in association with University groups. Scientific payloads for high resolution studies of the resonance lines of Mg II across the disc of the Sun are being prepared in collaboration with Queen's University, Belfast for Skylark rocket and for balloon platforms. The feasibility of using rocket VUV observation during a scan of the solar disc by the moon at a total eclipse (1972 North America) to obtain precise information about the structure of the solar atmosphere is being examined in association with Imperial College and groups in the USA and Canada. Finally X-ray experiments for Leicester University have been flown with Culham instruments in many of Skylark solar flights. In addition to these joint ventures with University groups, academic links have been further strengthened by a working arrangement which has been established with University College, London for further joint experiments and for various academic exchanges.

For the staff of the unit the future should be exciting and if only a fraction of projected aims are achieved, the accomplishment will be considerable.

Leopards, landscapes, and 'Royal' telescopes

a short account of the work of the
Royal Observatory, Cape of Good Hope

J. B. Alexander

The Royal Observatory, Cape of Good Hope, was founded in 1820 for the improvement of practical astronomy and navigation. At this time, although several northern observatories were engaged in the determination of the positions of stars, the southern sky had been very neglected. The reason for this is not hard to find; most of the countries south of the equator were not highly developed at the beginning of the nineteenth century.

The Observatory was built about three miles from the centre of Cape Town in what was then a rather isolated position. However, it was near enough to Table Bay to allow visual time-signals to be given from the Observatory to vessels in the anchorage. Fallows, the first HM Astronomer at the Cape, chose a site which was part of a bare, rocky hill covered with thistles and infested with snakes; the jackals howled dismally around it at night-time and a guard of soldiers was required to protect the property of the Observatory from theft.

Sir David Gill, who was HM Astronomer at the Cape at the turn of the century describes an incident in these pioneer days. 'After the Observatory building had been nearly completed but before the scaffolding and ladders had been removed, Fallows went into the mural circle room one evening, after the workmen had gone, to test the opening of the shutters. He had prided himself on the design of these shutters and the ease with which any particular one could be opened. But on pulling the rope to open the shutter for observing zenith stars, he found that it would not move. He ran up the staircase leading to the roof, peeped out of the door at the top, and there comfortably seated on the central trap door of the meridian opening, was a large leopard. The astronomer and the leopard both disappeared rapidly in different directions.'

Determined to avoid a recurrence of this unpleasant experience, Fallows opened a school and taught the children of the nearby farmers for a fee of one load of earth for each lesson. The soil was used to cover the bare rock and this not only helped to remove the menace of the snakes but it allowed trees to be planted as a wind-break.

When the Cape Observatory was founded, there was a real need to improve the determination of the positions of stars for practical purposes. The precise positions of a relatively small number of southern stars were required for navigation and for the determination of time. However, the urgency of this problem became less and less as data of greater accuracy were accumulated. In the late seventeenth and in the eighteenth centuries, the main academic interest in astronomy was in the dynamics of the solar system.

Although this topic is still an active field today, it occupies only a small fraction of the total manpower engaged in astronomical research.

A series of rather gradual developments in the nineteenth century, followed by the very rapid advances of this century, has greatly broadened the outlook of astronomers. Astronomers are now very much interested in stars as entities in themselves; their positions, colours and spectra are studied for their own sake with no direct utilitarian view in mind. The Cape Observatory has shared in this general trend, at the same time continuing with the older aspects such as the provision of a time-service. We shall not review the history of nineteenth century astronomy in any detail, but we shall briefly mention two very important developments where the Cape Observatory made a major contribution. These are the derivation of the distance to a star by Henderson, and the introduction of photographic techniques on a large scale by Gill.

Conjectures as to the distances of the stars had been made by several scientists a long time ago. These were either lower limits based on the absence of any sensible parallax or estimates obtained by assuming that the intrinsic luminosity of a typical star is the same as that of the Sun. Because the Earth moves in an elliptical orbit around the Sun, a nearby star will appear to describe a small ellipse in the sky relative to a much more distant star. Three astronomers, Bessel in Germany, Struve in Russia and Henderson in South Africa, all made a reliable determination of the distance of a 'fixed' star at about

from left to right

front row
B. F. Offen
G. R. Acaster
H. P. C. Cook
J. v. B. Lourens
D. S. Evans
R. H. Stoy
A. W. J. Cousins
D. V. Thomas
A. Menzies
T. W. Russo
S. V. M. Clube

second row
M. C. Coetzee
R. M. Banfield
B. Brown
M. J. Parr
W. F. Turner
E. Fiamingo
G. P. Bradshaw
D. E. Johnson
G. G. Schonrock
C. Van den Berg
J. M. R. Cammidge
C. A. Byrnes
H. J. Webster
M. Malan

third row
A. T. Rose
J. Churms
R. E. Wallis
L. C. Browne
O. G. F. Fiamingo
W. A. Rasmussen
B. D. Yallop
D. J. Momsen
D. J. Rigby
R. P. de Kock
D. S. Malan
W. G. Pearson

fourth row
M. A. Congwane
Z. N. Matiwani
L. Makobs
P. P. Okkers
K. J. Jacobs
J. Blom
G. Mgayiya
N. G. Thompson
J. Masithela

April 5 1967

the same times using this parallactic method. Henderson's results for the bright southern star Alpha Centauri were published in 1839.

Gill, who was one of the greatest observational astronomers of his time, made an outstanding contribution to astronomy with the introduction of photographic catalogues of the sky. When he examined plates of the great comet of 1882 taken with a portrait camera, Gill noticed how many stars were visible on the longest exposure. He immediately conceived the idea of taking direct photographs of the entire southern sky. Photography had been used before this in astronomy, but Gill was the first to use it in star charting.

The present Royal Observatory has a total complement of 55 people, of whom about 30 are directly involved in astronomical work. The majority of the staff are South Africans, but over half of the observational astronomers are based at the Royal Greenwich Observatory, Herstmonceux and are seconded to the Cape for a limited time. (The most common period is three years). In addition, there are often visiting astronomers from abroad and graduate students from the University of Cape Town using the facilities of the Observatory. The association between the Observatory and the University has for long been a happy and fruitful one. However, it was only in 1957 that this connection was formalised by the creation of a Department of Astronomy in the University, with the present H.M. Astronomer at the Cape, Dr. R. H. Stoy, as Professor.

The two largest telescopes are the Elizabeth reflector and the Victoria refractor. The Elizabeth has an aperture of 40 inches and was installed in 1963. It is used mainly for photoelectric photometry. The Victoria is a multiple refractor with a 24 inch photographic objective and an 18 inch visual objective. It is used for the determination of trigonometric parallaxes and for photoelectric photometry. There are also 30 inch and 18 inch reflectors, a 13 inch refractor, a 6 inch meridian cicle, a Danjon prismatic astrolabe and two photoheliographs, one for photographing the Sun in white light and the other in the light of H alpha. A variety of wide-angle cameras are used for astrometry and for photometry. Observations of artificial satellites are made with the Askania Kinetheodolite. The Cape staff also share in the use of the 74 inch Radcliffe reflector at Pretoria which is at present an SRC responsibility under the terms of a seven year agreement with the Radcliffe Trustees. Most of the observing time there has been spent doing radial velocity work on individual stars, planetary nebulae and galaxies.

The Cape Observatory is well-known for its work in positional astronomy. The transit circle, which is in regular use for observing the positions of stars and planets, is of particular importance since the Cape instrument was for a long time the only one in the southern hemisphere. In recent years, observations made with the astrolabe have served as a check on the systematic accuracy of the previously adopted positions of some of the bright stars in the southern sky. Experiments are being conducted with photographic plates secured with a wide-angle lens; using the method of overlaps, it is hoped to obtain greatly improved relative positions (and in time, proper motions) of stars widely separated from each other in the sky.

