SRC

BULLETIN

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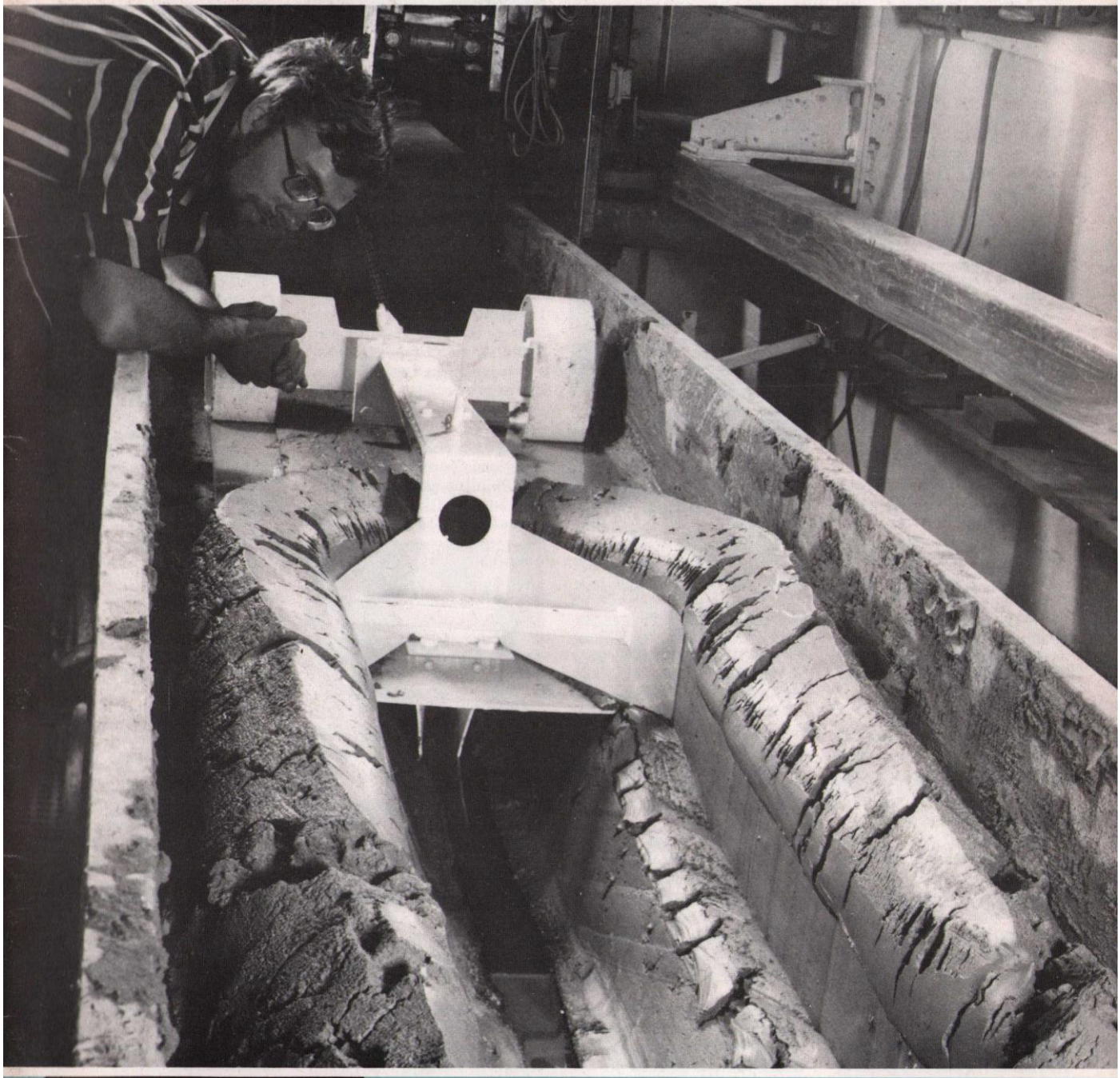

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Cover picture: When cutting a trench for subsea pipelaying, the force needed to drive the plough could be reduced if less clay adhered to the blade. Laboratory tests (shown here is a 1/10 scale model) and full scale trials have been used to study adhesion and the way it varies with the speed of the cutting blade. This work is part of a programme at Newcastle University, supported by SRC's Marine Technology Directorate. Close links have already been formed with a number of offshore companies including R J Brown, Smit International, BP, Single Buoy Moorings Inc. and UDI. Further projects in the MTD programme are pictured on pages 14 and 15.

