QUEST

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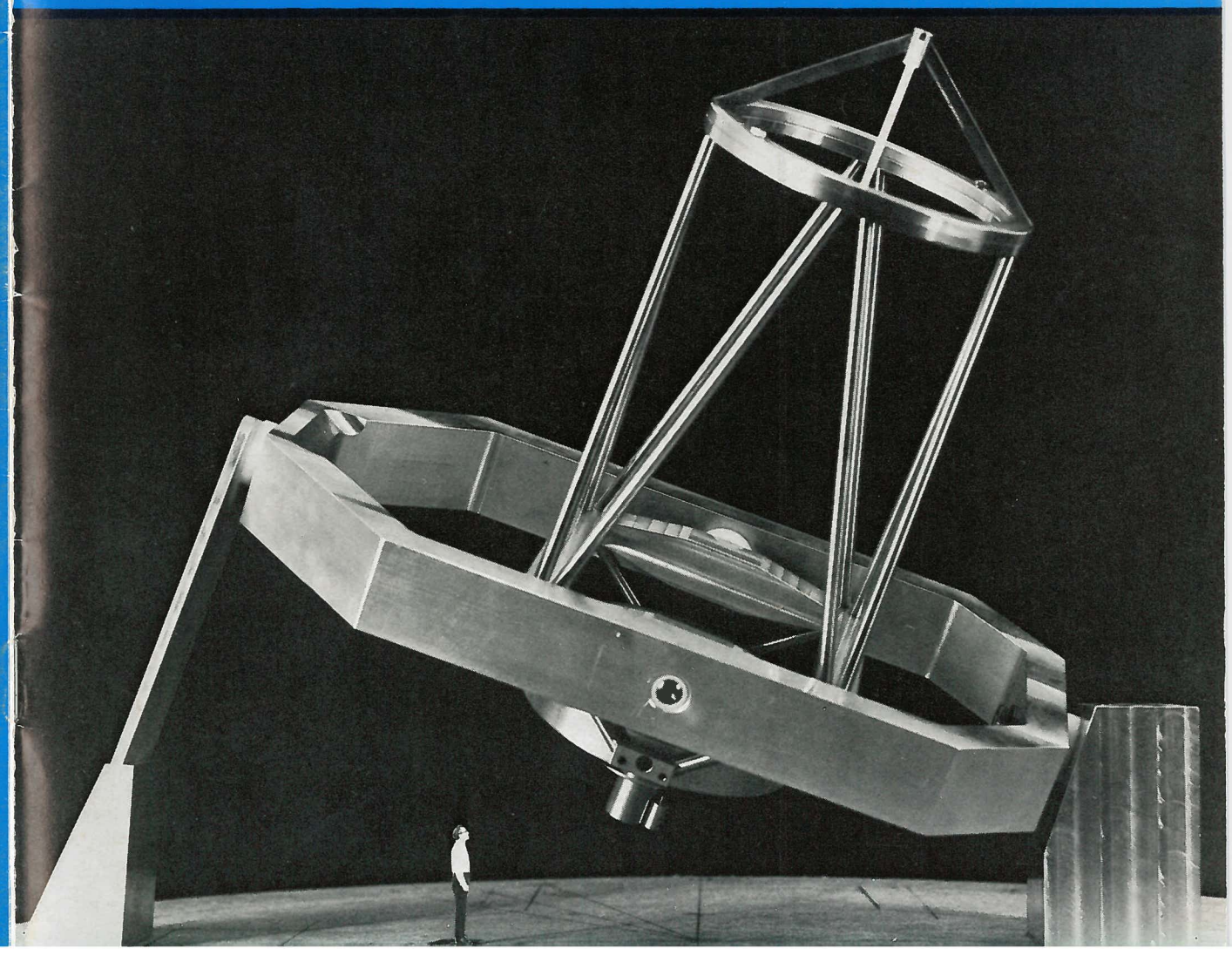
Laser Lab opened

New neutron source at Rutherford

Sports day



QUEST

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Our cover picture shows the UK 3.8m aperture infra-red telescope, as it will appear when completed on Hawaii in 1978.

As many readers will already be aware, about three years ago the Royal Observatory, Edinburgh became responsible on behalf of the Council for the construction of a 3.8m infra-red telescope to be installed by arrangement with the University of Hawaii on the summit of Mauna Kea at a height of 4,200m on the Island of Hawaii. The telescope, which will be one of the largest in the world and certainly the largest purpose-built for observations in the infra-red region of the spectrum, was unveiled before the press on June 21 at the Sheffield Works of Messrs Dunford Hadfields.

The building and dome have been erected on the mountain ready to receive the telescope early next year. Figuring of the primary mirror has been completed at the Newcastle Works of Sir Howard Grubb Parsons & Co Ltd. The secondary and Coudé mirrors are due to be completed by the end of this month.

The design of the telescope is unique in that it uses a relatively thin primary mirror, its weight being only 6 tons whereas a mirror of conventional thickness would weigh approximately 15 tons for the same diameter. Consequently it has been possible to reduce the structural requirements for the telescope and hence to reduce the overall cost by a substantial amount. The primary mirror support system is extremely sophisticated and, despite the low-cost concept, good optical performance is anticipated.

The Project Manager is Dr Colin Humphries of ROE who took over responsibility in this role following the sad and untimely death of Mr Gordon Carpenter. The project is guided by a steering committee of infra-red astronomers under the chairmanship of the Project Scientist, Professor Jim Ring of Imperial College.

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To the staff of SRC from Professor Allen

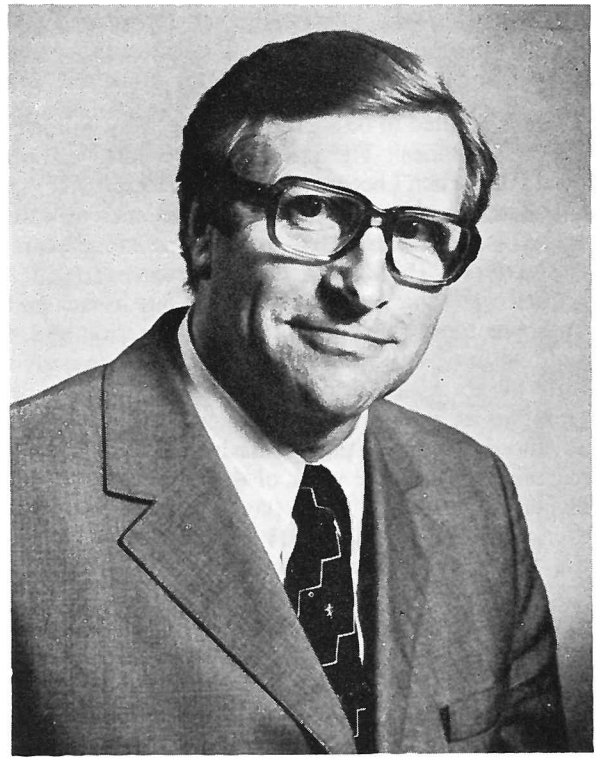
On October 1 I took over from my friend and scientific colleague, Sir Sam Edwards, as Chairman of the Council. During my years of service on committees and boards I have made many friends within the organisation. I hope to make many more!

The central task of the Council remains to provide for Britain through the universities and polytechnics an ongoing programme of training and research in the biological, physical and engineering sciences. At his last press conference Sir Sam pointed out that SRC needed more cash to discharge its responsibilities properly. Fortunately, his legacy is a robust programme with exciting initiatives taking shape; it provides a good basis for seeking additional funds. We must build on this and ensure that a sound programme continues to evolve as more new ideas come forward from academe, private industry and the public sector.

I have made plans to visit laboratories in the early months, to develop my own understanding of your activities and to meet people—especially those I don't yet know. Previous Chairmen have enjoyed a reputation for being approachable, I certainly wish to maintain that tradition.

Within the next year we must complete the move to Swindon. I shall retain an office in London and the boards and committees and Council will in general meet in London. I hope that most of the people concerned will elect to go to Swindon. It will be a testing time but also a good time for simplifying some of our procedures and implementing new, good practices.