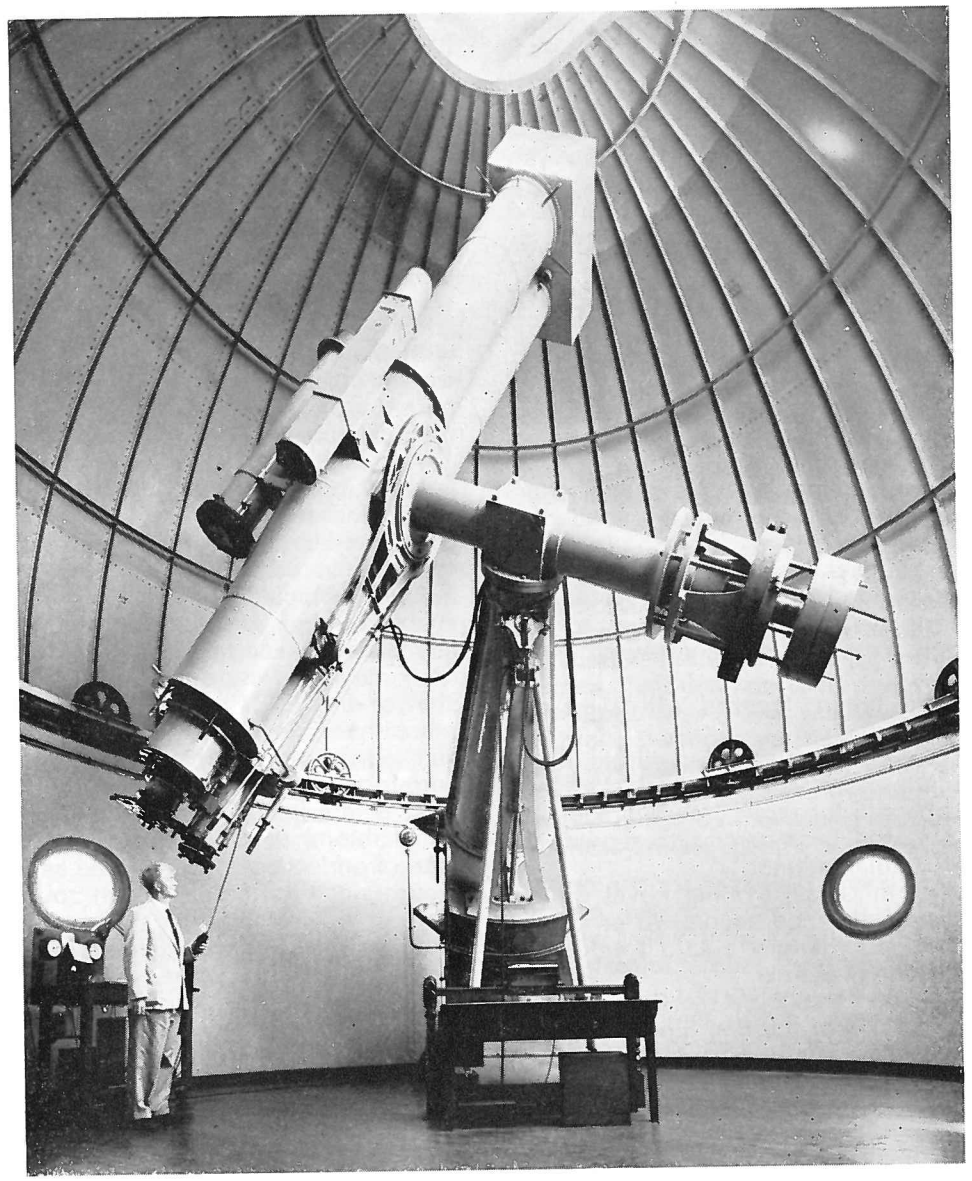
Mention must be made of the Cape Photographic Catalogue for 1950. This immense undertaking has just been completed after 25 years work. This catalogue gives accurate positions for 68,397 stars. Unlike its northern counterparts, it also gives newly determined proper motions, magnitudes, colours and spectral types. It is a mine of information both for the statistical astronomer and for the astronomer looking for individual stars of special interest.

In the field of photoelectric photometry, much work has gone into providing standard stars with accurately determined magnitudes and colours. Bright stars all over the southern sky have been carefully observed; these can be conveniently used as secondary standards. A large amount of routine photometry on stars of intermediate brightness (e.g. nearby stars, RR Lyrae variables) has also been carried out during the last few years. Photometry of faint stars is no longer possible at the present site because of the brightness of the night sky, but there is a possibility of moving the Elizabeth telescope to Sutherland, 235 miles inland from Cape Town, which has a climate favourable to optical astronomy.

Considerable attention has been paid to a study of the nearest stars in the southern sky. Trigonometric parallaxes have been obtained with the Victoria telescope. Radial velocities of these stars have in many cases been obtained from spectra taken by Cape personnel at Pretoria.

Radial velocities have also been obtained of objects of special interest such as selected stars in the globular cluster Omega Centauri, RR Lyrae and W. Virginis stars, planetary nebulae and galaxies. For the fainter objects, a specially fast spectrograph has been designed for the Newtonian focus of the Radcliffe reflector; it has now been in use for a few years. Finally, we shall make some general comment on the need, as we see it, for astronomical observations in the southern sky at the present time.

In certain branches of astronomy, there is a need to balance northern observations with southern ones in order to eliminate certain types of systematic errors. However, one of the main reasons for observations of the southern sky is that it contains considerably more than half of the interesting objects in the entire sky. The centre of our Galaxy is only observed with difficulty from California, but it passes near the zenith in South Africa. Observations of the Magellanic Clouds, the nearest galaxies to our own, can only be made from a site which is far south. A 20-inch telescope working on the Magellanic Clouds can detect stars which have the same intrinsic brightness as stars in the Andromeda nebula which are at the very limit of the capabilities of the 200-inch telescope on Mount Palomar. There are also of course a great number of interesting objects in the general field in the southern sky. Since there are far fewer observatories south of the equator than north of it, the interesting objects in the south tend to have been observed far less than corresponding ones in the north. There is therefore a great need for continued observations of an astrometric, photometric and spectroscopic nature in the southern hemisphere. The advent of the large telescopes in Australia and South America in the near future will increase rather than decrease the demand for observations with telescopes of moderate size.



Dr. D. S. Evans at the controls of the Victoria telescope.

enquiries from the general public

Some experiences of an Observatory spokesman

R. H. Tucker

It all started about a year ago.

The telephone rang. Being rather busy, I sighed before picking up the receiver and giving my name.

It was the DCSO.

'Could you spare a minute to come over and see me?'

I decided I wasn't so busy after all. You know how it is.

I made my way to his office. (What's up now, I wonder?)

'Take a seat' (Good sign. Nothing catastrophic, anyhow.)

'You know Mr. R has retired?'

'Yes I knew that, R had been quite a pal of mine. Nice chap.

'Mr. R was responsible for dealing with letters from the public and for arranging the conducted tours of the establishment.'

Aha, the light begins to dawn!

'It has been decided to ask Mr. S to look after the conducted tours. We should like you to deal with the letters. You will also share with Mr. S the duties of Press Officer.'

The blow had fallen. I gazed with wild surmise, but was silent.

'This does not involve answering all the letters yourself. In many cases you will be able to send them to other people for reply. You will soon get to know who is the best person to provide an answer on a particular subject.'

I thought that this was a rather novel way to make friends and influence people. After a brief discussion on minor matters, I said I would do my best and left the Presence.

So now to work. First job, take over the file. Judging from the size of the file, 'Enquiries from the General Public' accounted for a large fraction (it turned out to be about ten per cent) of the establishment's correspondence, but this was hardly surprising; after all, the Royal Greenwich Observatory is well known and is surely the obvious place to consult on the many astronomical topics which are so puzzling, and so fascinating, to the ordinary citizen.

It was soon discovered that there was a bit of a backlog to catch up. This eventually amounted to about thirty letters. On several of these R had made notes to assist in drafting replies, so I decided to polish these off by taking them all home for the weekend. By the Monday morning I had twenty-six replies drafted, and the typing pool sent in a relay team who took the dictation in batches of eight letters at a time. This was my first real experience of dictating, and I was greatly impressed by the magnificent way in which the young ladies rose to the challenge. After this operation, the job reduced to dealing with the letters as they arrived, usually a steady trickle of about eight per week, with occasional periods of greater activity when some astronomical subject aroused public interest.

At first there seemed to be no pattern in the letters; most of them contained specific questions, and required individually drafted replies, based on standard reference books, or on a little research in the library. My education began to make spectacular progress as I grappled with such problems as the state of the tide in Pevensey Bay on a certain date in 1703, the strange 'dark day' in New England in 1780, the meteor shower in 1833, the possibility of there being more than one Sun, and the identity of a bright star or planet seen in a certain direction at a certain time.

After the first two months, however, it became noticeable that a fair proportion of the letters came from school children who asked for leaflets, pictures or information which could be incorporated in a 'project' they were doing at school. The same answer would serve in all these cases, and a stock reply letter was adopted and duplicated, referring the enquirer to the local public library, and to the standard sources of information. When similar letters began to arrive from the USA, another stock reply was composed, giving American standard sources, and including a brief summary of the history of the Royal Observatory.

Some of the letters written by children are not connected with their school work, but these are extremely interesting, because the writers are obviously strongly inclined to astronomy in their tender years, and stand a good chance of making it their chosen hobby or profession in due course. As the Observatory is now recognised as being concerned with scientific research, we follow the policy of giving encouragement to all such enthusiasts, and endeavour to answer their questions in full detail. The preparation of such answers may involve several hours of work, for it is well known that children's questions often go right to the heart of the matter, and the young mind is not easily deceived, as any conjuror will tell you.

The question which took the longest time to answer came from a boy in Oxfordshire who became interested in single and triple conjunctions of the planets Mars, Jupiter and Saturn. These conjunctions are events which occur from time to time, and follow a pattern which seems to be irregular over the years, but is actually regular over the centuries. The problem is similar to the fascinating way in which eclipses of the Sun and Moon fall into a pattern when considered over the centuries, but the difference is that eclipses have been documented in detail over several thousand years of the past and future, while planetary conjunctions have not.