New Council members

In November the Secretary of State for Education and Science appointed the following new members of Council:

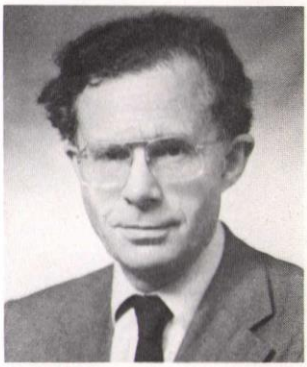
Dr Anthony Challis, CBE, was Director of SRC's Polymer Engineering Directorate until October 1980 when he became the Department of Energy's Chief Scientist in succession to Sir Hermann Bondi, now Chairman of the Natural Environment Research Council. Dr Challis, who is 59, came to PED as Director in 1976 after 30 years with ICI. He joined ICI on completing his PhD at Durham University to work on the chemical engineering of process and

product development and then on methods of polymer fabrication. His later appointments included Research Director of ICI Mond Division, head of their Petrochemical and Polymer Laboratory, General Manager, Company Planning, and finally Senior Vice President, ICI Americas Incorporated. He has been on the Council before but had to resign after only six months (1973-4) in order to make up an ICI appointment in North America.

Professor Jack Lewis, FRS FRIC, has been Professor of Chemistry at Cambridge since 1970 (following professorships at Manchester and University College London) and Warden

of Robinson College since its foundation in 1975. Professor Lewis has served on SRC's Polytechnics Committee, twice on the Chemistry Committee (of which he was chairman 1975-1979) and on the Science Board. He has also served on the CNAA Committee, the Standing Committee on University Entry and the Schools Council. He is the author of many papers mainly appearing in the *Journal of the Chemistry Society*, and has lectured extensively in this country and in North America. In 1970 he received the American Chemical Society Award in Inorganic Chemistry and the Transition Metal Award of the Chemical Society in

Professor K A Pounds, FRS, has been Professor of Space Physics and Director of the X-ray Astronomy Group at Leicester University since 1973. One of the pioneers in x-ray astronomy, Ken Pounds initiated its series of rocket-borne experiments to carry out the first x-ray observations of the southern sky; this later led to involvement in the Ariel-5, Ariel-6 and NASA Einstein Observatory programmes. In the international context, Professor Pounds originally proposed EXOSAT, now ESA's main project in x-ray astronomy, took part in the first US selection of Spacelab missions and recently has been a member of the NASA AXAF working group, charged with defining the principal US thrust in x-ray astronomy during the next decade. He is Chairman of the Astronomy, Space and Radio Board and was elected a Fellow of the Royal Society in March 1981.



Dr Alan Muir Wood, FRS, is Senior Partner of Sir William Halcrow & Partners. His principal fields are tunnelling, geotechnics, coastal engineering, roads and railways and energy. He has been President of the Institution of Civil Engineers (1977-78) and was the first President of the International Tunnelling Association (1975-77); he is the author of many papers and a book on coastal hydraulics. Dr Muir Wood is currently Chairman of the five-man task force sponsored jointly by the SRC and the Department of the Environment to review the R and D needs of civil engineering in this country for the next 20 years.

The Science Research Council is one of five Councils funded through the Department of Education and Science. Its primary purpose is to sustain standards of education and research in the universities through the provision of grants and studentships and to the facilities which its own establishments provide for university research.

The SRC Bulletin summarises topics concerned with the policy, programmes and reports of the SRC.
All publications described are available from the appropriate department of the Council, free, except where otherwise stated. The SRC's Annual Report (available from HMSO bookshops) gives a full statement of current Council policies together with appendices on grants, awards, membership of committees and financial expenditure.
Enquiries and comments are welcome and should be addressed to the editor, Miss J Russell, at the address below. Published by the Science Research Council, PO Box 18, Swindon SN2 1ET. Tel Swindon (0793) 26222.

Council commentary

SEPTEMBER 1980
Council held an important extra meeting this month to consider long term matters of policy which are difficult to discuss at the regular monthly meetings. It took the form of a residential weekend at Oriel College, Oxford. Themes under discussion included SRC's future commitments on research manpower; UK participation in the proposed Large Electron Positron accelerator (LEP) at CERN; the operation of SRC's Central Office at Swindon; and the value of collaboration with industry. Many of these topics were pursued at subsequent meetings.

Research manpower: It was decided that a full review should be carried out of SRC's policies on research studentships. This review was undertaken at a special meeting of the Postgraduate Training Committee in January (see below). In addition the Committee was asked to conduct a wide ranging examination of research studentship schemes.

LEP at CERN: The scientific case for UK participation in the LEP project at CERN was presented fully to the Council and it was acknowledged to be an excellent project and vital to the long-term health of European high-energy physics.