Putting all these things together, we in SRC now have a unique opportunity to help provide the training and research programmes required in the national interest and to build up a support system for the polytechnics and universities which surpasses even our present endeavours. One of my main aims will be to encourage staff to seize this opportunity and so, despite immediate problems, ensure for themselves good career development.



Professor Geoffrey Allen FRS

Professor Geoffrey Allen FRS

Professor Allen is Professor of Chemical Technology in the Department of Chemical Engineering and Chemical Technology at Imperial College. He was until September Chairman of the Council's Engineering Board.

He was educated at Tupton Hall Grammar School, Clay Cross and the University of Leeds, where he obtained a PhD degree for thermodynamic studies of solutions. From 1952-54 he was a postdoctoral fellow working on Raman spectroscopy at the National Research Council in Ottawa, Canada and in 1954 he returned to an appointment in the Chemistry Department of Manchester University. He was appointed Professor of Chemical Physics at Manchester in 1965.

It was at Manchester, in collaboration with Geoffrey Gee that he established his main research in the field of polymer science. From 1969-73 he was director of an ICI/Manchester University Joint Laboratory working on new polymeric materials and from 1970-74 he was seconded half-time to the ICI Corporate Laboratory at Runcorn.

Professor Allen has been consultant to ten different companies and served on the Chemistry, Neutron Beam, Polymer Science and Material Science and Technology Committees. He was elected to the Royal Society in 1976.

He is 49 years of age, married with one daughter. He lives in Wimbledon; his recreations are walking, talking and eating.

A farewell message from Sir Sam Edwards

There is reputed to be a Chinese curse 'May you live in interesting times'. The last four years have certainly been that. When I became Chairman I found SRC with a budget which when translated into current values was £145M, and expected that over my four years it would rise to £162M. In fact it has decreased to £133M. At first sight this appears a disaster but in fact many problems have been sorted out in this period and the Council has passed into a period of intense activity, with all its establishments having substantial programmes at present and with more projects in the advanced planning stage. This has meant a massive rearrangement of the work of the Council's establishments, and must at times have appeared as drastic, even draconian, to the staff, and I must give thanks to the staff for their confidence in the ability of the Council to make the right decisions in this difficult period. I think these decisions have proved to be good ones, for they leave us in the position of having the world's first infra red telescope, the world's first purpose built radiation synchrotron, the world's first spallation neutron source, and Europe's first laser laboratory and interactive computing laboratory.

Provided political problems are resolved, the NHO should soon go ahead, and the next major project for Appleton is planned to be the world's leading millimetre wave telescope. It is an encouraging prospect, but has involved consuming, by cannibalization, all the Council's existing resources.

Thus though the next five years seem assured, the longer term future will depend on some increase in the Science Vote, which will in particular allow the Council's ambitious plans in engineering to come fully to fruition, and allow some reinstatement of a space programme appropriate to Britain's scientific standing.

I am handing over the Chairmanship to an old friend, Professor Geoffrey Allen, who is uniquely qualified to do the job by virtue of his knowledge of science both pure and applied, and both big and small. I feel sure the staff of the Council will give him the support that I have enjoyed from them in these last four eventful years.

Introduction to lasers

The word Laser is an acronym for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation, ie they are light amplifiers (see Fig 1).

If we imagine taking a sufficient fraction of the output of a light amplifier and feeding it back to provide

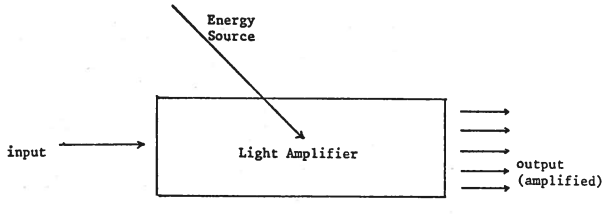


Fig 1 Laser Amplifier

its own input (Fig 2), the system becomes a self-sustaining light oscillator, ie a source of light. The most commonly available lasers are, in fact, light oscillators. They may, of course, be followed by amplifiers to increase the output power. This is done in the Rutherford Lab laser. (See page 3).

Amplification of light requires the addition of energy, which must be pumped into the amplifier from an external source. The method of pumping varies considerably from one laser material to another. There are many hundreds of known laser materials—solids, liquids and gases—each with its preferred method of pumping.

Main properties of lasers

(a) The amplification is a maximum at some particular light wavelength (colour) which may be in the visible, ultra violet or infra red. This is the normal working wavelength of the laser.

(b) The beam emitted from a laser oscillator has very low divergence (ie it does not spread out like a torch beam) and can be focused to a very small spot.

(c) The power of the light beam can be very high.

(d) Pulses of light of extremely short duration can be generated in some types of laser. By 'extremely short' one means about 1 picosecond (equals 10^{-12} seconds or one millionth of a millionth of a second). A light pulse, which can travel a distance equal to seven times round the earth in a second, travels only 0.3 mm in 1 picosecond.

Not all the above properties are available simultaneously in all types of laser. Relatively few lasers can generate very short light pulses and all are limited as regards the maximum power they can give, though some are more limited than others. The maximum power is limited by one or more of the following:

(a) *Saturation* The amplification decreases at high light intensities.

(b) *Refractive Index Changes* At high light intensities the refractive index of the material changes so that, for example, a plane glass plate behaves like a lens.

(c) *Damage* High light intensities can burn the laser material itself. This hazard is made worse by (b) above since the beam can be self-focusing.

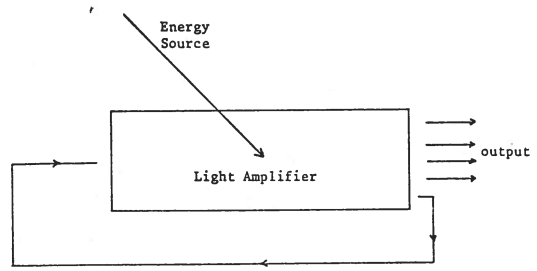


Fig 2 Laser Oscillator

Laser Lab opened

In October 1975 the government gave approval for the Council to provide a high power laser and ancillary equipment for use by university and polytechnic research groups at the Rutherford Lab. By December the following year the first experiments were under way.

In a ceremony at the Lab on 20 June 1977, the Chairman Sir Sam Edwards inaugurated the new central laser facility.

The main scientific objectives of the unit's research programme are:

(i) to create and study plasmas generated by laser compression;

(ii) to study non-linear interactions of intense laser radiation with matter; and

(iii) to develop more efficient and new high power lasers for future experiments in these and other fields.

A milestone in the progress of the facility was reached earlier this year when laser 'compression' was recorded with the first shot of the new two beam laser at a glass micro balloon target. The aim of the experiment was to direct very intense laser light at a small target (ie the micro balloon). If two beams arrive at the same time on opposite sides of the target they can create a shock wave that travels into the target, heating it and compressing it as it goes. The resulting plasma is of scientific interest.

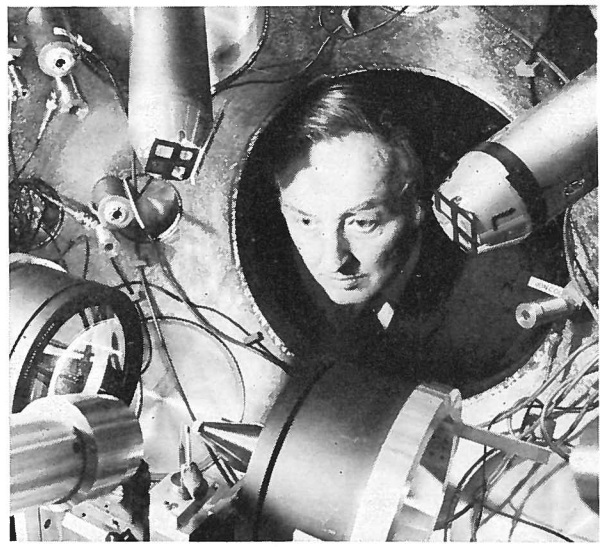
Laser Facilities

The laser is of the neodymium doped glass type and consists of an oscillator which generates single pulses

