
QUEST

QUEST

House Journal of the Science Research Council

VOL. 1 No. 1

JANUARY / MARCH

1968

editorial

Volume 1, No. 1: these are symbols of portent in the life of any journal and certainly not less for 'QUEST'.

Our choice of title has obvious connotation, but for a house journal such as this we have a particularly difficult "quest". We need to define our terms of reference and to discover how to satisfy the need for coherent communication between all who are employed within the Science Research Council.

We are making a modest start by appearing quarterly, guided by an editorial board consisting of one representative from each station. Each of these representatives is in close contact with the work of his station and so is able to appreciate its particular needs and to convey to the editorial office the kind of features and local news most likely to appeal to the other member stations.

The object of each issue will be to deal with matters of moment; topical items which reflect the pattern of life in SRC. There will also be longer term issues to consider, but the format of the journal is designed to carry features and news, technical and social which will help to bind the scattered elements of SRC into a cohesive unit.

This first issue appears too late to bid a personal goodbye to our first chairman who has now left to become Principal of Queen Mary College, London. We wish him every success and happiness in his new role and welcome our new chairman and our readers with the words of our Royal Charter: *To all whom these presents come, greeting!*

contents

chairman's message

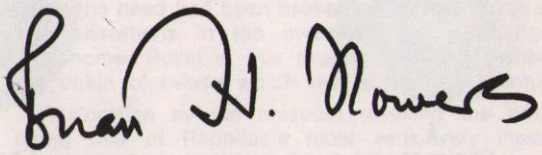
It was with great pleasure, and also excitement, that I accepted the Secretary of State's invitation to become Chairman of the Science Research Council. The multifarious components which together form the SRC have been assembled under the leadership of Sir Harry Melville, and already our organisation is widely recognised as a vital part of the scientific and technological life of the nation.

The SRC consists of an intimate partnership between its national laboratories, the universities, and the London Office, each with its own functions and interests certainly, and yet each impoverished in isolation from the others. We have to develop and strengthen this partnership.

With the help of the Council for Scientific Policy a broader picture of the growth and functions of civil science is beginning to emerge. At the same time, the economic health of the nation is not yet such as to sustain the rate of growth that would be necessary if we were to undertake all that we might wish. In present circumstances it is necessary to examine our priorities very carefully so that we do not spread our limited resources too thinly. There will inevitably be some disappointments. Nevertheless, apart from immediate difficulties arising from devaluation, we are for the first time assured of a growth rate much above the national average.

We must hope that good times are coming and we must prepare for them; indeed we should be able to contribute our share to bringing them about. There have been remarkable changes in scale and organisation of scientific and technological research in the past few years, even since the creation of the SRC. It would be foolish to suppose the situation will ever again be static for long. We must therefore be flexible if we are to benefit from future changes.

In my first few months of office I am hoping to meet as many of the staff of the SRC and of our Board and Committee members as possible. I am planning to visit all our laboratories and also hope to see some of the university groups. I have been greatly encouraged by the warmth of your welcome, and I have the utmost confidence in the organisation which it is now my honour to serve.



The origins & objectives of the SRC

The Science and Technology Act of 1965 made provision for the establishment of the Science Research Council to "carry out, encourage and support research and development in science and technology; to provide and operate equipment for common use .... by universities, technical colleges or other institutions or persons engaged in research; to make grants for post-graduate instruction .... and to disseminate knowledge concerning science and technology".

It was formed as part of the reorganised arrangements for Government support of civil scientific research and it is one of a group of autonomous agencies responsible to the Secretary of State, who allocates their resources on the advice of the Council for Scientific Policy.

Responsibilities

The SRC has taken over the responsibilities of DSIR for giving research grants, for the support of applied as well as pure science, to universities and post-graduate training awards. It is also responsible for the operation of the former National Institute for Research in Nuclear Science, The Royal Greenwich Observatory, The Royal Observatory at Edinburgh, the Radio and Space Research Station; for supervising the Scientific Space Research Programme and the United Kingdom's participation in international research bodies such as the European Organisation for Nuclear Research and the European Space Research Organisation.

These responsibilities, particularly those for giving research grants and post-graduate training awards entail close contacts not only with the other four Research Councils, but also with the Royal Society, the University Grants Committee and the Ministry of Technology.

Organisation

Three specialist Boards, each with its own division, assist the Council and have particular responsibility for 1. Astronomy Space and Radio: 2. Nuclear Physics: 3. University Science and Technology; the particular sphere of responsibility within these areas being shown in the diagram.

SCIENCE RESEARCH COUNCIL

Chairman
Professor B.H. Flowers, F.R.S.

University Science and Technology Board

Chairman
Professor Sir Ewart Jones, F.R.S.

Committees for:–
- Pure Science
- Applied Science
- Research Grants & Postgraduate Awards in Universities & Technical Colleges
- Atlas Computer Laboratory
- NATO Fellowships

Nuclear Physics Board

Chairman
Professor C.F. Powell, F.R.S.

- Rutherford Laboratory
- Daresbury Laboratory
- Grants to Universities
- CERN

Astronomy Space & Radio Board

Chairman
Professor Sir Bernard Lovell, O.B.E., F.R.S.

- Royal Greenwich Observatory
- Cape of Good Hope Observatory
- Royal Edinburgh Observatory
- Radio & Space Research Station
- Grants to Universities
- ESRO
- UK/USA/NASA programme

The much maligned bust of Sir Isaac Newton

by Phil Laurie

The earliest work of the great French sculptor Louis Francois Roubilac (1705-1762), long thought to be lost, was recently discovered among the possessions of the Royal Greenwich Observatory. It is the terracotta model for the marble bust of Sir Isaac Newton (1642-1727) which was carved for the Royal Society before 1738. The circumstances which led to its disappearance and eventual re-discovery make quite interesting reading.

Under the terms of the Public Records Act of 1958, the archives of the Royal Greenwich Observatory, dating from 1675, were scheduled as documents of national importance; a distinction which eventually entailed their inspection for listing. During the examination of early inventories, there became apparent one particular item of interest; namely a terracotta bust of Newton by Roubilac bequeathed by a Dr. John Belchier, F.R.S. (1706-1785), an eminent physician, 'in order to have it placed at the Observatory in Greenwich Park'.

Whilst in the keeping of the Astronomer Royal, the bequest was described in the documents from 1786 in identical terms, until the following significant entries :—

c. 1829	Great Room 11	A bust of Sir Isaac Newton in Terra Cotta, by Roubilac
1831	Great Room 16	A bust of Sir Isaac Newton
1840	Octagon Room 112 (the re-named Great Room)	A plaster bust of Sir Isaac Newton (G.R.16)

This last reference is from an inventory drawn up in great detail by G. B. Airy, the Astronomer Royal himself, who from his appointment in 1835 had obviously considered the bust to be made of plaster!

Henceforth, this important sculpture was grouped with the plaster casts and marble busts of celebrities which the Observatory had accumulated over the years —in spite of at least one examination by an eminent authority who was searching for the missing terracotta model!

From the turn of the present century the bust stood on an imitation marble pedestal in a prominent (and vulnerable) position in the main building of the Observatory. Throughout the 1939-45 war it was thoughtfully provided with, in addition to suitable graphic embellishments, a steel helmet—partly out of affection and partly because of its suitability as an emergency hat rack, Greenwich being a much-bombed locality!