Central Office efficiency: The operation of Council's Office in Swindon and, in particular, measures which might be taken to improve efficiency without detriment to the service offered to the academic community were discussed. Suggested measures, which are now under investigation, included the attribution of the operating costs of Divisions to the Boards, reducing the length of grant applications (since implemented), streamlining the processing of small grant applications and maximising the use of cost-effective office automation techniques.

SRC and industry: Council reaffirmed its belief in the necessity of collaboration with UK industry and stressed to its Boards the need to continue and increase collaborative programmes. Added impetus was given to the development of mechanisms for the industrial use of some of SRC's major central facilities such as the SRS.

OCTOBER
Two of the topics covered were CASE and the computer at Daresbury. Council agreed that under the CASE scheme the collaborating body's payment to academic departments should continue to be mandatory and be increased to £400 pa with indexation annually thereafter. On the other score, Council approved the case for the early replacement of the IBM 370/165 computer at its Daresbury Laboratory while deferring a final decision until the financial implications were more clearly defined.

NOVEMBER
LEP: Council gave its formal approval to UK participation in the LEP proposal as a phased project to be built within an essentially constant budget. A significant feature of the project is that although some of the existing machines at CERN will form an integral part of LEP, they will also continue to be available as experimental facilities in their own right. It has been proposed, therefore, that LEP should be included in CERN's basic programme to ensure the necessary managerial and operational flexibility. The Council's recommendation has now been passed to the DES for ministerial approval. It is estimated that if the CERN Council decides to proceed with the project at its meeting in June 1981, the machine could be available for first experiments in 1987.

Studentships: It was agreed on financial grounds that some reduction was necessary in the number of postgraduate awards to be offered in 1981 (see page 22).

Finance: Council was conscious throughout this quarter that it was likely to incur a significant overspend on its domestic programme in 1980/81. Permission was sought from the Treasury to transfer the savings arising on international subscriptions to offset this overspend and Treasury's agreement to partial transfer was reported in November. Forecasts of expenditure continued to indicate an appreciable overspend and Council therefore took a number of measures to reduce this to a minimum. These included severely curtailing SRC recruitment and imposing strict limits on new external commitments at Council establishments. A moratorium on the announcement of standard research grants was introduced affecting Round One applications. This was lifted in mid-December but the restrictions within Council establishments remain.

DECEMBER
Collaboration with industry: A further example of collaboration with industry was presented to Council in a paper on SRC participation in a linked Satellite/Local Area Networks Project (UNIVERSE). Council welcomed the initiative and negotiations are in progress to establish a formal collaboration involving SRC, DoI, MoD, British Telecom and industry.

JANUARY 1981
The January meeting was replaced by a special Postgraduate Training Committee meeting (see below).

FEBRUARY
M Pierre Aigrain, Secretary of State for Research of the French Republic, accompanied by Mr Neil Macfarlane, MP, Parliamentary Under Secretary of State for Education, joined Council for part of the meeting. M Aigrain spoke informally about Anglo-French cooperation in science and invited a British delegation to return his visit later in the year. Council then gave preliminary consideration to the 1981 Forward Look and discussed the submissions of the four Boards.

STOP PRESS: NAME CHANGE

The Science Research Council has decided that it wished to change its name to the Science and Engineering Research Council. This change was approved by Her Majesty the Queen in Council on 13 April 1981.

Research training: SRC's policies for the future

The Postgraduate Training Committee held a special two-day meeting in January to discuss the future direction of SRC policies on postgraduate research training. The Committee was augmented by Chairmen of the SRC Boards and invited guests. The discussions concentrated on four main areas: the objectives of research training; the numbers to be trained: the quality and duration of training; and industry-related training.

The meeting confirmed that SRC policy should remain that of providing support for the research training of a proportion of good graduates with the right qualities. Emphasis was placed on the importance of good training in the skills and methods of research (and of writing up the research) and on the need to ensure that supervision was of good quality.

The balance of quota and industry-related (primarily CASE) awards appeared now to be right but a need was recognised for greater involvement by small firms in the SRC schemes; it is hoped that the regional broker network can help in this area.

Cooperation in research

SRC's successful experimental grants scheme

The Cooperative Research Grants Scheme, an excellent illustration of academic/industrial partnership, is rapidly becoming one of the most significant projects in SRC's portfolio.

Under the scheme, joint programmes of research are developed by academic departments and industrial companies. The scheme has generated considerable interest since it was set up in March 1979; applications have been received covering subjects ranging from the physical sciences to heavy engineering and involving both large and medium-sized companies. It is hoped that more medium-sized and small companies will in due course take part. So far more than £1.5 million has been committed in support of more than fifty research projects and some of the earliest grants to be approved are nearing completion.