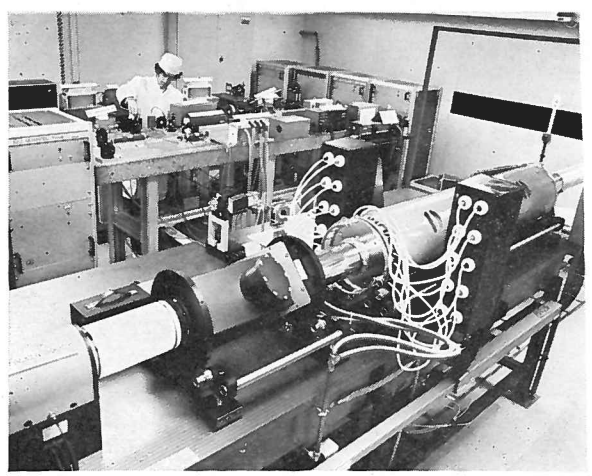
A memento of the inauguration day for Mrs Shirley Williams, Secretary of State for Education & Science, is handed over to DES representative Mr Ulrich, by Dr Stafford, Director RL

of radiation of 1.06 μm wavelength (near infra red) followed by a sequence of amplifiers and beam control

discs. The duration of the oscillator pulses may be varied in steps in the range 30 picoseconds to 300 picoseconds but 100 ps pulses are most commonly used (1 ps$=10^{-12}$ seconds). The amplifiers consist of neodymium doped glass rods of steadily increasing diameter up to a maximum diameter of 76 mm. At this point the beam power is about 100 Gigawatts (1 Gigawatt$=10^{9}$ watts) and the beam can be directed into the target chamber for use in experiments.



Dr Alan Gibson, head of the Laser Facility looks inside the Laser Target vessel showing small stem supporting micro balloon target sphere *Keystone Press*



A general view showing Dr Ian Ross working on the Laser Oscillator *Keystone Press*

Dr Alan Gibson presents Sir Sam Edwards with the photograph of the shot he had fired at the inauguration ceremony

Alternatively, the beam is split into two and, after further amplification to reach a power of 400 Gigawatts per beam, the two beams are directed into the target chamber in opposition. This two beam facility is required for compression experiments, the target being near the focus of both beams and compressed between them.

Target and plasma diagnostic facilities

At the entrance to the target chamber the laser beam(s) have their maximum diameter of just over 10 cm. They are then focused by two f/1 lenses onto the target which is mounted in an evacuated chamber since the laser intensity near the focus is more than enough to ionise the air.

Targets may take many forms, depending on the requirements of the users. Targets for compressional experiments consist of hollow glass spheres, about 0.1 mm diameter, which may be filled with gas. A target fabrication facility has been set up.

The target chamber is surrounded by a wide range of diagnostic instrumentation to measure various properties of the plasma created by the laser. Much of this equipment has been built and commissioned by university groups taking part in the programme.

Council Commentary

March to July 1977

Visit of the Secretary of State for Education and Science

The Rt Hon Mrs Shirley Williams, MP, attended part of the July Council meeting. She took part in the consideration of postgraduate training policy and stayed for informal discussions with Council members over lunch.

Visit of the Council to the Daresbury Laboratory

The May meeting of Council was held at the Daresbury Laboratory. Members were given an introductory talk by Professor Ashmore and saw work in progress on the construction of the Nuclear Structure and Synchrotron Radiation Facilities. The Council was impressed by the high standard of engineering employed on these projects and the Laboratory's ability to use its expertise to develop new designs and techniques.

Forward Look

In March and April the Council considered bids from Boards, etc as part of its preparation of the Forward Look. The Forward Look, as submitted to DES, covers the four years 1978/9 to 1981/2 and is based on an effective rate of decline in the Council's resources of 1.7% a year. In drawing up its Forward Look on this basis the Council was faced with many difficult decisions and was concerned that towards the end of the period it might not be able adequately to fulfil its responsibility to sustain standards of education and research in universities. The Forward Look makes provision to increase the number of postgraduate studentships offered to about 3,800 in 1981/82; the increase will, however, not keep pace with the expected rise in the number of qualified candidates. Expenditure on engineering would increase by 25% with the increase being entirely devoted to special programmes of national importance such as the Teaching Company Scheme, Marine Technology and Polymer Engineering. There would be a slow increase in expenditure within the Science Board area to provide important new central facilities at the expense of some reduction in research grant expenditure. Expenditure on nuclear physics is planned to reduce by slightly less than 25% over the period and that in the astronomy, space and radio area by slightly less than 20% over the period.

Spallation Neutron Source (SNS)

In the last edition of "Quest" reference was made to Council's approval in principle of the conversion of Nimrod to provide a machine and target station for a spallation neutron source at the Rutherford Laboratory. In April Council gave final approval to the scheme at a capital cost of £7.86M at prices then current. DES approval of the project has since been announced.

Part-time Postgraduate Training

In July Council considered a report from the Postgraduate Training Advisory Panel on whether different arrangements were necessary to cater for the needs of the large numbers of students taking part-time postgraduate training. At present the support of such students is the responsibility of Local Education Authorities on a discretionary basis. The Postgraduate Training Advisory Panel expressed fears that when higher tuition fees were introduced in the next academic year more students might opt for part-time training and some currently undergoing such training might experience financial hardship. The Council agreed that part-time education should be encouraged and that there might be a case for central Government to meet some of the costs; it asked for discussions to be held with DES and other relevant bodies to pursue the proposal. In the meantime it agreed in future to allocate a few studentships to enable some part-time students to have up to one year's full-time study.

Fabrication Facilities for Solid State Devices Research

To enable universities to play their part in solid state devices research (an area of considerable industrial importance) adequate fabrication facilities are required. In July the Council approved a proposal involving four grants amounting to £683K over four years to enhance university device processing centres to provide a service to all academic devices research groups. It also approved capital expenditure of £530K to establish an electron beam lithography facility at the Rutherford Laboratory. The Laboratory, in addition to operating an electron beam lithography machine, will develop software for its control and implement design programmes on the SRC's central computers to enable universities to design large scale integrated circuits before their manufacture on the machine.

Data Compilation Committee

In 1974 SRC assumed responsibilities for support of data compilation following the demise of the Office of Scientific and Technical Information. To administer this responsibility the Council established a Data Compilation Committee initially for a two year period (later extended to three years). In July the Council considered the second report of the Committee, which described the overall support given to data compilations and actions taken by the Committee to improve the dissemination of data. Council accepted the recommendation in the report that the Committee should be disbanded on 30 September 1977 and that Boards and subject committees should assume responsibility for support of data compilations. An Advisory Data Panel reporting directly to Council will be established to periodically review the working of these new arrangements.

Superconductivity

All the SRC Boards have some interest in superconductivity either as users (eg the Science Board in the Synchrotron Radiation Facility) or because of their support of research on the phenomenon of superconductivity and the characteristics of superconducting materials. In the Rutherford Laboratory, in particular, considerable expertise has been built up in various aspects of superconductivity. In July Council approved a proposal that SRC should take the lead in a national superconductivity research programme. It is appropriate at this stage in the development of superconductivity that SRC should take the lead since, although there is a need to retain a national activity in the field, possible commercial applications of the phenomenon are some way off.

Management Committees for the Marine Technology and Teaching Company Programmes

The Council has approved the appointment of Management Committees for the Marine Technology and Teaching Company Programmes. That for Marine Technology will be chaired by Mr R A Huskisson (Chairman of Lloyds Register of Shipping); Mr A F Masters (CompAir Ltd) will chair the Teaching Company Management Committee. Council's approval of the first substantial batch of grants for marine technology research is reported below.

Grants and other financial approvals

(*i*) *ASR*

(a) a grant of £208K to Professors Rees and Lynden-Bell (Cambridge University) over 4 years for research in theoretical astronomy;

(b) a grant of £185K over 5 years and 7 months to Dr Rees (University College London) for an interferometer experiment for the Electrodynamics Explorer satellite;

(c) a grant of £429K for one year to Professor Boyd and Dr Culhane (University College London) for research at the Mullard Space Science Laboratory;

(d) a grant of £238K for one year to Professor Sir Bernard Lovell (University of Manchester) for radio-astronomy research at Jodrell Bank;

(e) a supplement of £161K to Professor Houghton (Oxford University) for work on a stratospheric and mesopheric sounder for a NASA satellite NIMBUS G;

(f) supplements amounting to £55K to Professor Pounds (Leicester University) for a study of cosmic x-ray sources from the UK-6 satellite;

(g) £166K capital for provision of instrumental facilities on the UK infra-red telescope;

(h) a supplement of £52K to the existing commitment of £151K for feasibility and site studies for a millimetre and sub-millimetre radio telescope.