A class of letter which is not so welcome comes from people who hold unorthodox views, and who complain that there is a conspiracy among established scientists to suppress the unorthodox 'truth' and to compel conformity with orthodox 'falsehoods'. It would be very easy to dismiss these writers as eccentrics, and to ignore them, but this does not seem a very scientific thing to do. It can well be imagined that if Newton or Einstein had presented their novel theories in correspondence, the views would have appeared very unorthodox indeed, but the person who decided to ignore them would have done so at his peril. It may be irksome to conduct a futile argument with the gentleman in India who flatly denies the rotation of the Earth, or with another in Lancashire who sees diagrams proving Pythagoras' Theorem formed by stars in various constellations, but courtesy and patience cost little, and it does help these people to know that at least somebody has taken the trouble to read their letters.

Occasionally there is a letter which is completely incoherent, usually without an address for reply, to which an answer is quite impossible; and there was one example so offensive that it merited immediate destruction.

A sharp increase in the number of incoming letters followed the widespread reports of sightings of Unidentified Flying Objects in the autumn of 1967. Many people who had seen such things over the years, but who had not dared to say so, now plucked up courage and sent in their descriptions of saucer shapes, cross shapes, spherical shapes, cigar shapes, hovering, moving rapidly, flashing red lights, pulsating orange lights, silent, humming deeply, flying alone, flying in formation, departing rapidly, departing slowly, vanishing into thin air. One or two of the sightings could be identified with a bright star or planet, but most were clearly not astronomical at all.

After this episode things quietened down a little, and we got back to the usual run of school projects, and 'could you recommend a good star map', and 'is space really infinite', and 'what was the time in Bombay when it was 8.5 a.m. in the Malay Federation in 1937?'

There are a good many other people who are interested in the complications and details of Time, including Summer Time, Zone Time, and that far-off mystery the International Date Line, where you have to alter the calendar rather than the clock. The calendar itself causes one or two puzzles about Leap Years, and what was the first day of the 20th Century, and were there only 365 days in the year in ancient Egypt? The Moon often attracts attention, and people want to know all about its size and motion, and why was there no Full Moon in February 1866? One or two people can remember seeing an eclipse, or a comet, in their early days, and now wish to fix the date when it must have happened.

The other planets of the Solar System are a favourite topic for study by various folk ranging from a Londoner who is busy finding out whether there is an undiscovered planet beyond Neptune and Pluto to the Oriental philosopher who informs us that Jupiter is drawing atoms into itself, and that something exciting will happen on a certain date. The periodic comets are of great interest to historians as providing a means of fixing dates in the past. One school-girl looked up the dates of recent apparitions of Halley's Comet, and complained that the figures did not work out right if it appeared in 1066. She was quite correct: the interval between apparitions has varied considerably over the two thousand years since the earliest Chinese record of a sighting of this comet, and all credit to the young lady for discovering this little-known fact for herself.

One of the smallest members of the Solar System has recently come into the limelight, namely Minor Planet 1566, otherwise known as the asteroid Icarus. Its claim to fame is that it was expected to pass close to the Earth in June 1968, and this rather worried a gentleman in Surrey who planned to take a holiday in Sorrento at the critical time, and was anxious about being trapped at the foot of the cliffs by a tidal wave. We were able to reassure him that the diameter of Icarus is only a mile or two, and that when astronomers say 'close approach' they really mean, in this case, nearly 4 million miles. It is therefore extremely unlikely that any cataclysm will overtake us, but, of course, we cannot really be sure about such things.

council commentary

This is a new feature which will be of great interest to many readers. The Council has agreed that Dr. Willis of the Council Secretariat, shall prepare a potted version of the Council's monthly deliberations, so that in each quarterly issue of Quest, it will be possible to review three meetings.

In this first edition, the most newsworthy item is of course, the 300 GeV decision, and whilst the subject has been well aired in the press, the background to the decision makes interesting reading.

The regular Council meetings are held on the third Wednesday of each month except August and September and since the volume of work has been growing, they now regularly start at 11 a.m. continuing through most of the afternoon after a short break for a sandwich lunch.

In January, February and March the Council received broad statements of policy and programme from the NP, ASR and UST Boards respectively, various aspects of the work being further illustrated by oral accounts given by the Board members on the Council. The Secretary of State for Education and Science (The Rt. Hon. Patrick Gordon Walker) and the Minister of State (Mrs. Shirley Williams) attended the ASR and UST Board's presentations respectively. The Council have approved the publication this year of the most generally interesting parts of the ASR Board's statement, and intend from time to time in future years to approve the publication of similar statements from the other Boards. With the advantage of this very full review of the policies of the three Boards, the Council went on in April and May to draw up its financial five year Forward Look, which has to be submitted to the Government each year. The Chairman and the three Board Chairmen presented a summary of the Forward Look at a meeting of the Council for Scientific Policy, where it was well received. The May meeting was held at the Royal Observatory, Edinburgh. A very interesting tour of inspection was arranged, and members were most hospitably entertained.

At the June and July meetings, the Council considered altogether some forty matters great and small, the most weighty of which was the Government's decision not to participate in the proposed 300 GeV accelerator project. Notwithstanding the present adverse decision, the Council accepted the view of the NP Board that participation in either the 300 GeV or a similar European project was vital to the future of British high energy physics in the 1980s. The Council therefore agreed that, although a 300 GeV project could no longer be provided for in the planned programme, the possibility of the UK joining this or a similar European project later on must be kept constantly in mind. Meanwhile, in view of the economic situation and the 300 GeV decision, the Council decided to reduce its request for funds in the next five years. The new proposals seek funds increasing from about £42 million in 1968/69 to about £57 million in 1973/74 and, within a falling nuclear physics share of the total budget, envisage a slightly larger domestic nuclear physics programme than was proposed in the original Forward Look.

Sir Harold Himsworth Deputy Chairman and Secretary of MRC and Dr. J. A. B. Gray, Secretary-elect of the MRC, attended for part of the June meeting to describe the MRC's highly successful ways of supporting inter-disciplinary research. Another interesting item in June was the planning of a co-ordinated programme of development of ground-based infra-red astronomy by groups from Imperial College, Queen Mary College, University College and Edinburgh University with the ROE. This is a fairly new subject. Although water vapour in the atmosphere absorbs the infra-red radiation it has been shown recently that ground-based observations are possible at mountain sites in certain parts of the world.

In July, the Council received a general report from the UST Board on their work in the session, and approved six recommended grants outside the powers of approval delegated to the Board, five because they exceeded £50,000 and one because of its unusual nature. The latter was a grant of £14,500 over three years to Professor F. R. Bradbury (Stirling University) for an investigation into the best ways of allocating research and development funds between competing projects. Four of the five grants over £50,000 were for the development of computer applications, for example a grant of £68,100 over three years to Dr. D. H. Sleeman (Leeds University) for the development of improved techniques for computer-assisted learning. Two proposals for new centralised facilities were also approved. The first of these, a result of the concept of a National Instrument Centre which has been under discussion for some time, is an arrangement providing for the use by universities of the services of instruments such as nuclear magnetic resonance, infra-red and mass spectrometers at the AEA Harwell and Aldermaston laboratories. The second, in collaboration with the Rubber and Plastics Research Association, is for a polymer supply and characterisation centre to be sited at the RAPRA Laboratories at Shawbury, Shropshire.

In the ASR Board's field, the Council began its review of space research policy which will take some time to complete, and meanwhile recommended proposals for a further stage in the programme of British satellite experiments launched through the co-operation of the USA National Aeronautics and Space Administration.

The report of the Fulton Committee on the Civil Service was noted at the July meeting, and the Council looked forward to considering its application in the SRC later, in the light of discussion within the Civil Service and with the SRC Staff Side.

Finally, in July the Council approved a change in patents policy. This was complicated, as patents matters usually are, but broadly speaking, except at the Rutherford, Daresbury and Atlas Laboratories, which will continue to deal with the AEA, the NRDC will take over the responsibility for seeing that the results of research supported by the SRC are exploited in the national interest. The SRC will not seek a share in the revenue from exploitation, and the NRDC will not charge for its services.

a plain man's guide to accelerator static power supplies

J. A. Fox

The orbital magnet systems of some particle accelerators require extremely large cyclic pulses of energy, 50 to 100 megajoules with peak power excursions of ± 150 megawatts or so.

Since pulsating loads of this type would cause unacceptably severe voltage fluctuations to be induced in the public supply network – equivalent to switching say Oxford on and off every few seconds – the normal solution has been to install motor-alternator sets near the accelerator to act as a buffer between the supply authority and the magnet. This kinetic energy storage method permits the input power from the 'mains' to remain almost constant whilst the output power pulsates.