The scheme appeals to companies because it provides external funding for part of the costs of research projects of direct value to them but perhaps beyond the resources of their own R & D departments, and because they can enlist specialist academic expertise to aid their own research efforts.

The SRC supports the academic side of the collaboration; the company makes a substantial contribution in effort, material and expertise. The application for grant is made by the academic partner in association with the company, and any UK company is eligible that is directly engaged in the manufacturing or extraction industries or in supplying commercial services, provided that it intends to exploit the results of the research.

In return for its contribution to the project, a company is assigned any patent or other intellectual property rights arising from the work, subject only to a small royalty to NRDC on successful exploitation.

The field is wide

Projects supported by Cooperative Research Grants cover a wide range, including:

- **synthesis and properties of polymer catalysts and reagents**
- **mechanisms of drug degradation and compaction**
- **biological effects of insecticides**
- **fluidised bed combustion of waste products**
- **artificial intelligence**
- **design of electrical testing and measurement devices**
- **design of telecommunication systems**
- **numerical control of various manufacturing processes eg. tool grinding, steel stripping**
- **development and application of high energy lasers**

In the long run the whole UK economy should benefit from this combination of academic and industrial skills directed towards developing new products or improving processes and increasing industrial efficiency.

The type and range of research sponsored by the scheme are illustrated by the following examples of approved projects.

● High speed production of thermoplastic filaments

The British textile industry can, it is claimed, only remain in competition with overseas manufacturers if it can significantly increase the speed of thermoplastic yarn production. A joint research project, by the Manufacturing Systems Design Centre at Bradford University and leading textile machine manufacturer, Ernest Scragg and Sons Ltd of Macclesfield, is therefore regarded as essential to the industry's survival. It aims to identify the changes required in machine design and process control in order to produce the yarns much faster. The research team will use a test rig provided by the manufacturer and fitted with a rapid response control system based on microprocessors to analyse the variables affecting each stage of the production process. Improvements will be made to the twisting disc system and new design and control parameters will be established to increase twisting rate and product quality.

● Laser facility for materials processing

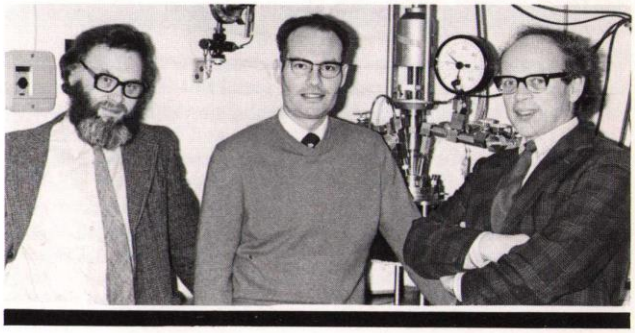
The Department of Metallurgy and Materials at Imperial College, London, has been awarded funds to enhance, in collaboration with Control Laser Ltd, its laser facility for materials processing research. This facility will be one of the most powerful university systems in the world. With the installation of a second 2.5 kW laser the department will be able to conduct a wide range of fundamental research using the two lasers separately for double beam experiments or together for high power single beam studies. The proposed programme includes investigations into laser glazing, high speed weld structures, transformation hardening, surface cladding and surface alloying. Studies will also be undertaken on the laser system itself, in particular the effects of varying discharge characteristics, the use of pulsed electronics and the development of simple coupling optics. This cooperative venture will therefore not only facilitate a major new programme in materials processing but also assist in testing and demonstrating the range of applications for which the laser could be marketed. Other university groups interested in using the facility are invited to contact Dr W M Steen at Imperial College.