(*ii*) *Engineering*

(a) grants totalling £3,991K over 3 years for marine technology research. The grants are made to the Marine Technology Centres at London—Imperial College and University College (£1011K); Glasgow University (£557K), Strathclyde University (£336K), Heriot Watt University (£658K) and Newcastle University (£429K);

(b) a grant of £364K over 4 years to Professors Ash, Cullen and Davies (University College London) for devices and systems research in microwaves, optics and high frequency acoustics;

(c) a grant of £180K over 4 years to Professor Hammond and Mr Binns (Southampton University) for investigations of rotating electrical machines;

(d) a grant of £179K over 4 years to Professor Tobias (Birmingham University) for research in metal forming and associated areas;

(e) a third instalment of terminals for the interactive computing facility at a cost of £198K.

(*iii*) *Nuclear Physics*

two grants totalling £434K over 1 year for maintenance of accelerators for nuclear structure research at Glasgow (£164K) and Oxford (£270K).

(*iv*) *Science*

(a) a grant of £150K over 4 years to Professors Heine, and Sir Sam Edwards and Dr Inkson (Cambridge University) for research on the theory of condensed matter;

(b) a supplement of £39K to Professor Sir George Porter (Royal Institution) for research on primary photoprocesses;

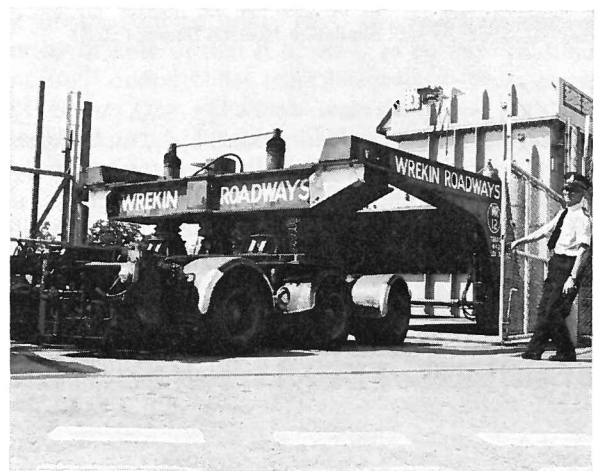
(c) a superconducting wiggler magnet for the synchrotron radiation source at a capital cost of £236K.

(*v*) *Data Compilation*

a grant of £112K over 4 years to Dr Kennard (Cambridge University) for work on the maintenance and development of critical data compilations.

New neutron source at Rutherford

The Government has approved the construction of a new facility to provide intense neutron beams at the Rutherford Lab. The new facility, known as the Spallation Neutron Source (SNS), will serve the needs of university scientists studying the liquid and solid states in physics, chemistry, biology and material science.



The energy storage choke, which was part of the NINA synchrotron at Daresbury Lab, arrives at the gate of Rutherford Lab during July. The 130 ton choke will form a vital part of the power supply for the SNS project

The new source is based upon a high repetition rate (53 cycles per second) high intensity (2.5 $x10^{13}$) protons per pulse proton synchrotron of 800 MeV energy. The proton beam is directed onto a heavy target in which spallation reactions produce intense bursts of neutrons. These neutrons are slowed to thermal energies using an assembly of reflectors and moderating material, and collimated beams pass on to the neutron scattering experiments.

Thermal neutron scattering is a technique used in an increasingly wide range of scientific disciplines. Nuclear reactors have been the usual source of neutron beams for several years, and today about 300 UK scientists use the facilities at AERE Harwell and at Europe's highest flux research reactor at ILL Grenoble. These installations are severely overloaded and there is little possibility of significantly extending the capability of reactors to satisfy the demands of new experiments. However, it is possible to use a *pulsed source* to provide effective neutron fluxes at levels exceeding those of steady state sources but with greatly reduced technological constraints on source cooling, radiation damage etc, and with corresponding financial economies. The SNS is expected to be generally complementary to the existing high flux sources, but for applications well matched to its particular spectral and temporal characteristics will be 100 to 1000 times more powerful.

A Project Committee for the SNS is now operating at the Rutherford Laboratory with Dr G Manning as the Project Leader. Dr L C W Hobbis, Deputy

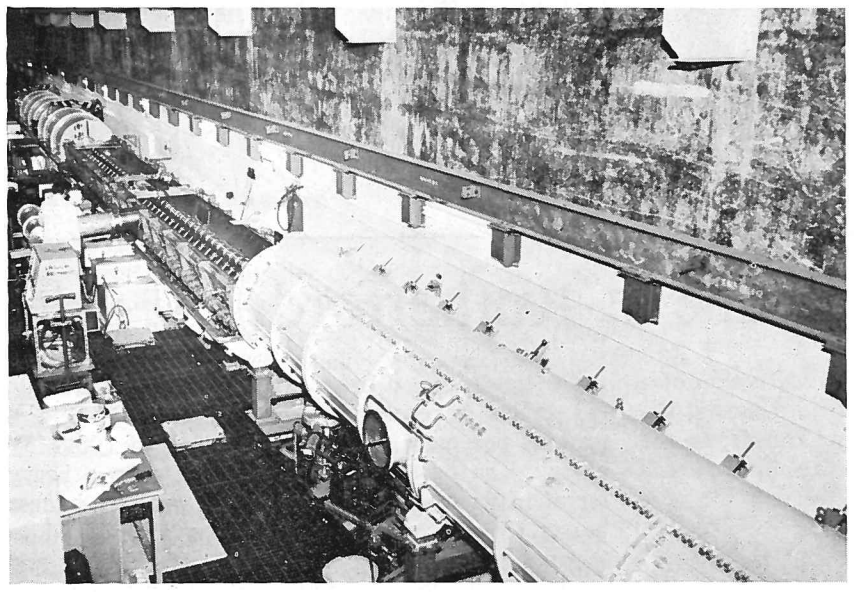
Project Leader, has special responsibility for utilisation. Where appropriate, the Rutherford Laboratory is advised by a Science Planning Group (a Sub-Committee of the Neutron Beam Research Committee) representing user interest and chaired initially by Dr B E F Fender of Oxford University.

The detailed design of the SNS is now well advanced. The construction and installation will start in 1978 following the closure of Rutherford Lab's 7 GeV proton accelerator, Nimrod. The estimated capital cost of the basic facility is about £8 million spread over approximately five years. In addition, up to £3 million will be spent on providing appropriate research equipment. The Science Planning Group is presently assessing the possibilities of the future scientific programme with a view to defining the experimental facilities.

Striking economies have been possible in the cost of the SNS facility by using existing plant and buildings, leading to savings of close to £20 million. It is planned to use the new Nimrod injector, Nimrod beam handling magnets, vacuum and control equipment, the extensive service network, steel and concrete shielding and also the magnet power supply from the NINA accelerator at Daresbury Laboratory. No new buildings will be needed.

The optimisation of the final design parameters is being pursued with tests using the Nimrod accelerator at an energy of 0.7 to 0.9 GeV and sending short pulses into the target area. Experiments performed during August include a series of measurements of thermal neutron yields, spectra, and pulse shapes, for different targets (uranium, lead), moderators (water, polyethylene) and reflectors (beryllium, graphite), in different combinations and geometries. These results will be valuable in determining the final design of the SNS.

The SNS project is at present the most advanced of its kind, and is attracting international interest. The first experiments are planned to begin by the end of 1982.



A view of the new 70 MeV proton linac, recently commissioned, which is to be used as the injector for the Spallation Neutron Source (SNS)

Sports Day 1977

The SRC Sports Day on 13 July took place on one of the cool cloudy days that have been typical of this summer: nice for competitors but not so pleasant for spectators. Sir Sam and Lady Edwards spent part of the afternoon watching the keen competition between the establishments, and prizes to the victorious were kindly presented by Mr and Mrs Walker during the early evening.