About $2\frac{1}{2}$ years ago we started to become increasingly unhappy about the reliability of these large motor generator sets. Several failures had occurred, with more to follow, resulting in considerable 'outage' time at various laboratories. It was apparent that regardless of the ingenuity of design engineers, the special nature of the pulse load imposed complex loading conditions that were outside normal technological experience and consequently such motor generator sets would continue to carry a definite element of risk.

The reliability prospects for the proposed 300 GeV accelerator, with its even larger motor generator requirement, did not appear overbright and it was this consideration that provided the initial impetus to our study. Other accelerator applications have since followed.

In considering what sort of power supply alternatives might be available to us, our thoughts naturally turned to connection of the pulse load directly to the public supply – back to square one in fact. The two principal questions were:

(i) Could we install some reliable type of apparatus that would compensate for the reactive component of the pulse load and thereby limit, to acceptable values, the induced voltage fluctuation in the public supply.

(ii) If the voltage problem could be solved, were national power systems sufficiently strong to accept the pulse load and distribute it fairly uniformly among the various generating stations without incurring unpleasant disturbances.

There were, of course, a number of other questions but this article is entitled 'a plain man's guide' and, for the plain man, the law of diminishing deception applies.

The first task then was to solve the voltage fluctuation problem since if we couldn't do that there was little point in proceeding to the complicated, and potentially more expensive, problem of the dynamic behaviour of a large power system in response to a 300 GeV type pulse load.

The pulse-induced voltage fluctuation in public transmission systems is predominantly related to reactive drop due to the high X : R ratio of lines and transformers and the lagging power factor nature of most loads. Hence it can be compensated by the provision of reactive current at or near the load point with a phase relationship in opposition to that of the load reactive-current producing the original voltage drop. This in fact means having some form of variable shunt capacitor at the accelerator supply point and control-

ling it in a precise and repeatable manner to both minimize the pulse-induced voltage disturbance in the public supply system and provide a reasonably constant voltage platform for excitation of the accelerator magnet.

Variable capacitors are of course manufactured for radio sets but not alas in the size we require – 120 Megavolt amperes. The alternative approach, incremental switching of small fixed-capacitor units is a little too ambitious at present. There are however two other possibilities which seem quite practicable – a fixed capacitor bank in combination with either a large saturated reactor or a group of incrementally switched air-cored inductors. The reactor current which is, of course, in phase opposition to capacitor current, is controlled in such a manner that the resultant current from the capacitor/reactor combination can vary from inductive to capacitive in accordance with the compensation requirements.

The Atlas computer at Chilton has been used to study several variants of these basic schemes for application to the 300 GeV, Nimrod, CERN PS Booster and the High Magnetic Field Laboratory proposal.

Having resolved the voltage problem the more onerous task of establishing the power system dynamic behaviour was considered and it was agreed with the CERN 300 GeV group to take the United Kingdom power system (CEGB) and the Mundford site as the study basis. This proved to be a happy choice and we have benefitted greatly from the sustained and enthusiastic professional help supplied by our CEGB colleagues.

The joint SRC/CEGB investigation commenced with a computer study of the dynamic behaviour of the UK power system. The CEGB programme gives an advanced representation of all significent generator, transmission and load elements in their system. The time dependent pulse load quantities (i.e. the input) were provided by the SRC Atlas programmes.

It was of course recognized that, regardless of the sophistication of the theoretical approach, no gigantic engineering/commercial enterprise like the CEGB could afford to take chances with their system behaviour, particularly since we were jointly breaking new ground together, and some sort of convincing practical demonstration was obligatory. This was a sensible approach and also beneficial to the accelerator since if the 300 GeV load connection had gone ahead on a 'suck it and see' basis and system disturbances had proved intolerable it would have been rather embarrassing to redesign the magnet power supply using high-speed gas or some other energy-yielding commodity.

Self-interest, the key to most things in life, gave us the opportunity of exploiting the October 1967 Nimrod mg set breakdown by arranging a direct pulse test between the Nimrod magnet and the CEGB 400 kV super-grid connection at Cowley, Oxford. Pulse trains with peak power swings of up to 60 MW were applied at frequencies ranging from 0.3 to 0.1 cps. Measurements of the pulse-induced frequency disturbance were made at Daresbury and the results analysed on the Atlas Computer using the BOMM time series analysis programmes developed by Sir Edward Bullard and his colleagues (referred to on page 16 of Quest 3).

In June of this year the experience gained during the Nimrod dress rehearsal played a useful part when extensive 160 MW pulse tests were carried out between the CEGB and Electricité de France using the Cross-channel submarine cable that provides a d.c. interconnection between these two national systems. The CEGB system was repetitively pulse loaded and the EDF repetitively unloaded. The measurement programme was very comprehensive and included the Daresbury, Rutherford and CERN laboratories who undertook frequency measurement and the Atlas computer Laboratory where the time series analysis was carried out.

In August it was our pleasure to assist our CERN colleagues in the analysis of generator and frequency disturbances induced in the collaborative pulse tests with the CERN PS and Services Industriels de Genève power system which were undertaken to determine the feasibility of a direct connection of the Booster pulse load. The willing help of BEA, Swissair, Customs officials and, not least, the Atlas Computer Laboratory, gave a surprisingly fast turn round of data and results between Chilton and Geneva.

One final point, the cost of static power supplies; it is probably in contravention of some natural law but a 300 GeV static system costs approximately 50% of the mg set it is designed to supplant (a saving of approx. £750,000) and total running costs are 90% below.

'As I want a career with real power and authority I'm staying a student''.

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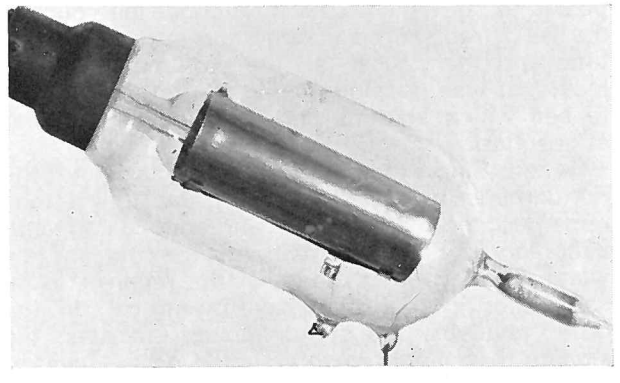
old scientific instruments

radio telegraphy

part 2.

The curious looking valve illustrated in Figure 1 was invented by H. J. Round of the Marconi Company just before the outbreak of the First World War. An example has recently been presented to the Station collection by Dr. R. L. Smith-Rose a former Director. As can be seen, it bears some faint resemblance to a mains electric light bulb, having the familiar bayonet socket fitting. The electrode structure is that of a triode; a central filament is surrounded by a thimble shaped grid which is in turn surrounded by an outer metal shell forming the anode; these two electrodes are reached by small wire contacts sealed in the glass envelope. A curious feature is a small extra chamber at the top of the valve which contains a pellet of asbestos. This pellet was a most important feature in the functioning of Round's valve for its characteristics, like others of the time, depended upon traces of residual gas in the valve being ionized. It was as called a 'soft' valve; that is to say one having a relatively



low vacuum. The degree of residual gas and hence the characteristic of the valve was controlled, as required, by heating the pellet of asbestos which would then give off gas absorbed by it. The flame of an ordinary match was usually sufficient, although in certain cases it was necessary to use two matches, hence the valves often become known as one or two match valves. Round's valve performed useful service in its day, but by the end of the First World War it was superseded by an ever increasing variety of thermionic devices of the 'hard' or high vacuum type. It remains an interesting relic of the progress of the vacuum tube.

The future of the valve as a powerful tool in many branches of physical science was quickly realized, once manufacturers could produce types having reasonably consistent performance. The multivibrator circuit and the valve-maintained tuning fork all date from the decade 1916–26 as well as many other circuits now almost, as it were, ascribed to tradition.

Early in the twenties a number of workers realized that the high impedances in a valve could be very useful in the measurement of voltages and several forms of valve voltmeter were attempted by workers in this country and on the Continent. In Britain, a particularly useful valve voltmeter was produced by Moullin. This is described in the Wireless World of 1922 and was produced for commercial purposes by the Cambridge Instrument Company. A production model

of this instrument dating probably from the middle 'twenties is shown in Figure 2. This has long been in the use at RSRS and is now in honourable retirement in our museum. We cannot quite get away from polished wood and lacquer and the voltmeter still tries hard to look like the ancestral and familiar laboratory meter shyly hiding any trace of its vacuum tube aspect. It is a far cry from the time when it was probably *the* valve voltmeter of the Station. Now such devices are found in all laboratories where electrical measurements are made.

Readers may well recollect that part 1 of this article began, anomalously enough, with the description of something which was not an instrument, but a book. Having this precedent, I make little apology for introducing another literary matter, as it were, because it is of considerable

interest and importance in the derivation of scientific terms. It is a letter of 1926 in which, we believe, the term 'ionosphere' was first defined and used. This is, I hasten to add, not the date of the first publication of the term, that was three years later in 1929, in Watson-Watt's paper 'Weather and Wireless'. In this particular communication of 1926 we find Watson-Watt writing to the Secretary of the Radio Research Board and putting forward his idea that the conducting layers of gas in the upper atmosphere might well be termed 'ionosphere'.