Thus relegated to the plaster casts, the bust was lost to sight during the removal of the Royal Observatory to Herstmonceux and it was not until 1961 that its true significance was realised. After a brief period of intense activity, it was resurrected and taken to the British Museum for expert examination. The investigation proved the identity beyond doubt and it was also discovered that at some time between 1829 and 1835, the head had been broken off and badly repaired! The alterations in the inventory and a change of Astronomer Royal at this crucial time had completed the chain of events which led to the final confusion!

Restoration by the Museum revealed the bust as being one of Roubilac's most sensitively modelled works, made, acording to Dr. Belchier, 'under the eyes of Mr. Conduit' (Newton's nephew) and acknowledged by contemporaries to be one of the best likenesses of the great scientist.

With the Astronomer Royal's permission, the bust was exhibited at the British Museum for a year before being returned to Herstmonceux and it is now on display in the Castle, restored to its rightful status as an important work of art.

Opening of Daresbury Nuclear Physics Laboratory

There were doubts, right up to the last minute, whether Mr. Wilson, so pre-occupied with urgent affairs of state, would be able to keep his appointment to open formally the Daresbury Nuclear Physics Laboratory. However, as most of you will now know, he did arrive to perform the ceremony and to operate the mechanism which accelerated the NINA beam to full energy.

In his speech, the Prime Minister paid tribute to the intellectual significance of the occasion. He said that high energy physics was aimed directly at the most fundamental questions concerning the basic laws which govern the structure of matter and the universe.

"British scientists have been pre-eminent over many years in this particular branch of science and today's opening of Daresbury is yet another important landmark in the great British contribution."

He paid tribute to the outstanding contributions made by British Nobel prizewinners, all of whom were present—Sir James Chadwick who discovered the neutron, Sir John Cockcroft, Professor P. M. S. Blackett, president of the Royal Society and Professor Cecil Powell, present Chairman of the SRC Nuclear Physics Board. He welcomed the distinguished guests from many parts of the world includng Professor Alikhan'yan from Russia, Professor R. Wilson from Harvard and Dr. G. W. Funke, the President of CERN.

Professor Merrison, the Director of the laboratory, in thanking the Prime Minister for declaring it open, referred to the fact

The Prime Minister presses the button to start NINA and a moment later electrons were accelerated around the synchrotron. On Mr. Wilson's right is Professor A. Merrison. On his left are Sir Harry Melville, Mr. Goronwy Roberts, M.P., and Professor C.F. Powell. (left).

Professor Merrison conducted the Prime Minister and Sir Harry Melville on a tour of NINA. Behind them is one of the forty magnets that make up the synchrotron. (opposite).

The following day was an Open Day and many visitors took advantage of the fine weather to enjoy the canal and the lawns in front of the restaurant. (below).

that laboratories like Daresbury, Rutherford and CERN "were really no more than extensions of the universities, the proper homes of intellectual power."

Daresbury is situated in the pleasant open countryside of Cheshire and very appropriately sited near the birthplace of Lewis Carroll. Carroll was perhaps lesser known as the Reverend Charles Dodgson, the Oxford mathematician.

The laboratory staff at present numbers about 400, including theoretical, experimental and applied physicists, as well as engineers, laboratory assistants, administrative and secretarial staff.

The 4 GeV electron synchrotron is being used by experimental groups from the universities of Glasgow, Liverpool, Manchester, Lancashire and Sheffield as well as the laboratory staff themselves.

The synchrotron consists of forty magnets in a ring of about 230ft. diameter. Electrons are injected into the ring at 40 MeV by a linear accelerator in such a way that they join the circulating beam at a small angle to minimise disturbance. Electrons travel around the synchotron in about three-quarters of a miscrosecond. A large R.F. triode amplifier supplies the power for accelerating the electron beam around the magnet ring.

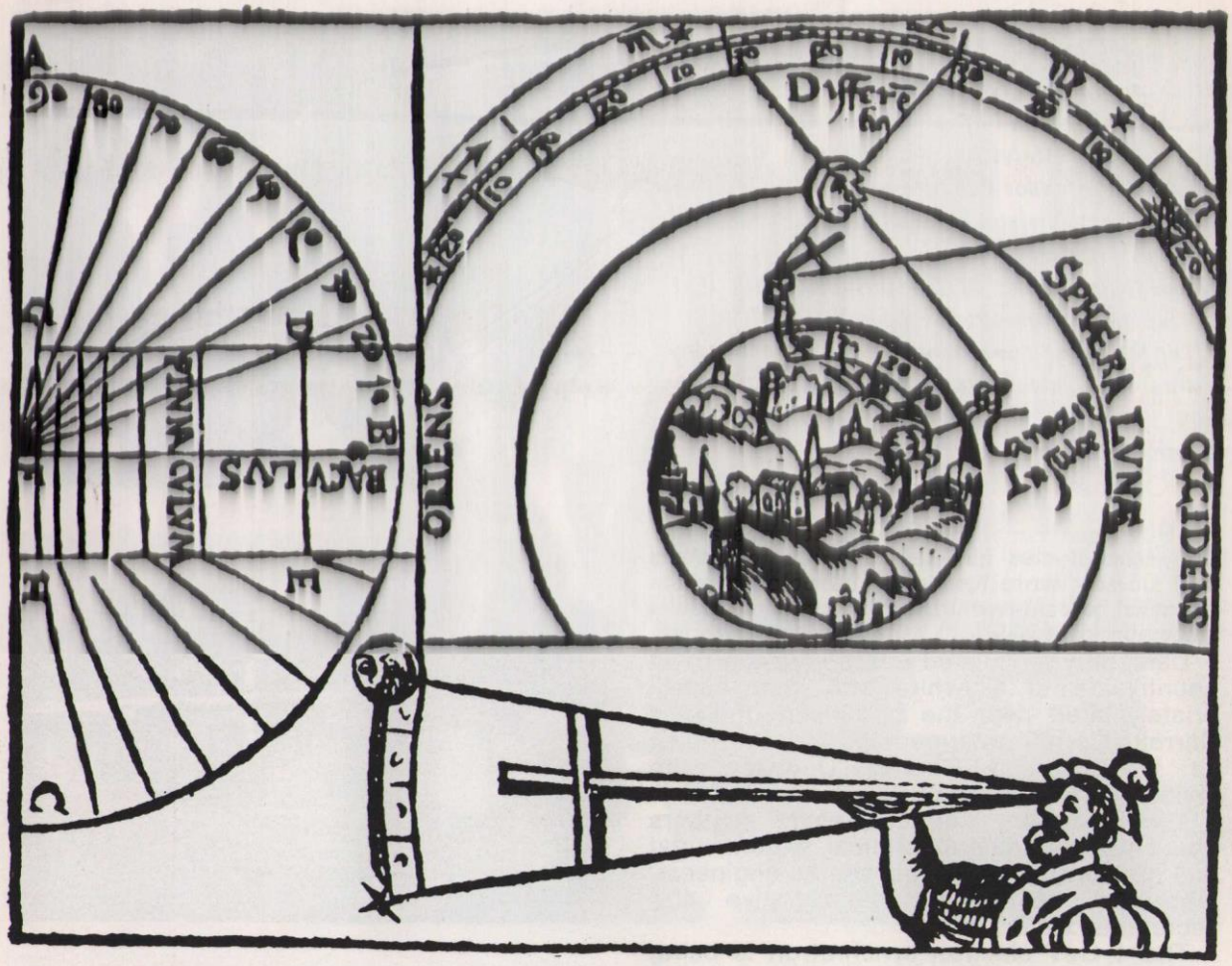
When the circulating beam has reached the required energy, it can be made to hit a target within the ring itself to produce a photon beam, or to pass tangentially out of the ring to produce an electron beam in an experimental area.