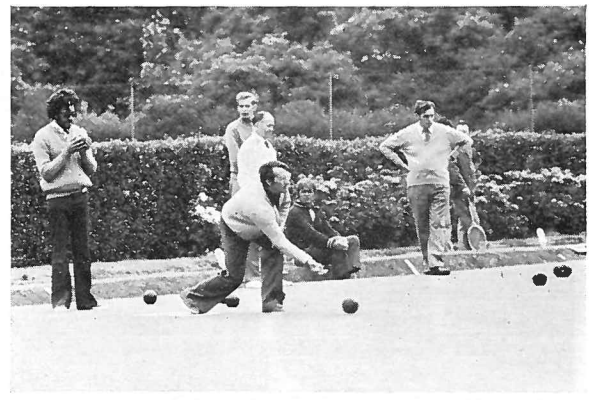
One new event was added this year: bridge—and it proved successful enough to be worthy of a permanent place in the future. The other competitions were, as usual, football, netball, tennis, bowls, cricket and chess.

The football competition attracted a lot of competitors, with 15 six-a-side teams entering. The competition was organised in four leagues. The eventual winners were the London 'A' team beating Rutherford 3-2 in an exciting final. This win was particularly worthy of note in that it appears to be the first time that any London Office team has won an event at an SRC Sports Day. (The team went on to win both the knock-out and league Civil Service Subsidiary Championships for the London Region.)

Four teams entered the netball competition, from London Office, Daresbury, Appleton and Atlas. The Daresbury team were the winners, thus retaining the cup that they won in 1976, winning all of the five games that they played and beating the Atlas team by 26 goals to 4 in the final.

Two tennis competitions were held: mixed doubles and men's doubles. The mixed doubles attracted a large number of entries. It was played as an American Tournament with two couples meeting in a three set final where Brian Yates and Eileen Robson of Daresbury beat Richard Smith and Shelagh Akrivos of Appleton. The men's doubles was won by Paul Gardner and Arthur Robert of Appleton, who won all the sets they played.

London Office 'B' team

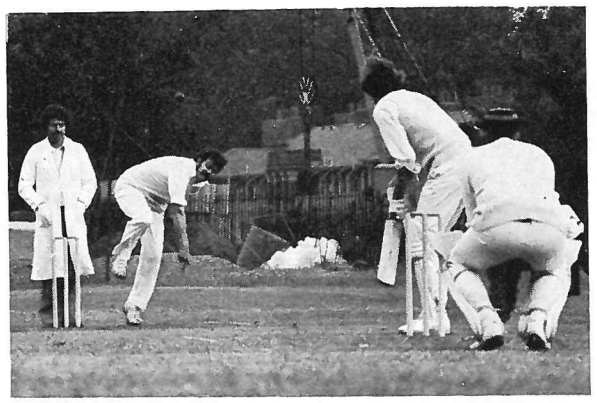


Daresbury v London Office during the bowls competition

Atlas v Appleton

There were also two bowls events. The pairs tournament was won by Brian Blackwell and Albert Knight who beat Tex Mooney and Albert Wilkinson in an all Daresbury final. The Triples Cup was retained by a Rutherford team: Cyril Grindrod, Peter Knight and Alec Goodsell, who beat the London Office team of Harry Cook, Ron Sommerville and Jack Sawyer in the final.

In the quieter atmosphere of the marquee the chess and bridge competitions were held. The chess was, as usual between teams of three. Seven teams entered and the winners were the Appleton 'A' team of Eric Bramley, Dudley Long and Terry Burns. The best individual performance was from Eric Bramley who won all his five games. The second placed team of Jim Riddle, Peter Hemmings and Andy Williams

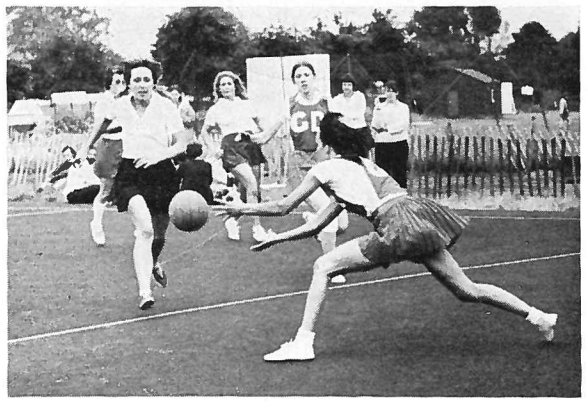


Rutherford bowling

Rutherford 'C' team take a break

(Rutherford) lost by only one game. The bridge attracted nine pairs and the Appleton pair of W Bain and D McEwan were the winners with a Rutherford pair, Jim Riddle and Peter Hemmings, finishing in second place.

After the presentation of the prizes a disco was held in the pavilion during the evening. Thanks are due to the Appleton Laboratory for organising it, and also to all the people who organised and refereed the events and manned the first-aid post.



Daresbury v London Office

The cricket competition was rather different this year. In previous years the standard 11-a-side tournament had often taken a long time to complete with the winning team missing the prize giving. So to make the event shorter, and more exciting for spectators, we experimented with a six-a-side tournament with each innings limited to four eight-ball overs. There were two leagues of four teams and the winners of each league met in a final, which was won by the RGO 'A' team beating an Appleton team which has not lost a wicket in reaching the final by eight runs.

Newsfront

New Director for Appleton Lab

Dr Fred Horner, former Deputy Director of the Appleton Laboratory became its new Director in succession to Dr Saxton, at the beginning of July.

Dr Horner, who was educated at Manchester University, began his career in the Radio Division of the National Physical Laboratory (NPL) in 1941. This became a separate organisation after the war and has evolved into the present Appleton Laboratory. In 1947 he began a two

Dr F Horner

year tour of duty with the United Kingdom Scientific Mission in Washington DC.

Since 1950 he has been increasingly involved in international matters in radio science, becoming Secretary of the Inter-Union Commission on the allocation of frequencies for Radio Astronomy and Space Research. He is also UK Chairman of Study Group 2 of the International Radio Consultative Committee (CCIR). This study group is concerned with the topics of space research and radio astronomy as they relate to radio communication.

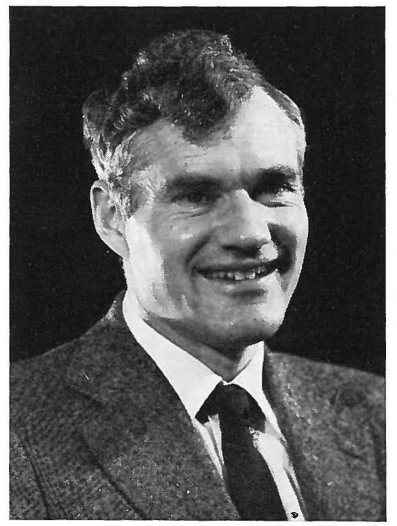
His career in research has been principally devoted to the study of radio noise, particularly that resulting from lightning. This work gained him a DSc of the University of Manchester. He was appointed Deputy Director of the Laboratory in 1969.

An active sportsman, Dr Horner's enthusiasm and skill as a tennis player are well known. Partnered by Mrs Horner he has successfully represented the Laboratory on many occasions.

Dr Henry Rishbeth

We offer our sincere congratulations to Dr Rishbeth on his appointment as Deputy Director of the Appleton Laboratory.

Born in 1931, he attended the Perse School, Cambridge and entered Christ's College in 1951. A period of post-graduate research at the Cavendish under Mr J A Ratcliffe was



Dr Henry Rishbeth

followed by radio-astronomical studies at the Radiophysics Laboratory, Sydney, Australia, after which he returned to Cambridge.

He first came to Ditton Park in 1960 on his appointment as a Senior Research Fellow. During 1962-64 he held a consultant post at the Central Radio Propagation Laboratory, Boulder, USA and returned to join the Staff of RSRS in 1965. In 1971 his work gained him the ScD of the University of Cambridge. In 1972 he was promoted on Individual Merit to SPSO.