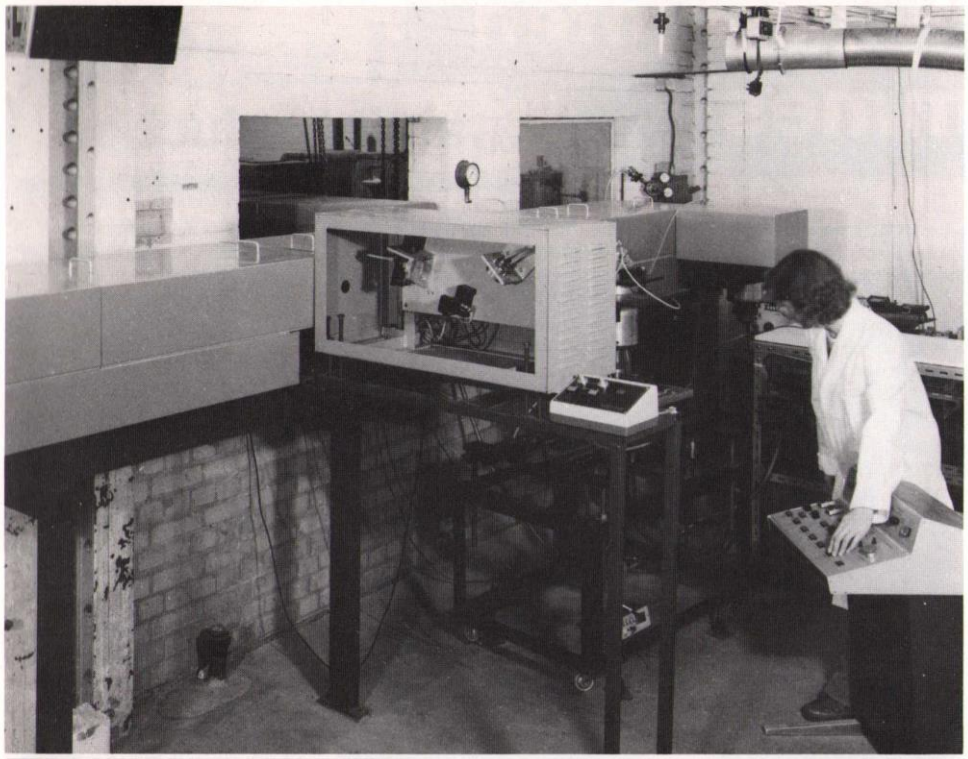
● Acoustic resonance in heat exchangers

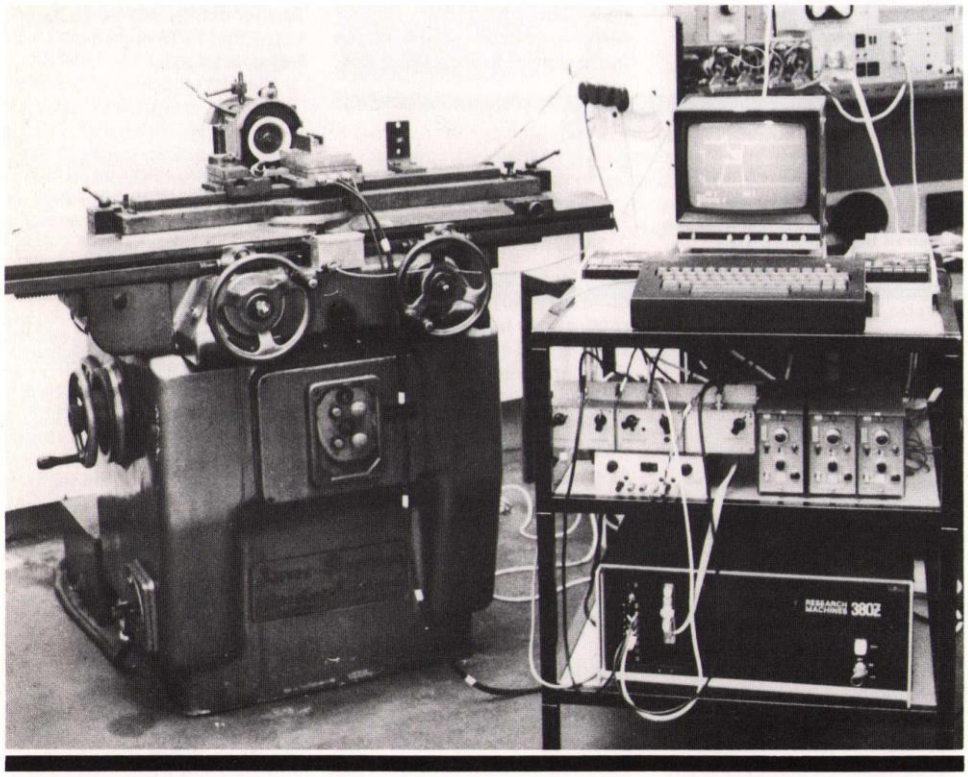
In collaboration with Renfrew boiler manufacturers, Babcock Power Ltd, the Department of Mechanical and Offshore Engineering at Robert Gordon's Institute of Technology will investigate the problems associated with acoustic resonance in heat exchangers. The principal aim of the research is to refine and validate the feedback model of noise generation. A reverberant wind tunnel will be constructed by Babcock's research department and used by RGIT to collect experimental data particularly on the effect of controlled variations in the acoustic damping on the gas velocity at which acoustic instability occurs. It is intended that the results of the research will lead to a significant reduction in the amount of testing currently required during the design stage of nuclear heat exchangers thereby leading to considerable financial savings by manufacturers.