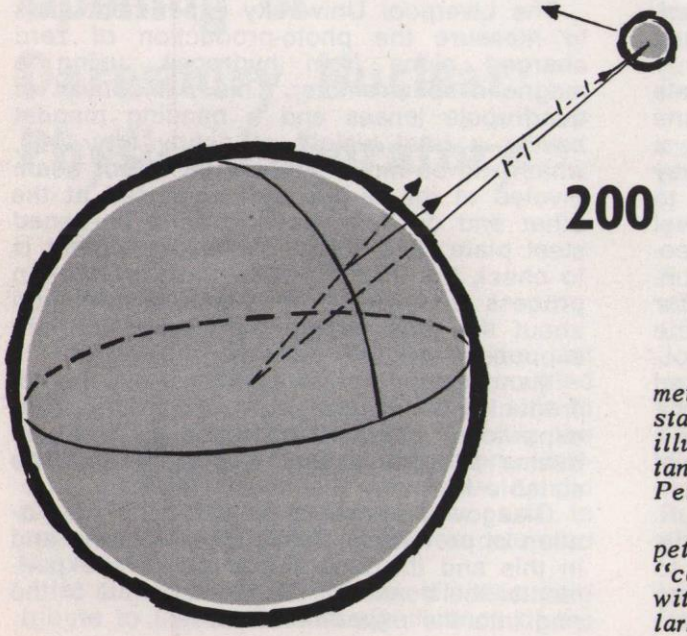
A brief glance at the programme initially scheduled for NINA will give substance to the Prime Minister's observation regarding fundamental questions concerning the basic laws of the universe.

The Liverpool University experiment aims to measure the photo-production of zero charged pions from hydrogen, using a magnetic spectrometer. This will consist of quadrupole lenses and a bending magnet having a total weight of nearly fifty tons, which will be mounted on a thirty-foot beam pivoted at the target and supported at the other end on balls running on a hardened steel plate. The object of the experiment is to check the theory of the photo-production process and hence to obtain information about the intermediate particles which are supposed to play a part.

Manchester is interested in the photo-production of neutral kaons and during the experiment the Group hopes to produce beams of high energy K°s which will be suitable for many other experiments.

Glasgow propose to measure the polarisation of protons in elastic e-p scattering and in this and the Manchester Group's experiments, the beam will be directed out of the ring into the experimental area.





200 Years of Guidance

by D. H. Sadler
Supt. H.M. Nautical Almanac Office.

As early as 1514, John Werner suggested the method of using the Moon's motion among the stars as a clock. The above diagram was the first illustration demonstrating the method of lunar distances. It was published in 1524 in Cosmographia Petri Apiam per Gemma Frisium.

The first issue of the "seaman's bible" trumpeted its publication with the promisory words: "contains everything essential to general Use... with many other useful and interesting Particulars". (see opposite page).

When the Science Research Council assumed responsibility for various establishments engaged in scientific research, it also took over H.M. Nautical Almanac as part of the Royal Greenwich Observatory.

1967 was the two hundredth anniversary of the first issue of the Nautical Almanac and Astronomical Ephemeris which first made possible the determination of longitude at sea.

In the seventeenth and eighteenth centuries, 'the discovery of the longitude at sea' became the greatest challenge to scientific research and invention. Without the means of determining longitude, ocean voyages could, and often did, mean privation, shipwreck and death. Kings, Heads of State and Parliaments offered huge prizes for a solution. In an act of parliament dated 1714, the British government offered the enormous award of £20,000 for a practical method of determining longitude at sea to within half a degree (about 30 miles).

It was early realised that due to the rotation of the earth, time and longitude were essentially the same. Local time can be readily obtained from observations of the sun and stars, particularly local noon, so that the longitude can be found at once if the equivalent of Greenwich Mean Time is known.

Two differing but general principles were invoked in the search for a practical method. The first, that of constructing a practical timekeeper capable of accuracies of one or two minutes deviation within a voyage time of several months. This was thought to be impossible at the time, yet in 1762 John Harrison, a Yorkshire carpenter, did just that! After an amazing sequence of official doubts, investigations, parliamentary debates and royal intervention, Harrison received most of the promised award.

The second method, suggested early in the sixteenth century by John Werner and possibly earlier by Regiomontanus (1474), was to use the moon as a clock, reading it by measuring its distance from the sun or bright stars in the zodiacal belt. This second method known as the method of lunar distances, gave rise nearly three hundred years later to The Nautical Almanac and to the absolute determination of longitude without recourse to the continued accurate operation of a chronometer. The method was used at sea for well over a hundred years and continued to be used as a check on chronometers until the first decade of the twentieth century.

The moon orbits the earth relative to the stars in an average period of $27\frac{1}{3}$ days and therefore moves about 0.5° in one minute of time. Thus if the distance between the moon and a star can be predicted in terms of a universal time scale, and if it can be measured to a few tenths of a minute of arc, the time of the observation—and thus the longitude of the observer—can be calculated to about one minute or 15′. Adequate answers to these "ifs" required no less than the theory of gravitation; the foundation in 1675 of the Royal Observatory at Greenwich to furnish observations of the moon and stars; the development of successively more accurate theories of the motion of the moon (culminating in Mayer's theory of 1761); the painstaking preparation of star catalogues; and the invention of the reflecting quadrant (rapidly becoming a sextant) by Hadley in 1731. Yet it still required a man of extreme ability, energy and competence to combine these developments into a practical method. The man who achieved this prodigious feat was Nevil Maskelyne, who became the fifth Astronomer Royal in 1765.

Maskelyne seized upon the key limitation, namely the theory of the moon's rotation, and made a long series of comparisons of his own observations with the theoretical development by Tobias Mayer (based upon Euler's method), which gave positions of the moon to within about 1′. He practised the method of lunar distances during his voyage

PREFACE.

"THE Commiſſioners of Longitude, in purſuance of the Powers veſted in them by a late Act of Parliament, preſent the Publick with the NAUTICAL ALMANAC and ASTRONOMICAL EPHEMERIS for the Year 1767, to be continued annually; a Work which muſt greatly contribute to the Improvement of Aſtronomy, Geography, and Navigation. This EPHEMERIS contains every Thing eſſential to general Uſe that is to be found in any Ephemeris hitherto publiſhed, with many other uſeful and intereſting Particulars never yet offered to the Publick in any Work of this Kind. The Tables of the Moon had been brought by the late Profeſſor MAYER of Gottingen to a ſufficient Exactneſs to determine the Longitude at Sea, within a Degree, as appeared by the Trials of ſeveral Perſons who made Uſe of them. The Difficulty and Length of the neceſſary Calculations ſeemed the only Obſtacles to hinder them from becoming of general Uſe: To remove which this EPHEMERIS was made; the Mariner being hereby relieved from the Neceſſity of calculating the Moon's Place from the Tables, and afterwards computing the Diſtance to Seconds by Logarithms, which are the principal and only very delicate Part of the Calculus; ſo that the finding the Longitude by the Help of the EPHEMERIS is now in a Manner reduced to the Computation of the Time, an Operation equal to that of an Azimuth, and the Correction of the Diſtance on account of Refraction and Parallax, which is alſo rendered very eaſy by either of the Two Methods invented by Mr. LYONS and Mr. DUNTHORNE, and publiſhed among the Tables requiſite to be uſed with the EPHEMERIS.