As an expert in the theory of the ionospheric F region, Dr Rishbeth has an international reputation; he is the author of numerous papers on the subject and co-author, with Professor Owen Garriott, one of the US 'Skylab' astronauts, of the book 'Introduction to Ionospheric Physics'. His current work includes a major contribution to the development of the European Incoherent Scatter Facility (EISCAT).

Dr J A Saxton

Dr J A Saxton, who retired at the end of June from his position as Director of the Appleton Laboratory, began his long career in government science when he joined the staff of the National Physical Laboratory in 1938. Prior to that, his early research at Imperial College, after gaining a first in physics, was carried out in the field of artificial radio-activity.

Subsequently however, at NPL, his interest was engaged by those problems of VHF radio wave propagation which, in view of the marked influence exercised by meteorological factors, has grown into the very considerable study of radiometeorology. It is in this branch of science that he has become a notable authority.

In 1960 he was appointed the Deputy Director of the Radio Research Station, as the Appleton Laboratory was then known. It had become an establishment separate from NPL in 1956. In the academic world he has held positions as Visiting Professor, first at the University of Texas and latterly at University College, London and has also held high office in the Institution of Electrical Engineers.

The international representation of science has made increasing demands on his time and abilities. In the United States he has been Director of the UK Scientific Mission and

Dr J A Saxton

Scientific Counsellor at the British Embassy. The International Radio Consultative Committee (CCIR) of the International Telecommunications Union has benefited from his advice, as has the International Scientific Radio Union.

Dr Saxton's retirement from the Laboratory is in no sense a retirement from his profession. He acts as Radio Propagation Consultant to the Home Office and continues as Internation Chairman of Study Group 5 of the CCIR.

Pictured above is Mr K E Welch, London Office who was awarded the MBE in the New Year Honours List. With him at Buckingham Palace is his daughter Mrs Judith Thompson, ex-SRC

Pictured right: Mr R D Prince, Appleton Laboratory who was awarded the BEM in the New Year Honours list. With him are Lt Col Palmer, Vice-Lieutenant of Berkshire who made the award and Mrs Prince

Evening Post, Reading

Birthday Honours

Her Majesty the Queen has been pleased to award Honours to the following: Professor F C Frank FRS and Dr R E Richards FRS were made Knights Bachelor; Professor N A Dudley and Professor J C West were awarded the CBE; Professor L Maunder and Mr J F Smith were awarded the OBE; and Mr J M Reordan the MBE.

Professor Frank is a former member of the Metallurgy and Materials Committee.

Dr Richards is a former member of the Chemistry Committee.

Professor N A Dudley is associated with the Teaching Company scheme.

Professor J C West is a former member of the Control Engineering Committee.

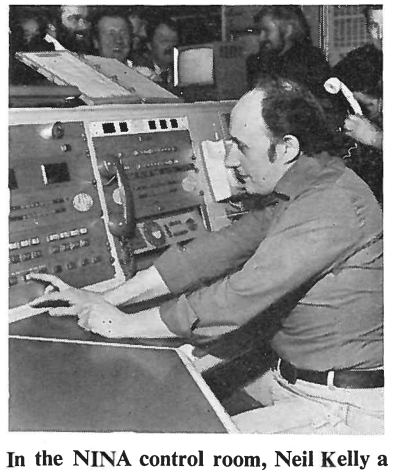
Professor Maunder is a member of the Engineering Board, Chairman of the Manufacturing Technology Committee and Chairman of the Working Party for the Teaching Company scheme.

Mr Smith is a Principal Professional and Technology Officer at the Appleton Laboratory.

Mr Reordan is a Personal Secretary at London Office.

"Goodbye to NINA"

At twelve noon on 1 April 1977, NINA, the 5 GeV electron synchrotron at Daresbury Laboratory, was closed down at an informal ceremony co-ordinated by the Deputy Director, Dr R G P Voss. Professor W Galbraith (University of Sheffield), Dr M Ibbotson (University of Manchester and Dr J C Thompson (Daresbury Laboratory) paid tributes to NINA on behalf of the particle physics users and Dr I H Munro (formerly University of Manchester and now Daresbury Laboratory) followed on behalf of the users of the NINA Synchrotron Radiation Facility. Mr G Saxon closed the proceedings by saying: "Goodbye to NINA but long life to the SRS and to the NSF".



In the NINA control room, Neil Kelly a member of the crew for the day, switches NINA off for ever

Farewell to

Mr H M Smith OBE

Mr H M Smith, RGO, retired on 3 June. Mr Smith joined RGO as Head of the Time Department at Greenwich, on 1 October 1936 in which capacity he served until 30 September 1976, thus completing forty years as Head of Department. During his service with the Observatory he held many important appointments in international organisations. He was awarded the OBE in 1973.

Mr P S Laurie MBE

Mr P S Laurie, RGO retired on 4 May. Mr Laurie joined RGO as a Temporary Computer on 28 January 1935 and was in charge of the Solar Department from 1957 until 1974 when he became responsible for archives. He was awarded the MBE in 1975.

Mr P J Bowles

Rutherford Lab's Chief Engineer, Mr P J Bowles, retired at the end of June, thus bringing to an end, a 30 year association, first with AERE and since its inception, the Rutherford Lab.

Mr Bowles was educated at Manchester University where he obtained a First Class Honours degree. This was followed by a two year graduate apprenticeship with Rolls Royce; he remained with the firm for a further two years obtaining his M Sc by external thesis.

He joined AERE, Harwell in 1947 and eventually became Head of the Engineering Division and Deputy Chief Engineer. After completing a number of major projects for Harwell, he became Project Head for Nimrod, the 7 GeV proton synchrotron which was built for the newly formed National Institute for Research in Nuclear Science. Not only did he successfully complete this very difficult project but he then went on to build a large part of the Rutherford Lab.

His outstanding services in the fields of both electrical and mechanical engineering (he is a Fellow of both the Institution of Electrical Engineers and the Institution of Mechanical Engineers) resulted in the award of the OBE in 1966.

Although now retired from the Rutherford Lab, he still has one major project to complete—the new SRC headquarters at Swindon a project far removed from his wartime experiences with Rolls Royce but perhaps not so very different to his first job at the age of 14 with a firm of builders!

Picture shows Nathy O'Hora (left) making a presentation to Humphrey Smith *Photo: Charles Parker*

Professor Graham Smith (left) makes the presentation to Phil Laurie

From left: Dr Stafford, Director RL and Mr and Mrs Bowles

Special Promotions

Congratulations to Dr K Nandy (ROE) who has been promoted to Deputy Chief Scientific Officer and to Dr L Thomas (AL) and Mr C W Trowbridge (RL) who have been promoted to Senior Principal Scientific Officer on the recommendation of the Individual Merit Promotion Panel.

Dr K Nandy

Dr Nandy joined the ROE in 1963 after completing his Ph D at Edinburgh University. His work has been mainly concerned with the composition and spectral distribution of interstellar dust. What is the chemical

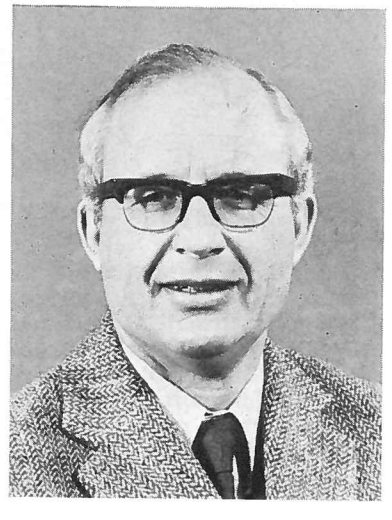
composition of the dust that dims and polarises the starlight? Where and how are they formed? Does this composition of dust vary across the galaxy? How does the extinction and polarisation of starlight vary with wavelength? These questions have been systematically investigated at first from the observations obtained with the small telescopes at Edinburgh. Gradually the observations have been extended using larger telescopes in the UK and Europe and the results have been widely published, including the ultra-violet interstellar extinction obtained from the analysis of the extensive data available from the S2/68 experiment in the TD 1 satellite.