● Novel zeolites

It is believed that the use of zeolites may eventually lead to the cheaper production of existing chemicals because of their greater efficiency compared with conventional processes. Research being carried out by the Departments of Chemistry at Edinburgh and Aberdeen Universities with ICI's laboratory at Runcorn centres upon an investigation into the synthesis and structure of novel zeolites to examine their use as catalysts and absorbents for a variety of chemical processes. Zeolites are







Left: The team of experts from Edinburgh University's Chemistry Department working on a joint project with ICI comprises (left to right) Dr B M Lowe (zeolite crystallisation), Dr D A Whan (catalysis) and Dr H F Leach (adsorption).

Top: The laser facility for materials processing at Imperial College, London, will become one of the most powerful university systems in the world as a result of collaborative programme with Control Lasers Ltd.

Above: The tool cutting and grinding machine used in Bristol Polytechnic's research, in collaboration with Jones and Shipman Ltd: the acquisition and processing of test data is controlled by desk computer.

already used as catalysts, for example, in breaking down hydrocarbons in the process of refining petrol from crude oil and one material can convert methyl alcohol or ethyl alcohol directly into a liquid suitable for use as a motor gasoline or into a high value feedstock for the plastics or fibres industries.

• Performance of highly turbo charged diesel engines

The School of Engineering at Hatfield Polytechnic, in collaboration with a diesel engine company, have a research programme under way to ascertain the major design parameters required to optimise the performance of highly turbo charged diesel engines. Using a single cylinder engine specially designed by the manufacturer, the department will carry out tests on the effects of systematic changes in a range of variables including compression ratio, valve timing, duration and rate of valve opening and closing, fuel injection tuning rate and duration. It is intended that the experimental data obtained will assist designers in planning the next generation of engines with significantly higher boost pressure levels. It is also possible that the prototype research engine may be developed into a marketable commodity.

• Automation of tool and cutter grinding

The aim of a joint research programme, by the Department of Engineering, Bristol Polytechnic and grinding machine manufacturers, Jones and Shipman Ltd of Leicester, is to develop the application of computer numerical control to grinding machines for the small batch manufacture of special tools. Existing grinders will be fitted with microprocessor controlled drives which can be programmed to produce reliable information about the optimal conditions for a wide range of operations. Investigations will involve conventional and semi-permanent wheels. The information obtained is likely to reduce dependence on highly skilled operatives and lead to higher efficiency especially in tool setting.

For further details on the Cooperative Grants Scheme and how it works contact Mr D Harman, at SRC Central Office, telephone Swindon (0793) 26222, ext 2279.

Specially promoted programmes ...an introduction

In recent years the Engineering Board has developed a policy of selective support. The aim of this policy has been to promote and encourage more research by universities and polytechnics in those areas which the Board judges to be of high priority in the national interest. Between 1975 and 1977 the Board launched three major initiatives, covering Marine Technology, Polymer Engineering and the Teaching Company Scheme, and established special directorates to stimulate academic activity in these fields. Since 1977 the Board has also been encouraging its committees to identify, within their individual remits, other areas of national importance which they consider merit special encouragement. This extension of the policy has led to the creation of a number of specially promoted programmes (SPPs).

A specially promoted programme is a discrete group of research projects with clearly defined objectives and target dates. The need for such programmes invariably arises from an SRC enquiry which identifies a serious imbalance between the national importance of a particular field in the industrial context and the inadequate level of corresponding academic activity. The overall objective is therefore to initiate more academic research to provide the essential underpinning for the introduction and development of advanced or improved technology in the industrial sector. Individual programmes are initially developed in consultation with leading academics and industrial companies in the field and take full account of what research is already under way.

When the SPP has been defined and approved by the Board the committee's task is to stimulate, through the short-term injection of a significantly increased level of grant support, sufficient high quality research activities to attain the programme's objectives.

To assist committees in this task SRC has appointed coordinators for most of the SPPs. These coordinators are drawn from the Council's own establishments, from academe or from industry depending on the required technical expertise. Their primary function is to encourage academics to undertake research in the field and assist them in drawing up proposals relevant to the overall objectives of the programme. They also maintain close links with industry to foster industrial collaboration in the research and ensure that industry is sufficiently informed to utilise the results obtained.

The Board expects that each SPP should start to produce significant results within three to five years of its inception and regular monitoring of their progress is carried out. It is envisaged that as the longer-term social and technological needs of the UK change new SPPs will emerge and supercede existing SPPs which have achieved their objectives.