"By Deſire of the Commiſſioners of Longitude I drew up the Explanation and Uſe of the Articles

to St. Helena in 1761 to observe the transit of Venus over the sun's disc, and proved that it was practicable—at least for an accomplished astronomer.

On February 9th, 1765 he sought the approval of the Board of Longitude, which resolved '. . . that application should be made to Parliament . . . for power to give a reward to persons to compile a Nautical Ephemeris and for authority to print the same'. The application was duly approved and the first edition of The Nautical Almanac and Astronomical Ephemeris was prepared for the year 1766 and published in 1767.

The almanac essentially predicted the geocentric lunar distances and listed them to one inch for every three hours of apparent time on the meridian of Greenwich. In order to do so, Maskelyne calculated the position of the moon from the manuscript tables which were prepared by Mayer on the basis of his own theory and Maskelyne's observations.

There still remained the reduction or clearing of the observed topocentric lunar distance before it could be compared with the geocentric values tabulated in the Alamanac. Corrections had to be applied for parallax and refraction and even today, the calculation is formidable. It is the mark of Maskelyn's genius that he made the method possible for the early seamen.

At the same time as the almanac, Maskelyne published his Tables Requisite to be used with the Astronomical and Nautical Ephemeris, in which was given full instructions, tables and illustrations for the clearing of lunar distances. It is said that 10,000 copies were sold immediately upon publication!

Maskelyne planned and supervised the calculation of the almanac; he arranged the work so that all calculations were made under his direction by two Computers working independently, the results were then collated by a Comparer. All computers and comparers worked in their own homes and exchanged calculations by post!

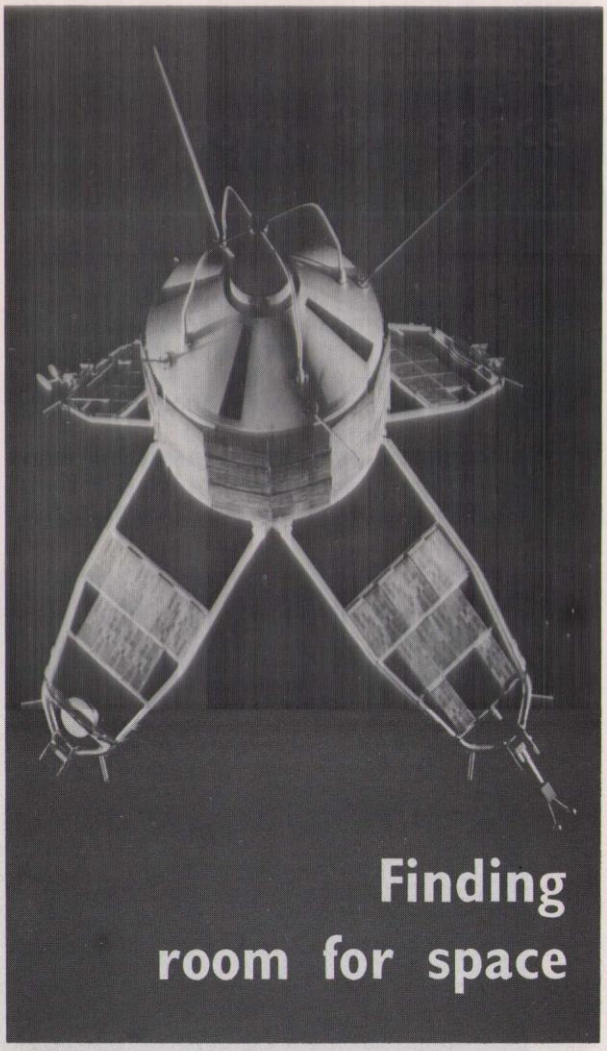
Under Maskelyn'e keen personal interest, the scheme worked very well, but after his death in 1811 it gradually deteriorated, until it lost its reputation for accuracy and fell into disrepute. During a contemporary debate in Parliament, one Admiral Smythe recounted the following tale: 'On one of the rare occasions of amicability between the two countries, a British warship met a Spanish warship in the Bay of Biscay and the British admiral dined his counterpart in a manner quite proper for a gentleman. Afterwards he was embarrassed by being presented with a gift of Spanish finery. With his honour at stake, the British admiral cast about him for a suitably elegant mutual gesture—and came up with one of his most valued possessions—his Nautical Almanac. Thus deprived of his precious almanac, he was forced to resort to dead reckoning on his return journey to Plymouth, but he arrived at the home port quite safely. The Spanish Admiral . . . ? ? . . . he was never heard of again!'

The Almanac became the subject of great controversy and at one time was described as 'a bye-word amongst the literati of Europe'. Reforms were recommended in a parliamentary debate in 1818 and again in 1828 when the Nautical Almanac Act was adopted. Thomas Young the distinguished discoverer of the wave theory of light was appointed "Superintendent of the Nautical Almanac" in 1818, but he did not introduce the reforms, although he did restore the accuracy.

Young died in 1829 and the responsibility for the Almanac temporarily reverted to the then Astronomer Royal, John Pond. The Admiralty, not for the last time, consulted the Royal Astronomical Society as to the revision of the Almanac. The Society very quickly presented a comprehensive report covering every aspect of the proposed revision, which was just as promptly accepted in its entirety! It was adopted in the Almanac for 1834 and shortly afterwards Lieutenant W. S. Stratford, R.N., Secretary of the Society, was appointed Superintendent.

The remaining story can be quickly told: the first part of the almanac which itself gradually became an astronomical ephemeris, was issued separately "for the convenience of sailors" as from 1896, and a completely separate edition, entitled The Nautical Almanac, Abridged for the Use of Seamen was introduced in 1914. Greenwich Mean Time was generally available, so that more direct methods of astronomical navigation were possible; lunar distances were relegated to the explanation, for use in emergency only. After a series of changes, the astronomical and navigational ephemerides have been given the appropriate parts of the original title, The Astronomical Ephemeris and The Nautical Almanac. The Air Almanac was introduced in 1937.

From 1831 to 1937, the Nautical Almanac Office was a separate entity under the Admiralty and quite independent of the Astronomer Royal. It became a separate branch of the Royal Observatory in 1937, but did not physically join it until the move to Herstmonceux in 1949.



Finding room for space

The year preceding this first issue of Quest has been the most significant and fruitful for the space science interests of the SRC since the inauguration of Council.

The very considerable success of ARIEL III, our first all-British satellite (given the imprimatur of congratulations from the Prime Minister to the Secretary of State for Education and Science), its continued first-class performance; the Rome meeting of ministers concerned with European space research; the appointment of our colleague Professor Herman Bondi, former Chairman of the Astronomy Policy and Grants Committee, as the new Director-General of ESRO; the opening of the Mullard Space Science Laboratory; and the successful trials of the Petrel rocket, are the evidence.