An extract from the text is as follows:

'With reference to recent discussions on the nomenclature of the 'upper conduction layer' of the atmosphere, may I suggest that it is not yet too late to obtain general agreement on a systematic name for the 'layer', avoiding the controversy arising from personal names.

We have in quite recent years seen the universal adoption of the term 'stratosphere' in lieu of a previously well established misnomer 'isothermal layer', and the adoption of the companion term 'troposphere' for the 'convective layer'.

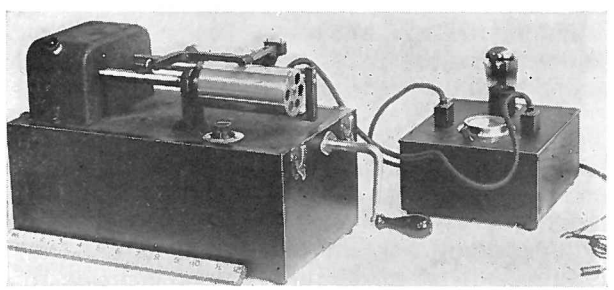
The term 'ionosphere', for the region in which the main characteristic is large scale ionization with considerable mean free paths, appears appropriate as an addition to this series. The objection that ionization occurs throughout the atmosphere is no more adequate against the proposed term [than] is the fact that stratification occurs locally in the troposphere, the systematic name should be characteristic of the main 'grand scale' phenomena without reference to minor and local phenomena.'

This interesting note was found in the loft of an old building at Ditton Park, thus providing an example of the unlikely places in which the amateur historian of technology may find items of interest.

Although long forgotten by most people, there was a brief time when the BBC flirted with the idea of a facsimile service for the public. This was towards the end of 1928 when a curious machine called the *Fultograph* (Fig. 3) became available on the market. It was, apparently, capable of installation and operation by relatively unskilled people, requiring little more than the ability to put a piece of paper on a drum and successfully manipulate the receivers in use at the time; although, bearing that fact in mind, this may not have been quite so easy as we may now think it. The Fultograph was the product of the ingenuity of one, Captain Otho Fulton and used a principle of operation common to many facsimile machines. The picture, placed upon a drum, was spirally scanned by a photocell which amplitude modulated the wireless transmitter. At the receiving end, the signal current variation caused variable density marks to be made by an electrolytic process on a piece of sensitized paper placed round a similar drum. Synchronization of transmitter and receiver was accomplished by an ingenious clutch mechanism, operated on the reception of pulses sent out with the transmitted photograph. With this relatively simple machine, photographs, weather maps, forecasts and drawings were transmitted, all of a quite tolerable quality considering the state of the art at the time. However, after a short time this service ceased, in fact, it never really caught on. Perhaps in the late 1920's the economic state of the time was against it, or perhaps it was just one of those things which the public, on the whole, did not want. Anyhow, within less than a decade, high definition television was available, at least to a limited section of the public in the London area, and the Fultograph was never revived. The reason for the existence of one of these machines at our Research Station can be traced back to an attempt made by the then superintendent, Watson-Watt, who wished to use the facility for investigating interference caused by lightning flashes. Some half-dozen or so were placed at strategic points throughout the country, the BBC transmitted a reference grid at a given time and then, when all the pictures were collected, it was possible, using the reference grid, to see which stations had received a particular atmospheric.

When this experiment came to an end the Fultographs were stored away and there they remained for many years. Surviving damp, and even flood, sufficient remained within the last few years for a working model of the receiver to be satisfactorily rebuilt. We have it with us still, the drum revolves, the stylus moves but alas, the signals that should have actuated it have ceased these forty years.

Those familiar with the work of the Radio and Space Research Station may well be puzzled about one omission; I have not referred to our most important piece of apparatus. This is a survivor from the 'thirties which we no longer possess; its importance was sufficient for it to warrant inclusion in the National collection of the Science Museum. It is the device used for the first radar experiment by the man who is our present Deputy Director, Mr. A. F. Wilkins. The story forms part of history on a bigger scale and, maybe, we can reserve the telling of it for some future date.

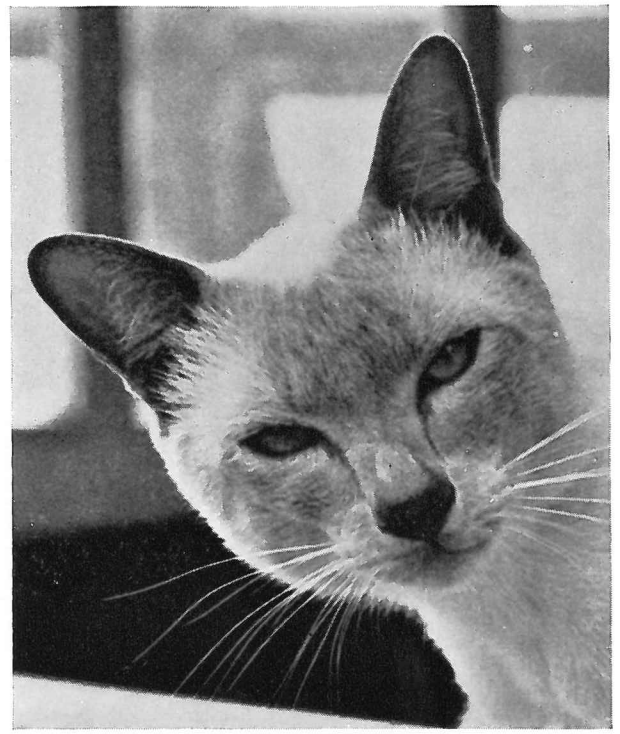


people and their pastimes

Cats

N. M. (and Marie) King

Rutherford High Energy Laboratory



This series is supposed to describe the *pastimes* of SRC personnel, but the activity as practised by Marshall King and more especially wife Marie, is more closely akin to slavery. Therefore in order that we may print as much as possible of the detail of the King family's subjection to their oriental captors, the usual (editor's) introduction will be reduced to a short overture, just to set the scene.

They were 'bitten' in 1963; when following the demise of their ordinary moggy they decided to go 'high hat' and *choose* a cat from a show. The outcome was the acquisition of a female Lilac Point Siamese who (subsequently) presented them with a fine litter of kittens, the first of the strain which bears the prefix TRISMEGISTOS, trade-mark of the King cattery. One of the litter became the best Lilac Point kitten in the 1964 Olympic National Cat Show. The next litter produced BELLEROPHON their resident Champion, then came CIRCE, now a USA Champion, then ENDYMION who became a premier (Neuter Champion) last year.

At this point it is appropriate to note that Marie King is not an SRC employee, but when you read the account of her daily life among the cats, you will readily understand that she just does not have the time for gainful employment. Here is an account of her life with her feline friends.

'All our cats are Lilac Pointed but Bellerophon's visitors may be Lilac, Seal, Chocolate, or Blue Pointed Siamese. Bellerophon's special house is not quite finished so he has a room to himself indoors. His visitors have another room containing a pen, through the wire of which they get acquainted.

If one of our females is 'calling', she has to be kept apart until we think it's a suitable time to have her mated. ('Calling' is what Siamese females do when in season—it consists of making a frightful racket, performing frantic contortions on the carpet, and investigating every possible mode of escape. The noise consists of deep howls, cries like a small child, and a species of bark.)

Kittens are all over the house during the day, and in the garden if the weather is good. We usually let them go to their new homes between 12 and 16 weeks, but often we have one up to six months.

If one of the females is in kitten she will have a room to herself (plus humans) at night: so it's not unusual to have cats in four different rooms for one reason or another. Each has to have a plastic tray of peat-moss and a water dish. Also, every cat, including each kitten, has its own food dish. All this means a lot of work washing and sterilising dishes; emptying, washing and disinfecting the dirt trays; and preparing food.

cat colony

1 Champion Stud (Champion Trismegistos Bellerophon)
2 Females (Trismegistos Filomela and Allegro Snow Maiden)
Usually, a litter of 5 Lilac Point Kittens (on average)
Frequently, 1 Female visiting Ch.T.Bellerophon.

daily routine

9 a.m.
Collect trays, empty, wash, rinse, refill with dry peat moss, and re-distribute as necessary.
Refill water dishes.
Heat up breakfasts – mixture of cooked beef (or rabbit, chicken, hare, etc.), egg yolk, meat jelly, a little 'Felix', a few drops of corn oil, a little vitamin supplement (Vionate), and some chopped parsley. Allow to cool and serve to adults.