Dr Nandy has now transferred his interest to extragalactic astronomy. He and his colleagues have developed a reliable method of determining radial velocities of faint galaxies to the detection limit of the objective prism photographs taken with the UK Schmidt telescope. These measurements undertaken with the fast measuring machine Cosmos (see Quest Vol 7 no 3) have provided for the first time the radial velocities and angular diameters of a large number of faint galaxies. In addition, Dr Nandy is a Fellow of Edinburgh University (1972) Fellow of the Royal Society of Edinburgh (1972) and an Honorary Research Fellow of the University College London (1976).

Dr Nandy has just returned from a visit to the Vilnins Astronomical Observatory in the USSR. As a hobby he is editing film which he has taken during his visits to countries throughout the world.

Dr Lance Thomas

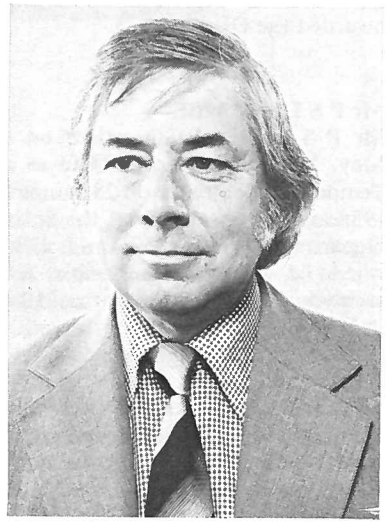
Dr Thomas graduated in Physics at the University College of Wales at Swansea in 1950 and continued research there, obtaining a PhD for his ionospheric studies in 1953. He joined Ditton Park in 1959 and was soon able to advance his work further, making valuable contributions to a number of investigations in atmospheric and ionospheric physics. In 1970 he took over leadership of the Laser Group, which benefited greatly from his knowledge



of mesospheric and stratospheric theory.

He was awarded a DSc in 1972 and is now a leading authority on the theory of the middle atmosphere, being much in demand to advise on the use of lasers in atmospheric research, eg from Spacelab.

Mr C W Trowbridge



Mr Trowbridge obtained an external London University Honours degree in Physics after joining AERE Harwell as a Scientific Assistant in 1957.

At the Rutherford Lab, his work on ion source development and optics calculations for the Oxford Electrostatic Generator (1961-67) involved the extensive use of digital computers for the solution of electrostatic field problems.

In 1967 he became leader of a group dealing with computational aspects of work in Applied Physics Division. The introduction of interactive graphics techniques in computer aided design of apparatus, also the development of new algorithms for the solution of three-dimensional non-linear electromagnetic fields, has led to the use of these techniques in laboratories throughout the world.

Last year he chaired the first International COMPUMAC Conference on the computation of magnetic fields held at Oxford.

Murder in the Cathedral

or The Mummer's Tale

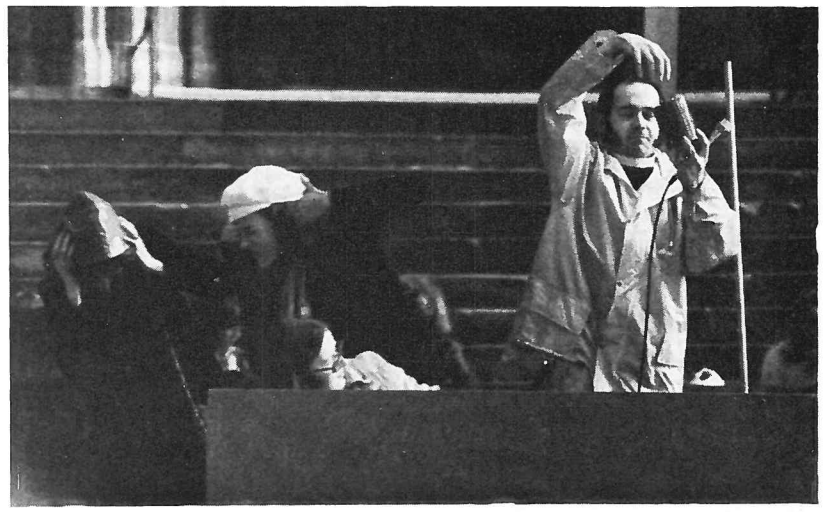
The Travelling Salvation Road Show had been in preparation for perhaps five months. We had devised the show, written the script (and most of the songs), made the set, rehearsed, panicked, and rehearsed again. Above all, we had put together a tour with, as a grand climax, a performance in Canterbury Cathedral. Now we are eating a hasty tea before our public dress rehearsal. A car pulls up, and people get out, looking lost. It rapidly transpires that our audience have been told different starting times, ranging from 7 to 8 o'clock, with a majority vote for 7.30. We give the early arrivals a cup of coffee. A reasonably good show—someone actually thinks the jokes are funny.

Next day we perform at West Wycombe. Our one real piece of scenery—a bus side—is travelling on a car roof rack belonging to one Michael Jakins. Michael arrives with roof rack in a collapsed state, but no bus. We discover that roof rack, bus, and all suddenly took off and landed in a ditch, whence the bus was rescued by our Director following behind. Damage fortunately is minor. We rehearse. Nearest loo is ¼ mile away down a steep hill. We were offered the use of the gardens, but these are floodlit at night, so we have a temporary Elsan in the bell tower. At tea-time (one unsatisfactory sandwich each) there is a mass expedition in search of alternative facilities. The more sensible seek them, and further sustenance, in the nearest pub. A packed house.

Next Sunday we perform in Finchley. No disasters, and an audience that will laugh at anything.

Good Friday, and the grand Kent tour begins. We travel to Dover and rehearse in a great barn of a building, struggling against appalling acoustics, and taking most of our lines at half speed. An audience who didn't quite know what to expect—"I thought it was some kind of service" said one in the interval.

Next day we are at Deal, having to erect our own stage in very



The intrepid author tackles an unexploded bomb

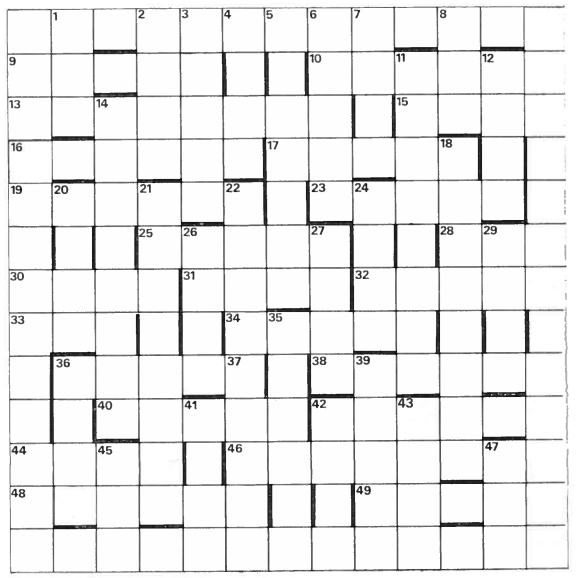
limited time. It is rather too small—beware of the edge—and almost all the entrances have to be made from the wrong side up a narrow set of steps. Somehow, everything works and the audience do all the right things.

A day's rest, then we go to Canterbury, to perform to several hundred footsore teenagers who've walked there from all around. As I arrive, the Director corners me. "We've been told the second half mustn't be longer than 45 minutes, and it's running at 50. Look through and decide what to cut". We decide to drop one song from the middle of a sketch. Very little rehearsal, and we're into the first half. It's murder. The acoustics are terrible, and the audience (probably because they can't hear each other) don't seem to be reacting. All round—on both sides and behind us—tourists are walking, chatting, and generally distracting. We soldier on. At the end of the first half, there's a lunch break.

We return to find no audience. (They're still in the cloisters listening to the Archbishop). We're also missing Jeanette (an actress and singer), and Rob (musical director and lead guitarist). Our Director says we'll start anyway. We manage the first song (mainly piano and rhythm guitars), and the first sketch, and fumble through the second song with our pianist making a valiant, but doomed, attempt to fill in Rob's part. Into the next sketch, and we're in a state of panic. The Director's wife is trying frantically to learn Jeanette's part for the following sketch, for which she is absolutely central. Rob and Jeanette arrive just in time—they got the starting time wrong. We sigh with relief, and go into Jeanette's big sketch, and the one after. Suddenly the Director appears. "We're cutting the next sketch". No-one's told the people on stage, and the microphones are all in the wrong place. Someone carries them across and we go into a song. At last we manage to coax reaction from the audience and we stumble on to the end.