A list of current specially promoted programmes is shown opposite with the names of the coordinators and corresponding SRC officers, and an outline of the aims of the two newest programmes is given below. In future issues of the Bulletin further details will be given of individual SPPs and their progress to date.

SPP in combustion engines

The launch of a specially promoted programme to stimulate more research in reciprocating combustion engineering was announced in the November 1980 *Bulletin*.

It is hoped that the programme will lead to significant improvement in the fuel economy and reduction in the noise and chemical emission levels of conventional petrol and diesel engines while maintaining performance. The following specific research topics have now been identified as requiring special consideration:

- small high speed direct injection diesel engines;
- lean burn, high compression ratio, high turbulence spark ignition petrol engines;
- direct ignition stratified charge spark ignition engines;
- combustion studies, particularly alternative fuels;
- basic studies in automatic control, including improved sensor and activator technology;
- turbochargers and engine/turbomachinery interaction;
- design and structural analysis.

The Machines and Power Committee invites grant applications in these particular areas. It will also welcome and consider for inclusion in the programme any proposal directed towards the primary objective of the initiative.

In launching the initiative the Committee is keen not only to encourage currently supported research groups to expand their activities in the required direction but also to attract the skills of chemical, control and mechanical engineers and pure scientists who may not have previously worked in the field. Applications are therefore invited from any research group which believes it can make a worthwhile contribution to the programme.

Applications should be made in the usual way on an RG2 application form and the normal closing dates will apply.

SPP in construction management

The Engineering Board approved in November 1980 a specially promoted programme to encourage research in construction management in building and civil engineering.

The programme is expected to cost £1.3 million and will take seven years to complete.

Expenditure by the construction industry alone currently amounts to about £16,000 million per annum. Technological developments and the application of research have until recently been slow in the field of building and the current research effort is very small when compared with other industries. A major proportion of the research resources is related to the manufacture and performance of materials and their environmental and functional performance within the fabric of the building. In this area building design standards have improved and substantial economy in the use of material achieved. Very much less work has been devoted to improving the efficiency of building construction. This disparity is surprising since the two aspects involve approximately equal expenditure, and there is every reason to believe that well directed research will make a significant contribution to efficiency and economy in this important area.

The subject is wide and complex but several areas have been identified where research should be taking place on a much greater scale than hitherto. The programme will therefore include work on operational estimating, the relationship of design and construction, the monitoring and control of construction projects, planning and on-site construction procedures, bid assessment and contractual procedures.

Another birthday for IUE

The International Ultraviolet Explorer (IUE) satellite has now completed three years of outstandingly successful operation as an orbiting astronomical observatory. A joint venture of the UK Science Research Council, the 11-member European Space Agency and the American National Aeronautics and Space Administration, IUE has been used by over 600 scientists from all over the world (See *SRC Bulletin,* June 1980).

The satellite was launched from Cape Canaveral, Florida on 26 January 1978 on board a NASA DELTA 2914 rocket and was placed in a geosynchronous orbit, over the Atlantic Ocean. Here the satellite drifts back and forth over the equator at a distance above the earth of between 25,000 kms (15,700 miles) and 46,000 kms (28,800 miles). It remains in constant view from the NASA tracking station at the Goddard Space Flight Centre, Washington, and for at least 10 hours per day from the ESA tracking station at Villafranca del Castillo (VILSPA) near Madrid, Spain.

SRC provided the highly successful ultraviolet sensitive television cameras and the image processing software; ESA provided the solar array and the VILSPA ground station which is also used by SRC astronomers; and NASA supplied and launched the spacecraft, and operates the American ground station in Maryland, USA.