With kittens in hall, place dishes on kitchen floor, open the door and deal with subsequent stampede, directing each kitten to its own dish. Supervise; removing fast eaters to hall as soon as they finish.
Wash and sterilise all feeding dishes.
During course of morning, let cats out for exercise, except calling females. Bellerophon has to be watched in case he strays – usually we try to let him out before breakfast as he will not then leave the garden.
Let the Champ. see his current girlfriend, and supervise mating. This can take up to 1½ hours if they are not already acquainted.
1 p.m.
Lunch for kittens and pregnant female(s). Heat up cooked white fish and tinned pilchards and serve individually as for breakfast.
Wash and sterilise dishes.
Deal with dirt trays as required.
Spend time talking to Bellerophon, and his visitor. (Siamese *need* human company.)
5 p.m.
Mix a meal for kittens. Meat jelly, finely chopped cooked meat and Farex. Serve as before.
Give raw egg yolk to pregnant female(s).
9—10 p.m.
Prepare adults' supper – chopped cooked rabbit, hare, or lean raw beef, serve at room temperature.
Mix kitten suppers – chopped rabbit or chicken, chicken jelly, Farex, Vionate, and raw egg yolk.
Change all dirt trays.
Arrange cats in their baskets and particular rooms for the night, retrieving crazy scampering kittens from all over the house.

Kittens traditionally sleep in the kitchen; (we have complete central heating). Siamese are very fond of their comfort, but are really no more delicate than ordinary cats.

grooming, showing

Cats and kittens are groomed about once a week. Lilac Pointed Siamese have white (Magnolia) coats, and only look their best when absolutely clean. Before shows, we may groom our cats several times within a week, and always the night before.

Complete grooming starts with a rub-down using a warm damp cloth soaked in a pure soap which is not injurious if licked up. While this is being done, dry bran is being heated up in the oven, this is rubbed into the coat 'the wrong way', and brushed out again until the desired degree of gloss is obtained.

During the season we attend about nine or ten shows, about half of which will be in London, and the remainder up to about 150 miles from home. In addition, we are often invited to exhibit Bellerophon and last year he appeared in this capacity at the Cats of the Year exhibition at Eastbourne.

Show preparations include washing all white show blankets, hot water bottle covers and so on. Equipment such as white dirt trays, water dishes, food dishes, etc., is washed and packed in a suitcase, along with TCP sprays and cotton wool for disinfecting cages etc. When Bellerophon goes on exhibition, (as distinct from competition), his pen decorations have to be washed and ironed: these consist of silk and velvet curtains and cushions in two shades of blue. His five championship certificates, rosettes, and silver trophies also go along.

On the day of the show, we are generally up at 4 a.m. The cats are attended to as usual, except that those to be shown do not have breakfast until they arrive at the show hall. If the circumstances are not too complicated, we generally ask a friend to look after the resident cats and to talk to them from time to time – otherwise Marshall drives to the show alone, and I stay at home: this usually happens about twice a year.

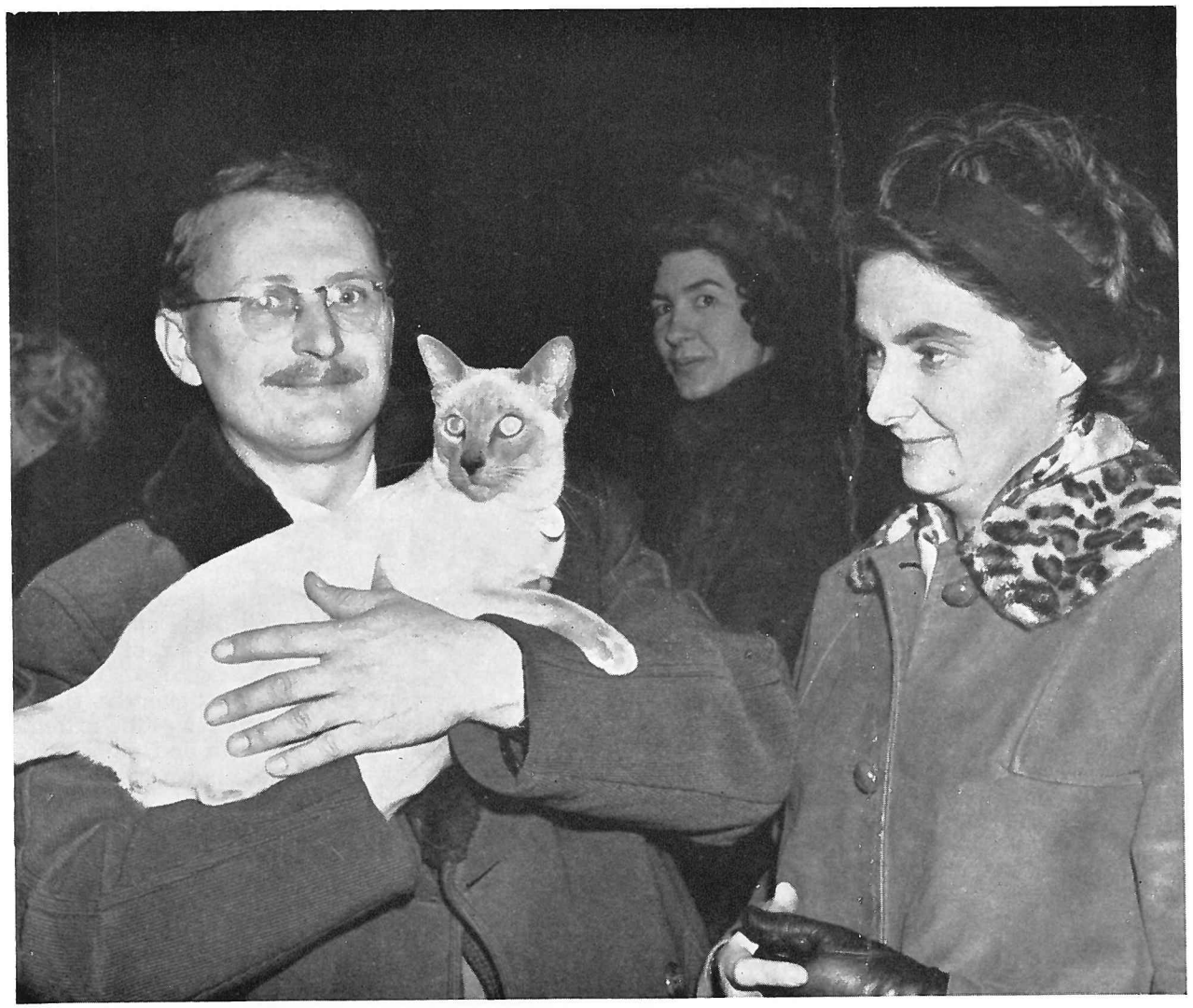
The cats prefer to ride loose in the car. The older ones are experienced travellers, and like to ride draped around Marshall's shoulders as he drives. Kittens sometimes take up to an hour to get used to the car, but by that time they are content to lie in my lap or on the back window sill.

office work

There is a terrific amount of correspondence on kittens and breeding, writing pedigree forms, filling in registration and transfer forms, keeping stud and kitten records, entering for shows, advertising kittens, and so on. We keep in touch with a remarkable number of the people who have bought Trismegistos kittens, and the telephone is kept busy. Marshall is on the committee of the Lilac Point Siamese Cat Society, and represents the club on the Governing Council of the Cat Fancy, and the Joint Siamese Advisory Committee: this means more correspondence for him. He is also interested in the genetics of domestic cats, and gets a lot of amusement out of studying and working out probabilities of various matings.

finance

People always ask about this. We keep records, and find that cat breeding is definitely a hobby; it costs us about £100 to £125 per annum – not counting the £150 we have spent on Bellerophon's house. Kittens sell at about twelve guineas each, although a really good Best-in-Show prospect may bring about £20. Food, car expenses, inoculation fees, equipment, disinfectant and peat moss are the greatest expenses. Even with first-class prizewinners, show entry fees are only just covered by the prizes. Stud fees at five guineas a time supplement the economy, but as we live rather remote from London, Bellerophon doesn't get as many visitors as a Champion otherwise would.'



ARISTOCAT

Ch. T. Bellerophon, wide eyed and alert as all good show-cats should be, is just about to be put into his show cage.

editor's note

We have now described the hobbies (or pastimes) of three members of staff and, besides this 'cat' article, we have been introduced to the intricacies of lute making and to the fascination of rock plant cultivation. In the next issue, J. C. Baldwin of the Atlas Computer Laboratory will describe his hobby of bellringing, which has taken him to many churches throughout the country.

There must be a wide variety of hobbies (printable ones) pursued by members, and the inclusion of Culham now adds another thirty prospects. We would like to hear about any unusual spare time activity, so if you have a hobby which you think is worth publicising, then write or telephone me at Room 1517, State House. ext. 255.

newsfront

'This Time It's Final'

It is not the policy of Quest to print 'hatches, matches and despatches', but the retirement of Charlie Osborn (68 years) from the Rutherford Laboratory, is rather different. He has worked for SRC for only three years, but such is the character of the man, that when he left on Friday, August 23, he was presented with a portable electric drill, a wallet and an illuminated scroll, by Mr. G. N. Venn, the Head of the Nimrod Engineering Department.