To begin at the begining however: for those readers who are unaware of the SRC's space interests, let us draw a brief diagram. They cover research in university departments (by far the largest being Professor Robert Boyd's group at the Mullard Space Science Laboratory), the development and launching of rockets and their payloads (such as Skylark and Petrel), work in our own establishments such as the Radio and Space Research Station and the space section of the Royal Observatory Edinburgh, co-operation in satellite launchings with the United States National Aeronautics and Space Administration, and finally but not the least significantly, participation in the European Space Research Organisation (ESRO).

Space research in Britain goes back more than ten years, with the civil scientific space research programme coming under the direction of the SRC (Astronomy, Space and Radio division) on the formation of Council. Since then, this busy division, under Mr. J. F. Hosie as Director), has been consolidating all the interests which were brought together, and preparing the next stages of development.

Let us look back at the programme in a little more detail: UK-US co-operation is a good example, for it is out of that programme that Ariel III was born.

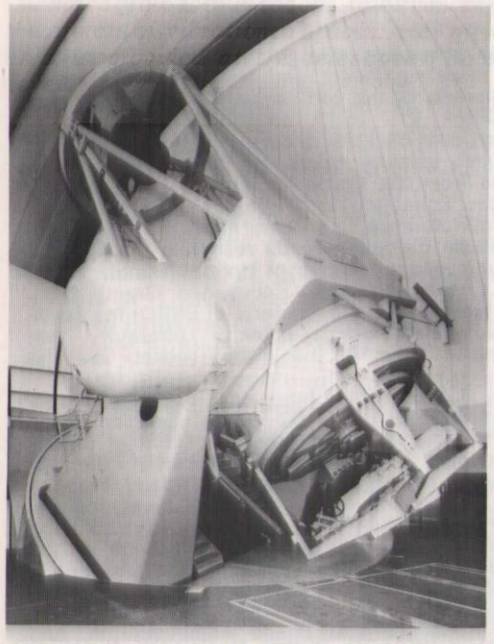
The origins of the programme go back to 1959 when NASA offered assistance to the international scientific community at that year's Committee on Space Research meeting (COSPAR). Britain took advantage of the

Continued on page 12

Ariel III was the first satellite to be entirely designed and built in Britain. British scientists were responsible for the complete spacecraft and also for the ground check-out and handling equipment.

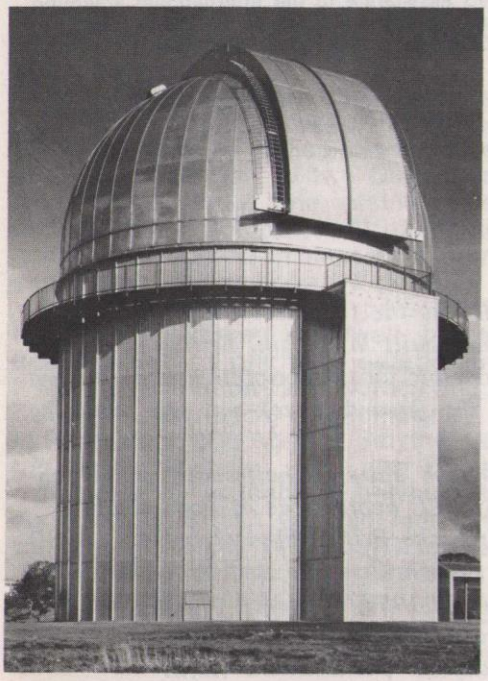
The photograph shows a half-scale model constructed by GEC apprentices at Portsmouth.

Apart from the British Skylark rockets, ESRO uses the French Centaure and Arcas sounding rockets. In May 1966, in Greece, the organisation launched a Centaure during the eclipse of the sun, to study the phenomenon. (left).



A particularly good shot of the telescope showing it pivoting through the floor and with an observer seated in the Cassegrain Chair.

The massive domed building is entirely insulated from the telescope to eliminate the effects of vibration. A public viewing area is provided at the telescope floor level.



The Queen inaugurates Europe's largest telescope

At a ceremony at Herstmonceux on December 1st, Her Majesty the Queen formally declared open the 98-inch Isaac Newton telescope of the Science Research Council.

Five thousand times more powerful than Newton's original telescope which he built in 1668, this instrument makes possible the

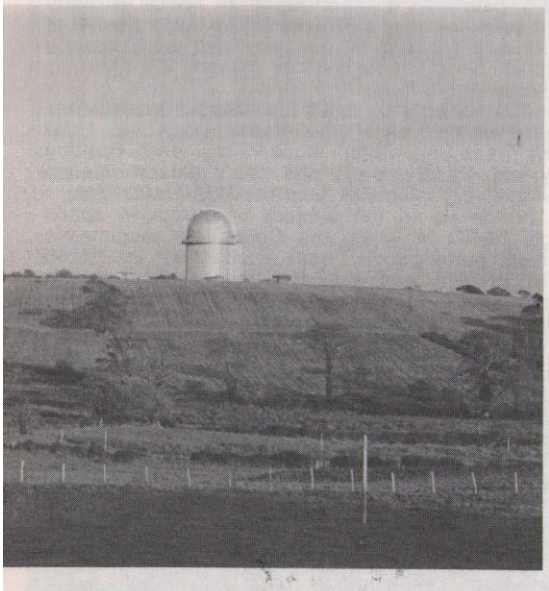
photographing of galaxies thousands of millions of light-year's away.

The decision to build a large telescope in this country was taken in 1946 and shortly after the decision was announced, the McGregor Trust of Michigan USA presented the Royal Observatory with the Pyrex glass disc from which the reflector was made. Practical construction work on the telescope did not begin until 1959, after the Observatory had moved to its new home in Herstmonceux.

Housed in a domed building which dominates the Sussex landscape for miles around, the telescope stands on a 48 ft. platform which raises it above the surrounding ground mists. The ambient temperature of the telescope is maintained constantly at the prevailing night temperatures, so that convective air currents cannot disturb the imaging of the instrument.

British scientists have made notable contributions to observational astronomy in the past, but in recent years their work has been hampered by the lack of a large telescope. This 98-inch reflector should therefore make it possible once more for Britain to play a leading part in astronomy. The total cost of the telescope and the rotating dome is in the region of £1 million and it is expected to have a useful life of 50 years.

Contrary to popular belief, the function of an optical telescope is not simply to magnify an image: the main requirement is for a reflector of such light-gathering power as to make possible, for example, the photographing of galaxies so far away as to require a photographic exposure of several hours.



The moving parts of the telescope, weighing about ninety tons are mounted on a disc 22ft. in diameter and 3 ft. thick which floats on an oil film of only four thousandths of an inch. It is exceptionally free to turn smoothly from East to West at a speed which compensates for the earth's rotation.

The mirror is made of Pyrex glass and was manufactured in 1936 in America by the Corning Glass Company. In the raw state, the disc weighed nearly five tons and during the year-long polishing process, Grubb Parsons removed 1,800 lb. of glass to reduce the disc to its final weight of 9,000 lb. In the telescope, the disc virtually floats on air contained within a very accurately controlled pressure envelope. This novel system eliminates the dangers of imposing surface deformations which could arise with more conventional mechanical mountings.

Astronomer-Royal Sir Richard Woolley operating the telescope by means of a remote control box from a specially designed seat at the Cassegrain focus.

Her Majesty operated the telescope from the control console.
On the platform are the Duke of Norfolk, Mr. Patrick Gordon-Walker and Professor Flowers. On the desk is a model of the original telescope made by Newton which was presented to Her Majesty to commemorate the occasion.

Finding room for space (Cont.)