Beckett didn't know how lucky he was—he should have tried *acting* in the Cathedral.

Peter Casey, author of this article, is Private Secretary to the Chairman.



MAXIM 15

MAXIM 15
The border of the diagram is to be filled with a closed loop formed from a clockwise-running chain of overlapping six-letter words. (Example: ....BIL / LET / HAL / VES / PER / SON / NET....). The 16 words involved are clued in *alphabetical* order.

Clues

Chain
1. Stopped 2. Dose 3. Pesticide 4. Sieve 5. Achieve 6. Fireplaces 7. Reduce 8. Guardian 9. Bird 10. Growing 11. Detector 12. Tennis-player 13. Outing 14. Shorter 15. Roof-support 16. Pests

ACROSS

9. Dull start to day and latter part (5)
10. To get cosily settled down for the night, the accent's on some chocolate (6)
13. Fix blame on our latest letter to depict lions, unicorns, etc (8)
15. Explosive gas combination locks (4)
16. Write about a friend in a truthful way (6)
17. The 'rose-red city', recently built by German physicists (5)
19. Decline the application, it's rubbish (6)
23. Where a maiden might find pollution in her river (5)
25. Monkeys on a pole, they're involved in necking (5)
28. Incline that's ripped up, we hear (3)
30. It's just like Kojak to take part in tribal dance (4)
31. I'd be in a quandary and have to wait (4)
32. Popular religion is work I'm about to start undertaking (5)
33. Prophet found wandering in 47 (3)
34. Badly-adjusted trace seen by box-watchers? (5)
36. Where to see ebb and flow in bar (5)
38. How to get souped-up? Retune, retune! (6)
40. Vapour surrounds California city festivals (5)
42. Caught in the larder, answering back (6)
44. 'Aqua' is example of water-collector (4)
46. Red Indians who'll take one miles off course (8)
48. Does LT mean least temporary? It can do (5)
49. Dam, lost head! Not that! (5)

DOWN

1. One joins the marines, the navy or the air force (3)
2. When fig-leaves started covering the whole human race (4)
3. High places in Russia cast a slur (5)
4. Often found reclining in symmetrical azymptote (4)
5. Was booed loudly and cut off (7)
6. A circle like this is a tube, and a tube like this is a circle (5)
7. Gave up temporarily, and at a suitable time (4)
8. Letter from Greece delivered by jet aeroplane (3)
11. Small-fish gatherer. Quiet now, take the little devil to the queen (8)
12. Lead-acid starter I possess is electrically unsafe (4)
14. Body that advances science meeting very noisily with Heath —mysterious! (8)
18. A. N. Other, I mistake for Jimmy Porter, or someone like him (8)
20. French articles picked up by foreign airline (2,2)
21. One of the French so far dead— that's what wave-forms do (8)
22. A long story depicted without its start or end (4)
24. A big laugh, and how it ends up as well (4)
26. Having the facility to bale out (4)
27. Tea's served—take this (4)
29. River that sounds to be slow about flowing (4)
35. Provide something second-hand, or else held clumsily in both hands (6)
36. What wife is to adoring husband —what's heard at wedding before start of liaison (4)
37. Thanks to the way of the orient, how to distinguish sweet and sour (5)
39. Join! (You've no choice if the shop's closed) (5)
41. She's no star in Las Vegas (4)
42. Sticks up and becomes complacent (4)
43. It's up to one to be opposed to ..... (4)
45. .... verse in modern context (3)
47. Flower arrangement exchanged for goods in Rumania (3)

The prize will be awarded to the first correct entry drawn on 1 December. Please send your entry to the Editor, 'Quest', Room 1532 at State House and state whether you would prefer a book or record token. The solution will appear in the next issue.

Solution to Maxim 14

D	E	C	E	N	C	Y	E	I	G	H	T	S		
O	G	L	E	S	O	D	D	E	R	E	V	E		
R	G	U	L	L	I	E	S	S	I	R	E	N		
I	C	E	B	O	N	N	E	T	T	E	N	S		
C	U	R	S	E	S	O	L	E	N	S	U	E		
O	P	O	S	S	U	M	P	R	A	Y	E	R		
W	I	T	H	B	L	I	S	S	B	R	I	E		
E	F	F	O	R	T	N	I	P	S	O	F	F		
S	L	I	D	E	U	A	B	O	L	E	R	O		
C	O	L	D	E	N	T	I	R	E	L	A	W		
R	E	L	I	C	F	O	R	E	M	A	N	N		
U	S	E	S	H	I	R	T	D	A	N	C	E		
M	A	R	K	E	T	T	H	U	N	D	E	R		

The winner was F Row (Rutherford Laboratory) who wins a £2 book token.

NUTCRACKER 24

Concilia uses the same calendar as Britain, but naturally the days of the week have different names (of Celtic origin). One day the King's secretary was trying to arrange a meeting of his great lords for a date in the following month. "I cannot make any day before the half-way point except the first Lughtig and the second Erustig and Taranistig", said the Earl of Lichton. "I cannot make any date before the first Machatig or after the fourth Lughtig", said the Laird of Ben Druigh. "I am away on the 9th, 17th, 18th, 22nd, and 24th", said Lord Polegate. "I cannot make the first Erustig or Badtig, the third Nudentig or Machatig, the fourth Erustig or the fifth Distig", said the Baron Eppontal. "Er, let me see, the second Lughtig is my birthday, so I certainly can't make the day after", said Lord Moore, "and the third Erustig and Badtig are out too". This left the secretary with only one possible date. Which?

The prize will be awarded to the first correct entry drawn on 1 November. Please send your entry to the Editor, 'Quest', Room 1532 at State House and state whether you would prefer a book or record token. The solution will appear in the next issue.

Solution to Nutcracker 23

The solution is province no 12.
The winner was C V Sukumar (Daresbury Laboratory) who wins a £2 book token.

Jubilee Medals

Some fifty members of the Council's staff were among those awarded the Queen's Silver Jubilee Medal. Only about 30,000 of the medals were issued, about a third of them going to the Armed Services. In general, two criteria were adopted in choosing recipients: that preference should be shown to people who had given service at least throughout the Queen's reign or to those who had some special connection with the Queen or the Jubilee. The medal, struck at the Royal Mint, is in silver and was designed by David Wynn, the sculptor. It is to be worn on all occasions when decorations are called for and the accompanying ribbon is watered white with a central strip of cardinal red, garter blue on each side and finishing edges of cardinal red. The photographs above show the medal and its accompanying scroll.

E II R

BUCKINGHAM PALACE
7th June 1977

By Command of
HER MAJESTY THE QUEEN
the accompanying Medal is forwarded to

to be worn in commemoration of
Her Majesty's Silver Jubilee
6th February 1952 : 6th February 1977

SRC Golf Tournament

The 1977 Inter-Establishment Golf Tournament was held on Friday, 24 June at the St Pierre Golf and Country Club, Chepstow. Eight teams of six players competed for the Brian Flowers Trophy, comprising three teams from Rutherford and Daresbury and one each from Appleton and London Office.

A splendid day was had by all concerned in the magnificent surroundings of the Country Club. In accordance with well established tradition, the Rutherford and Daresbury Laboratories dominated the team scores, with the Brian Flowers Trophy being won by the Rutherford 'B' team (J Connolly, G Manning, G Walker, R Roberts, A Slater, V Thorp). The sparkle of the Rutherford and Daresbury Laboratories' efforts was only dimmed by the performance of Reg Stokoe, representing RGO, who had two magnificent rounds of golf and but for the one individual prize only rule, would have won three trophies outright.

To enable those other golfers who achieved trophies to maintain their pride, we record the recipients of the other minor trophies:

Best net score over 36 holes:
J Connolly (Rutherford)

Best net score (old course):
K Quinton (Rutherford)
D Falconer (Rutherford)
M Jefferies (London Office/ Swindon)

Best net score (new course):
G Manning (Rutherford)