Charlie's working life began in the fateful year of 1914, when, at 14 years of age, he volunteered to do messenger work at the coastguard lookout stations in Cornwall until such time as his application for apprenticeship in the boilermaking works of the GWR at Swindon came through.

He has a wonderful memory for names and in laconic fashion recalled how he was sent from the coastguard station at Poldu to Mullion at night and via the hazardous cliff path, to collect the key of the code safe which the off-duty Petty Officer had taken home with him. On another occasion he recalls the stern admonition of the Station Commander who instructed him that 'in the event of a skirmish' he was to take the key and unlock the safe, take the code books and consign them to the boiler fire.

The GWR apprenticeship terminated Charlie's service as a coast guard messenger and he served his five years, plus a further two in the Carriage and Wagon Department. He was then covenanted to work for the Indian Railways for a period of five years. In Lahore, and eventually Rawalpindi, he was, in turn, Chargehand, Assistant Foreman and Boiler Inspector. He lived a very comfortable middle class life with a large bungalow and servants and has a fund of intriguing stories to tell. However, he decided not to return to India at the end of his contract and left the railways to become the Wantage area District Manager for the well known firm of J. Bibby and Sons of Liverpool. He stayed with the firm until retirement No. 1 at 60, but within the year, he was back at work again, this time as a Storeman with the American contingent at RAF Wellford. With the run down of the American overseas bases in 1964 he was once again retired and a year later, at the age of 65, he joined the Rutherford Laboratory as a Storeman.

Charlie has a son in Canada, a daughter in East Africa and another daughter in Sussex, and he says he is now prepared to acknowledge Anno Domini and settle in Sussex with his daughter and to follow his hobbies of stamp collecting and gardening.

Now that the Astrophysics group at Culham is to form part of SRC, we welcome another local correspondent to the editorial board of Quest.

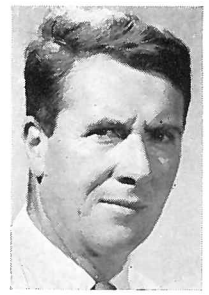
W. M. Burton is a Senior Scientific Officer engaged in spectrographic studies of the extreme ultraviolet spectrum of the sun and other stars, carried out by flying special optical instrumentation in stabilised Skylark rockets.

Prior to moving to Culham in 1964, Bill Burton worked at AERE Harwell on atmospheric radiochemistry, and plasma spectroscopy in the controlled thermonuclear fusion project.

four special merit awards for SRC

Four special merit promotions have recently been announced involving scientists in four establishments. The recipients of the awards are in widely differing disciplines, but it is unusual for a Department to receive four such awards.

The award is made at PSO level to research scientists of exceptional quality, and because it does not involve additional administrative duties, the promotion does not interfere with the individual's research work.

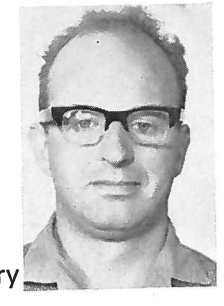


Dr. A. O. L. Atkin
Atlas Computer Laboratory

Dr. Atkin has been working over the last four years on congruence properties of the coefficients of modular forms, on congruence subgroups of the classical modular group. More recently he has been working in collaboration with HPF Swinnerton-Dyer at Cambridge on non-congruence subgroups of the modular group, which turn out to have remarkable p-adic properties. Many of the discoveries involved would not have been possible without the use of computers.

Dr. J. W. King
Radio and Space Research Station

Dr. King's research is concerned with the characteristics of the ionosphere, particularly at heights above 300 km, as determined by data obtained with so-called 'topside' sounding satellites in an international programme. His studies have demonstrated the important influence which global air winds, caused by pressure gradients in the neutral atmosphere, have on the ionosphere and he has thus been able to explain significant peculiarities of ionospheric behaviour observed over a number of years.

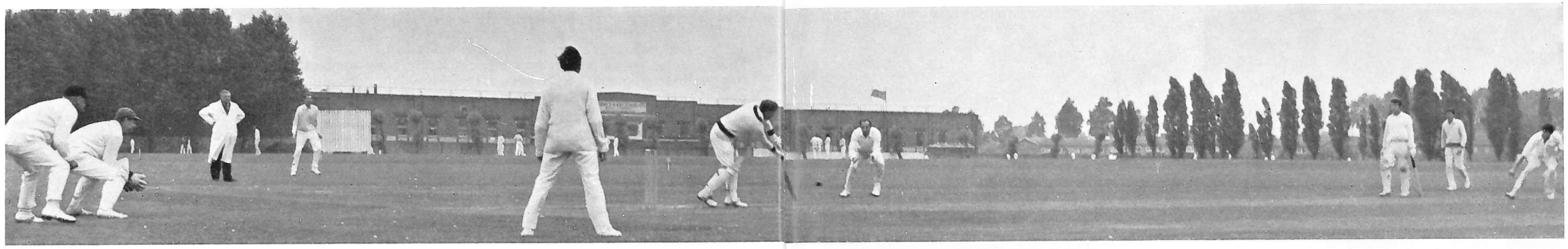


Dr. N. H. Lipman
Rutherford High Energy Laboratory

Dr. Lipman leads a team of physicists engaged in research on elementary particles using the 7 GeV proton synchrotron Nimrod at the Rutherford Laboratory. His present experiment is to determine the polarization of protons from the decay of the Sigma particle, and is designed to test one of the selection rules believed to apply to 'weak' interactions. He holds a joint appointment with the University of Sussex, as a part-time Reader, where he lectures on elementary particle physics to undergraduate and postgraduate students.

Dr. D. Lynden-Bell
Royal Greenwich Observatory

Dr. Lynden-Bell is currently working on the evolution of galaxies from studies of their formation and dynamical evolution. His current work concerns the theory of statistical mechanics of encounterless systems of stars which have yet to achieve a steady configuration, and the dynamical stability of galaxies.



The first SRC Sports Day did not attract favourable weather and in consequence, the attendance figures were not as good as they might have been. Conditions were not very comfortable for the competitors, but the standards were high and the honours fairly evenly distributed among the competing establishments. We are indebted to Harry Cook and Barry Briscoe for the report and to Robin Butler of RSRS for the photographs.

This, the first of what SRC Sports Association hopes will be many Sports Days, was essentially an exploratory occasion, and was arranged to provide competitive sport for as many of the Council's staff as could attend. It was decided that competitions would be run for cricket, tennis and bowls, the exact nature of the tournaments being left to the organisers to determine in the light of entries received. Both cricket and tennis enjoyed good support but unfortunately the entries for the bowls competition fell away and this had to be cancelled. It is hoped that it can be revived next year and with longer notice many bowlers will be able to participate.

The cricket competition was run on a 'knock-out' basis, with each side batting for a maximum 15 overs and with restriction on the number of overs any player could bowl. Five entries were received, with results as follows:

1st Round RGO (35 runs for 0 wickets in 7 overs) beat RSRS (34 runs for 10 wickets in 10.4 overs)
Semi-finals RHEL (60 runs for 7 wickets in 15 overs) beat RGO (54 runs for 8 wickets in 15 overs)

LO (75 runs for 1 wicket in 10 overs) beat Atlas (74 runs for 4 wickets in 15 overs)

Final RHEL (45 runs for 6 wickets in 13.3 overs) beat LO (44 runs for 9 wickets in 15 overs)
Supplementary Round Atlas (97 runs for 9 wickets in 15 overs) beat RSRS (64 runs for 6 wickets in 15 overs).

The supplementary round was arranged to give all participating teams at least two games during the day. The only 'seeding' resorted to was to put RHEL and Atlas in separate halves of the competition to ensure they played against teams from less familiar establishments.

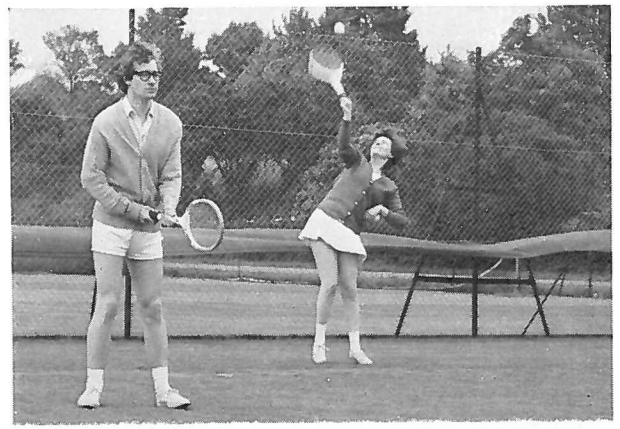
Two tennis tournaments emerged from the entries received, one for men's doubles and the other for mixed doubles, and to give all players plenty of tennis within the restricted time available both were run on American Tournament lines. Each competition was divided into two, with section winners playing off to decide the overall competition winners. Again, the only seeding adopted was to apportion teams from each establishment as equally as possible in either half of the draw to enable them to mix with other teams as far as possible. Despite a troublesome wind and some initial doubt as to whether the grass courts were ready, both competitions were played off as planned, with the result that in an all-RSRS final in the Mixed Doubles competition, Mr. and Mrs. A. C. Gordon-Smith beat Mr. R. Fitchen and Mrs. F. Horner 6–1, having won their sections with totals of 36 games and 30 games respectively.