A unique X-ray photograph of the sun taken on December 17th, 1964 from a stabilised version of a Skylark.

offer (through the Royal Society, and the former office of the Minister for Science) with the result that two American-built satellites, each carrying British experiments, and launched by American rockets, were put into orbit in 1962 and 1964.

Ariel I, the 1962 launch, worked well at first and yielded valuable information about the density and temperature of the ionosphere. Later, its solar power system became damaged and ended its working life.

Ariel II in 1964 likewise performed well during its first six months and accomplished most of its main experimental objectives—the measurement of cosmic radio noise.

By far the most significant of the series has been Ariel III, the all-British satellite with five British experiments aboard. It is a sophisticated scientific apparatus by any standard. It is functioning perfectly and gives every indication of continuing to do so.

The five experiments on board have all been co-ordinated through the Council's Space Research Management Unit under Dr. B. G. Pressey, and the whole project financed and led by the Council. Our two principal colleagues involved were Alan Ladd and John Smith of the SRMU. They have very deservedly received widespread congratulations on their extremely able management of a complicated project. The 'feedback' from the experiments is now coming in, for example, the RSRS terrestial noise experiment has yielded new information about noise levels over the Earth's equatorial regions and it recorded intense ionospheric storms over Western Europe during the first few days after launch. Early experimental results were reported to the COSPAR meeting which this year was held in London.

These satellite launchings by NASA are a splendid example of international scientific co-operation, but the scientific part of the space programme just begins with the launch of a satellite. The path of the satellite has to be recorded by a tracking station and the information collected or stored by the satellite and telemetered back to ground station, before the work of examining the results can be started.

At Winkfield in Berkshire there is a STADAN (Satellite Tracking and Data Aquisition Network) station which is one of a dozen operated by NASA throughout the world from Alaska to the Cape. Winkfield is supervised by RSRS personnel on behalf of NASA. Here, Bill Nicholson, the officer in charge of a busy establishment, leads a team which tracks and receives telemetry from a wide variety of NASA, or NASA launched satellites (including Ariel III).

At the Slough headquarters, a further team, under Graham Luscombe processes a good deal of the data received by tracking stations.RSRS also maintains outstations at Port Stanley in the Falkland Islands and at Singapore which also receives telemetry signals. In addition, the RSRS Satellite Prediction Service led by David Smith prepares and distributes thousands of satellite prediction times for the use of both professional and amateur observers at home and overseas.

Up in the green hills of Peebleshire, a small outstation of Council's Royal Observatory Edinburgh, records on average about a hundred points along a satellite's path. On a clear night as many as thirty different satellites may be tracked. The early passes of Ariel III were tracked in this way and subsequently many more. So our colleague in charge, Bill McInnes undoubtedly has a busy life.

The future looks even more full—British experiments are being carried on in the NASA, OSO and OGO satellites (Orbiting Solar Observatory and Orbiting Geophysical Observatory), and the Falkland Islands will be receiving telemetry from the ESRO satellites.

This brings us to the subject of European space research. ESRO in which the Council is responsible for British participation, was established in March 1964 'to provide and promote collaboration among European states in space research and technology exclusively for peaceful purposes'.

The member countries in addition to Britain are, Belgium, Denmark, France, the German Federal Republic, Italy, the Netherlands, Spain, Sweden and Switzerland. British delegates to the Council are, J. F. Hosie, Director of the Astronomy, Space and Radio Division, and Professor P. A. Sheppard, Imperial College London, Chairman of our Space Policy and Grants Committee.

To implement its rocket and satellite programmes ESRO has established its own centres for technological activities, research, telemetry and telecommand, data analysis, administration and rocket launching. This year, sounding rockets have been launched from Sardinia, from Kiruna in northern Sweden, and from Andoya.

The satellite programme in particular promises to offer substantial opportunities to British research groups. Of the thirty-nine experiments already planned in ESRO satellites, eighteen are of British origin. This programme was delayed by the failure of the rocket carrying ESRO II although, to quote from official sources, 'the satellite transmitted signals up to T + 500 seconds which proved that its system functioned successfully'. These satellites have been designed for the study of cosmic radiation and solar astronomy, and of the polar ionosphere.

ESRO has always planned that a major astronomical satellite should be its first big project. If this is realised, the LAS (Large Astronomical Satellite) will be sent on its way probably in 1972 as the largest satellite designed outside the US and USSR. It will be designed to carry a telescope no less than 30 inches in diameter.

Over the next five years ESRO is planning to launch at least four other medium satellites, a second large project and a number of Highly Eccentric Orbit Satellites.

The Rome Ministerial meeting in July was called to review overall European space activities (including launcher vehicles). It decided that further study was required before far-reaching decisions could be taken. It therefore set studies in motion and agreed to reconvene in Bonn in 1968.

Some thirty space research groups, the majority of which are in the universities, are also suported by Council through its Space Policy and Grants Committee. By far the largest group is at University College London under Professor Robert Boyd FRS.

The group has now moved to a quiet country house at Holmbury St. Mary, Dorking. The move was financed by Messrs Mullard Ltd. whose managing director Mr. F. E. Jones, FRS, formally opened the house for its new purpose at a gathering which included many distinguished space scientists.

In subsequent numbers of Quest we hope to be able to return to some of the fascinating work which is being carried out in the space research groups which Council supports and of course, to the other important aspects of the ASR Division's work in optical and radio astronomy. We move on with no more than a glimpse at one of the tools of the trade—the rockets which fly the scientific payloads.

The National Sounding Rocket Programme as it is known, began in 1957. Since then, 120 Skylark rockets carrying scientific payloads have been launched as part of the UK national rocket programme for experiments into the upper atmosphere. Twenty-seven feet long and seventeen inches in diameter, each Skylark is capable of carrying a payload of 450 lbs. to a height of about 136 miles without the aid of a booster. A stablished version of the rocket was first flown in 1964.

Most of the space research groups including those at the Royal Observatory Edinburgh and the Radio and Space Research Station, are concerned with the design and construction of rocket experiments and most of these are carried in Skylark.

Although Skylark is a magnificent unit, it is not always suitable for smaller payloads and this is where Petrel comes in. Developed by Mintech's Rocket Propulsion Establishment, the AWRE, Aldermaston, and manufactured by Bristol Aerojet, Petrel is only nine feet long, economical in cost and is particularly suitable for synoptic aeronomy and ionospheric studies. It is capable of lifting a payload of 30 lbs. to a height of eighty miles.

The national programme also makes available the tiny Skua II rocket which is operated mainly for meteorological purposes. With a diameter of only five inches, it is still able to lift a payload of 10 lbs. to a height of 40 miles.

British scientists through national or co-operative schemes with the United States and Europe, can look forward to a continuing programme of investigations into space phenomena. Moon pointing and possibly star pointing rockets are "just around the corner". ESRO will soon be offering opportunities for deep space and precise measurement. NASA has included British experiments in the proposed planetry and manned space vehicles, and have selected thirteen British scientists to co-operate in the study of the first moon samples to be brought back to earth.

Guests at the dinner at University College London, given by Mullard Ltd. to mark the opening of the Mullard Space Science Laboratory.

Goings on in the LORDS

The Science and Technology Bill, which gave birth to the Science Research Council, in 1965, was not everyone's cup of tea. You may delight in poring over official prose; on the other hand, you may delight in pouring boiling oil over official prose.