Dr. G. A. Wilkins and Mr. R. J. Dickens (RGO) won their half of the Men's Doubles with a total of 24 games and in the final beat Messrs. Butt and Beckwith (RHEL) (22 games) by the score 6–3, thereby ensuring that on this first occasion the awards were distributed around the establishment.

Cups were presented to the winners by Mr. Ray Edmonds, Chairman of the SRC Sports and Social Association, who interrupted his holiday to come along.

The Sports Social Committee is very grateful to him for doing so and also wishes to thank the staff who helped to run the competitions and so made sure that they went off smoothly, and the London Office Club for giving a magnificent cup as prize for the cricket competition. The Committee hopes that all who took part enjoyed themselves and will come again in future years bringing more colleagues with them. They will welcome any suggestions to improve or broaden the scope of this occasion.

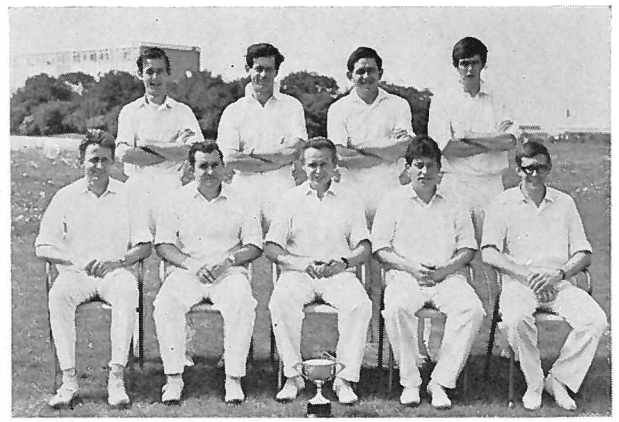
A dour, determined spectator and a quartet of scorers looking after the interests of RGO.



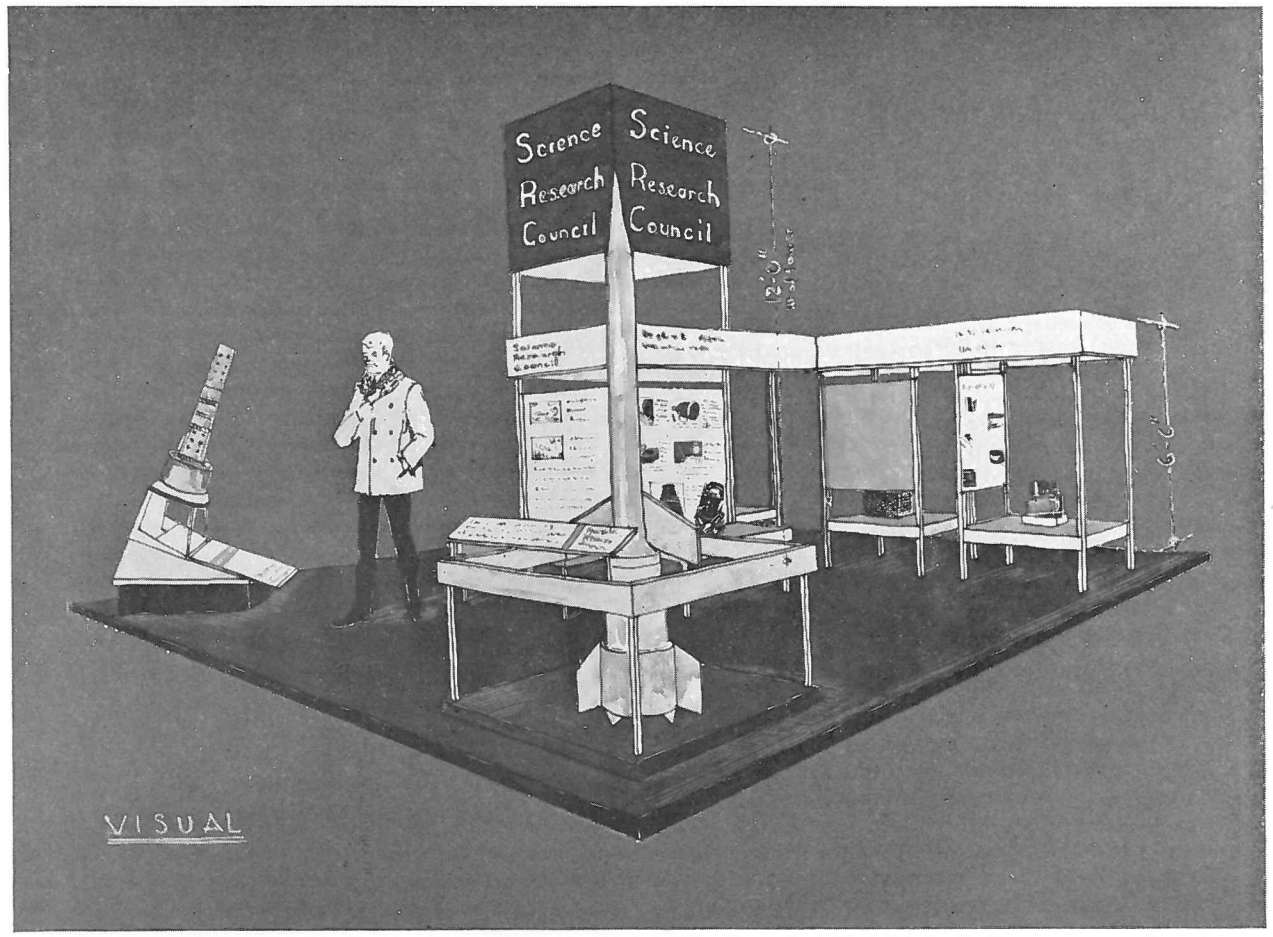
S. Lee and Miss J. Wall of London Office in play in an early round of the mixed doubles. Note the windbreak which has been blown into a horizontal position!.

Ray Edmonds, Chairman of the Sports social committee presents the men's doubles cup to R. T. Dickens. His partner, G. A. Wilkins (foreground) has already changed into warmer clothing.

DOUBLES ALL ROUND
Mr. and Mrs. Gordon Smith (husband in hiding) and Dr. Wilkins and R. T. Dickens, all of RSRS, the mixed doubles and men's doubles winners respectively.



Just so that we could inject a ray of sunshine into an otherwise murky spread, the victorious Rutherford cricket team went home to sunny Berkshire to have their photograph taken. Unfortunately the whole team couldn't be present on the same day, two were on holiday.



Farnborough '68

The theme of the SRC stand was 'SRC and Space Research' and the exhibits illustrated the support given to the national and international space research programmes.

In the National Sounding Rocket section, and dominating the stand, was a Petrel rocket and alongside it a RSRS experiment designed to obtain information about high speed electrons from space.

Experiments flown in the Skylark rocket include one from Culham for solar physics study, and an attitude control unit developed by RAE and Elliott Automation was displayed to illustrate the degree of sophistication the Skylark rocket has now achieved.

The third vehicle used in the national programme is the Skua rocket and an experiment from University College, Wales was shown as a typical payload. This experiment will be used to further the study of radio absorption in the ionosphere.

ESRO II carried five British experiments and to represent this section, a combined UCL/ Leicester University experiment was displayed. This is designed to measure the x-ray emission from the sun.

In the NASA section, a Universities of Oxford and Reading experiment which will be flown in the Nimbus D satellite was shown. This is scheduled for launch some time in 1970. A synopsis of the results of experiments carried in Ariel III was displayed, together with a powered model of this first all-British satellite, which is still operating after more than a year in orbit.

Installation of the first 'D' type ceramic vacuum chamber in a magnet at Daresbury. The individual ceramic sections can be seen making up the curved chamber with its metal end flanges.

Culham Laboratory
When the weather permits, the sheltered quadrangle adjacent to the canteen is popular for alfresco eating.

contributors

W. G. Griffen
'An SRC Astrophysics Research Unit at Culham Laboratory' *page 2*
Senior Experimental Officer, Stellar Group, ARU

J. B. Alexander
'Leopards, Landscapes and 'Royal' Telescopes' *page 6*
Senior Scientific Officer. At present on second tour of duty at the Cape, engaged upon photoelectric photometry.

R. H. Tucker
'Enquiries from the general public' *page 10*
Principal Scientific Officer. In charge of Meridian Department, RGO

J. A. Fox
'A Plain Man's Guide to Accelerator Static Power Supplies' *page 13*
Engineer 1, Rutherford Laboratory. Former power supply group leader at Daresbury and member of CERN 300 GeV study group.