We wondered how the legislators themselves thrashed out the details and what they did to heighten the experience. To satisfy this curiosity, we looked up the committee and third-reading stages of the Bill's passage through the House of Lords.

Among the eminent and most learned Lordships present was a formidable group: Lord Snow, author of such books as "The Affair" and "Corridors of Power"; Lord Bridges, Chairman of the Governing Body of the then National Institute for Research in Nuclear Science; the Earl of Bessborough; Lord Sherfield, once Chairman of the Atomic Energy Authority; and Viscount Dilhorne. This was how they fared . . .

The Earl of Bessborough was restive:

"May I say I hope Members of the Committee will forgive me for not having been present during the second debate on February 4. This was for medical or rather for surgical reasons. I might add that if your Lordships are concerned with any undue movement at this Box, this is due to the fact that my surgeon tells me that I must take as much exercise as possible, that is to say walk or jump up and down; at any rate not to stand still." "I hope, therefore, that the noble Lord, Lord Snow, will bear with me for a moment. I think, incidentally, that we should today take the opportunity of congratulating him on his imaginative use of heraldry in the design of his Coat of Arms which, with its cats as supporters, will I am sure greatly please the colleges of advanced technology". . . . (or CATS as they are commonly called).

Lord Bridges was quietly philosophic:

"The only difference (between Daresbury and Rutherford) is that at one laboratory the main instrument is the proton accelerator and at the other the electron accelerator—not I think a reason for justifying a separate pension arrangement".

"In my previous incarnations I have not always found myself agreeing with the staff associations. It is pleasant today to find myself agreeing with them".

"My Lords, may I quote one line of poetry? It is the first line of Oliver Goldsmith's poem *"The Traveller"*

'Remote, unfriended, melancholy, slow'

I hope, my Lords, you will not think this too frivolous, but it does express the type of administration that we all want to avoid".

"The National Institute for Research in Nuclear Science—called in short by the horrid title of NIRNS . . . like other people rarely gets what it hopes for; but that is the common fate of all mankind".

Lord Snow provided the literary thrust:

"I sometimes think that many scientists are frightened of the words "Civil Service". If we called it "Anti-Civil Service" or "Un-Civil Service" they would probably be much happier".

"No government can lightly ignore the feelings of scientists, old or young"
and, in these asides . . .

"Lord Snow: I am afraid the amendment sounds remarkably esoteric, but in fact is not so. It has caused some anxious concern in parts of Whitehall and Westminster.

A Noble Lord: the corridors of power".

"Lord Conesford: My Lords, may I put one question to the noble Lord, Lord Snow? It is always difficult to deal with a manuscript amendment but if I understand the Amendment correctly there seems to be a defect in grammar. Should not the word "subsequent" be "subsequently"?

Lord Snow: My Lords, by leave of the House, may I say that I believe "subsequently" is slightly preferable, though I think I might use either if I were writing a book".

Lord Sherfield wore a political mantle:

"I think I know tolerably well the point of view of what perhaps I may loosely call "the authorities".

"Why should we have this passion for conformity?"

"I am addressing the noble Lord, Lord Snow. I see Lord Shepherd is also doing so. If the noble Lord, Lord Shepherd, can be more effective than I am in persuading the noble Lord, Lord Snow, to change the attitude he has announced, then I welcome his assistance."

Viscount Dilhorne was gracious in victory:

"I am glad indeed that in the time passed the Government have made up their mind on this. If I may say so, the noble Lord, Lord Snow, wore his white sheet today extremely well."

But the final word without a doubt went to the persistent scene-stealer, the Earl of Bessborough:

"We now accept this Bill as it stands. It is, of course, still complicated by the fact that two ministries, rather than one, are now involved in its application. I hope, however, that the noble Lord, Lord Bowden, who is responsible for the Science Research Council, and the noble Lord, Lord Snow, who is concerned with the Atomic Energy Authority, will remain two, shall I say, heavenly twins (or, might I perhaps say, Siamese twins) and that they will not permit themselves to be separated".

Floodlighting of Herstmonceux Castle by Atlas was a memorable feature of the opening by the Queen of the Isaac Newton Telescope.

Professor Brian H. Flowers F.R.S.

Professor B. H. Flowers, F.R.S., is one of the best known theoretical physicists in this country and is acquainted already with a wide circle of staff and members of committees of the SRC.

He was educated at Gonville and Caius College, Cambridge, and the University of Birmingham and began his professional career in 1944 when he was engaged on the Anglo-Canadian Tube Alloy project at Chalk River, in Canada. In 1946, he returned to Britain to do research work in nuclear physics and atomic energy at the Atomic Energy Research Establishment, Harwell. After working from 1950-52, in the Department of Mathematical Physics at the University of Birmingham, he returned to Harwell as head of the Theoretical Physics Division and became a Chief Research Scientist in 1958. Later that year he became Professor of Theoretical Physics at Manchester University and since 1961 has held the Langworthy chair of Physics. He was a member of the Court and Council of Manchester College of Science and Technology, and Chairman of the Computer Board for Universities and Research Councils. During his five-year term as Chairman of the Science Research Council, he is on an unpaid leave of absence from the university.

Professor Flowers was a member of the Council of the Physical Society from 1956 and when it became amalgamated with the Institute of Physics in 1960, he became a member of the council of the joint organization, holding the office of Vice President for two years. He has been a Fellow of the Royal Society since 1961.

As a leading authority on national scientific policy, he has served on the Advisory Council on Scientific Policy from 1962-64, on the Council for Scientific Policy since 1965 and as a member of the governing body of the former National Institute for Research in Nuclear Science (now merged into the SRC) from 1962-65. Professor Flowers, who is 43, is making his home in London. He is married with two step-sons.

Apart from his work, Professor Flowers is interested in music (he plays the piano and the cello and used to conduct amateur choral concerts), travel, colour photography and rose-growing, although he informed QUEST that he is likely to have very little time for the latter activity while living in London. His hero is the late Sir John Cockcroft with whom he worked closely during his most formative years.

Already he has received sympathetic press comment on his drive, determination and fair-minded understanding of the problems he is likely to encounter. We feel sure that all readers of this first issue will wish him well during his term of office and look forward to meeting him.

profile

Sir Harry Melville, K.C.B., F.R.S.

Sir Harry Melville, K.C.B., F.R.S., who retired as the Chairman of the Science Research Council at the end of September after nine years in Government service was, from 1956 onwards Secretary to the Department of Scientific and Industrial Research.

Sir Harry was born in 1908 and educated at Edinburgh University and Trinity College, Cambridge. During a distinguished career as a chemist, he won the Meldola Medal of the Royal Institute of Chemistry, the Davy Medal of the Royal Society in 1955 and the Colwyn Medal of the Rubber Industry. He became a Fellow of the Royal Society in 1941. From 1940-43, he was a scientific adviser to the Ministry of Supply and from 1943-45, Superintendent of the Radar Research Station. From 1948-56, when he joined the Department of Scientific and Industrial Research, he held the Mason Professorship of Chemistry at Birmingham University. He was a member of the governing board of the National Institute for Research in Nuclear Science, merged into the Science Research Council in 1965. From 1961-65 he served as a member of the Research Council of the DSIR.

Sir Harry has now taken up a new career as Principal of Queen Mary College in London, and we know that all those who had the privilege of knowing or working with him in either the Department of Scientific and Industrial Research or the Science Research Council will join in wishing him well, and remembering his support, understanding and kindness during his term of office

Opening of Observatory at Monte Porzio

The new Italian Observing Station of the Royal Observatory, Edinburgh, at Monte Porzio near Frascati, was formally opened on 26th October by the British Ambassador to Italy, Sir Evelyn Shuckburgh, G.C.M.G., C.B., The ceremony took place in the presence of the Italian Minister for Education, the Hon. Luigi Gui, and a large congregation representative of Italian academic and public life. Dr. W. L. Francis, C.B.E., and Mr. M. O. Robins represented the London Office of the Science Research Council.

The Pavilion of the Station which contains, apart from the telescope, various offices and workshops, is situated in the extensive grounds of the Monte Porzio Department of the Rome Observatory, and the addresses by the Minister of Education, the Director of the Rome Observatory, Professor M. Cimino, the British Ambassador and Professor H. A. Brück (Astronomer Royal for Scotland) were delivered in the Library of the magnificent main Monte Porzio building. The speakers stressed the spirit of British/Italian friendship and co-operation in which the whole project had been conceived and in which it is to be pursued in future.

The base of the telescope showing the control console.

The telescope, constructed by Messrs. Sir Howard Grubb Parsons, Newcastle-on-Tyne, is a 16/24-inch Schmidt camera. It represents a sophisticated version of a similar instrument at the Royal Observatory in Edinburgh which has produced much observational material for work on problems of stellar evolution, the nature of interstellar matter and the field of galactic research in general. It is expected that, at the new Station, which will be manned by Edinburgh astronomers, and in the conditions of Italy, both amount and quality of observational data will be greatly improved.

Professor H. A. Brück, C.B.E., and Dr. W. L. Francis, C.B.E., seen with the Italian Ministers.

NEWSFRONT

The title's a misnomer ... a quarterly journal can't possibly carry 'news'! However, what we wish to achieve in this section is an interchange of information on a more 'personal' plane. For example, the chap who collects matchbox labels might be looked upon with a degree of tolerant amusement by the uninitiated, but a description of his collection, with details of how it was built, together with a history of matchbox labelling makes fascinating reading – especially if suitably illustrated. A particularly good photograph of an exotic (or commonplace) subject or situation often makes good 'copy', an amusing experience (must be printable), a personal achievement (same condition), these are the items we need to act as a 'leavening agent' to balance the weight of technical articles which will necessarily form the bulk of each edition of this journal.

LOCAL CORRESPONDENTS

Here are the photographs of the local correspondents who with your help are going to fill this section in future. Mrs. Chisholm may well have given up the job by the time this issue appears, because the Library is taking over the Newsletter and will become our contact in future.
The miniscule biographies are in no way due to the lack of space – just personal modesty!!

J.C. Baldwin, A.C.L.

Dr. Baldwin joined A.C.L. in 1965 and has since been working on a system of crystallographic programmes. At present he is engaged on a multi-access project on Atlas involving a small satellite computer. Aged 28, he obtained his B.Sc. in Chemistry at Bristol in 1961 and his Doctorate from Sussex University in 1965. His principal hobby is bell-ringing.

G.W. Gardiner, R.S.R.S.

Geoff Gardiner joined RSRS from the Met office in 1955. He works on instrumentation problems, particularly meteorological measurements; also finds time to edit the Station Newsletter, so is the ideal point of contact for the transmission of contributions to Quest! Geoff is 40 years of age and describes himself as a 'musical illiterate with omnivorous reading tastes'! Closer questioning revealed a genuine interest in the history of science and a fondness for opera ... sans Wagner!

Lesley Chisholm, D.N.P.L.

Without doubt, the most attractive of our local correspondents!
Lesley joined DNPL in August 1966 as an Asst. Personnel Officer and is involved in Establishment matters concerning superannuation, training, ACR'S and review boards, personnel records etc. as well as editing the Newsletter, sitting on the committee of the Lab's motor club, and the table tennis section of the Sports & Social Association! It would not be difficult to fill the page with details of Lesley's social interests, she obviously lives a very full and happy life, but here are a few of the things she finds time to do – mostly in company with her husband – a local Grammar School teacher; Press Officer to the local Liberal Association; member of the editorial committee of the Parish Magazine and the 'Forum' discussion group; member of the local Amateur Dramatics Society (she says that her work is confined to "backstage", her husband is the Player); hill walking; horse riding; tennis; and she makes all her own clothes!

Alan Powell, R.G.O.

Joined the Observatory in 1964 from the Atomic Energy Authority as a Senior Scientific Officer.
He is currently engaged upon the analysis of the spectra of stars and the subsequent deduction of their chemical composition. This work complements the astronomical research in other departments of the Observatory into stellar dynamics and evolution in our galaxy. Alan is married and claims that this fact, plus two young children, restricts his social life to bridge, music and a 'variety of sporting activities' ... that's restriction? !

Harry Norris, R.H.E.L.

Now mostly concerned with the public relations aspect of the Admin. Group, Harry has spent most of the post-war years in the Civil Service. After three years in the engineering department of the BBC immediately following service with the RAF, he joined the Health Physics Division of AERE Harwell, spent some time with the Reactor Division, and in 1960 joined the Proton Linear Accelerator Group where he was mainly concerned with water flow relay problems. In 1961 he transferred to N.I.R.N.S. and joined the Admin. Group at the end of that year.
His hobbies are varied, likes music, jazz and classical, photography, cars, (runs a much-modified A40), and radio. He has designed and built his own house and recently completed the landscaping of his quarter-acre garden.

J.G. Ireland, Royal Observatory, Edinburgh

'A mathematician with interests slanted towards theoretical astrophysics' is how Dr. Ireland describes his work at Edinburgh. His work ranges over the structure of stars and how stars form, stellar rotation and the effects of rotation on the stellar spectrum etc. etc. He tends to concentrate on the problems and theories which are readily amenable to direct observational test and those which seek to account for existing unexplained observations.

Dr. D.L. Croom and Mr. R.J. Powell operating a solar radiometer during an eclipse expedition to Greece. As well as maintaining outstations, staff of R.S.R.S. are from time to time involved in such short-time work abroad.

Mr. Patrick Gordon Walker, Secretary of State for Education and Science, photographed in the magnet room of NIMROD during a visit to the Rutherford High Energy Laboratory.

Miss Olivia Pui-Yin Mak.

Miss Olivia Pui-Yin Mak is 20 and came to England from Hong Kong four years ago, with a not-so-good grasp of the English language, but possessing the sort of personality which melts such problems into trivialities!

She is a member of the clerical staff in the London Office and has obtained permission for an extended lunch period to enable her to help the 'Meals-on-Wheels' service. In addition, she helps the Red Cross at Hampstead General Hospital and visits sick and elderly folk in their homes – all this with a limited knowledge of the language!

Her industry and enthusiasm have now been officially recognised by the award of the Gold Standard of the Duke of Edinburgh's Award Scheme for Young People. She received her certificate from the Duke at a Palace ceremony and a gold brooch which was presented to her by past Chairman Sir Harry Melville, K.C.B., F.R.S.

A party of scientific editors from the USSR, on a two-week visit to Britain, being shown around the 36 inch telescope at the Royal Observatory Edinburgh.

Printed by Mount Press Ltd., Hungerford Road, Bristol 4. Published by The Science Research Council, State House, London W.C.1.