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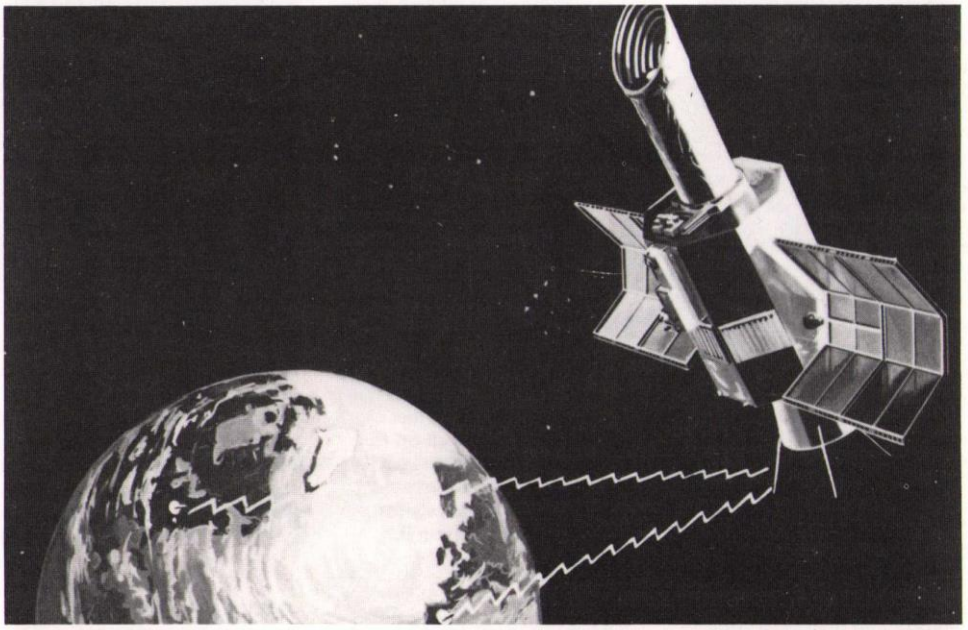

An artist's impression of the International Ultraviolet Explorer in its geosynchronous orbit above the Atlantic Ocean. The telescope mirror sits protected in the body of the satellite but the telescope tube can be seen extending upwards from the spacecraft. On the top of this tube there is a sun baffle which is designed to minimise the amount of scattered sunlight entering the telescope. Note also the solar panels. The spacecraft antennae are used to transmit the ultraviolet images to the two ground stations.

Specially Promoted Programme	Coordinator	SRC Contact*
Efficiency of Production Systems	Mr J G Waterlow 12 Clivedon Place London SW1 tel 01-730 6595	Mr F W Swales ext 2108
Application of Numerical Control to Manufacture	No coordinator	Mr M J Hotchkiss ext 2155
Robotics	Mr P G Davey RAL (Chilton Site) ext 6106	Deputy Coordinator Dr P C L Smith RAL (Chilton Site) ext 479
Dies and Moulds Manufacture	Mr P Gough Cheshire Engineering and Design Consultants Ltd 27 Park Street Macclesfield Cheshire tel Macclesfield (0625) 21222	Mr M J Hotchkiss ext 2155
Grinding Technology	Mr R Palmer Ray Palmer Associates Ltd 'Frogmore', Frogmore Lane, Fen End, Kenilworth, Warks. tel Berkswell (0676) 34297	Mr M J Hotchkiss ext 2155
Biotechnology	To be appointed	Dr K J Coleman ext 2101
Instrumentation and Measurement	Mr J Tallentine Room 510, Physics Department, City University, St Johns Street, London EC1V 0HB tel 01-253 4399 ext 370	Miss J A Spring ext 2401
Device Fabrication Facilities	Mr W Turner RAL (Chilton Site) ext 286 **Industrial Consultant** Mr L Manns Flat 23, Sherwood, Herne Road, Surbiton, Surrey KT6 5BU tel 01-390 0425	Mr A Kurzfeld ext 2161
Information and Communications Systems	Dr J Norbury RAL (Ditton Park Site) Mr P Wilde RAL (Chilton Site) ext 596	Dr P Sharma ext 2235
Distributed Computing Systems	Dr D Duce RAL (Chilton Site) ext 511	Mr J Monniot ext 2260
Coal Technology	No coordinator	Mr G D Richards ext 2350
Advanced Ground Transport	No coordinator	Mr C C Bray ext 2102
Combustion Engines	To be appointed	Mr J E Farrow ext 2117
Biomaterials	Dr E A Mason, Manager Dental Products Department, ICI Limited Pharmaceuticals Division Macclesfield SK10 2NA tel Macclesfield (0625) 582828 ext 6667	Mr S D Ward ext 2110
Energy and Materials Conservation	Dr J Butterworth RAL (Chilton Site) ext 275	Dr S J Milsom ext 2338
Energy and Building	Mr B Day Department of Architecture Bristol University 25 Great George Street Bristol BS1 5RA tel Bristol (0272) 298473	Mr N L Williams ext 2353
Construction Management	To be appointed	Mr N L Williams ext 2353

* at Swindon (0793) 26222 unless otherwise stated.

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From its vantage point high above the earth's atmosphere, which is opaque to ultraviolet rays, the 45 cm diameter telescope on board collects radiation from astronomical sources and directs this to one of two spectrographs (two are needed to cover the full wavelength range). A spectrum of the input radiation is produced which is detected by the UV-sensitive television cameras and converted to video signals for telemetring to either the GSFC or VILSPA ground stations. In this way a spectrum covering the wavelength region from 1150-3200 Å can be obtained.

The telescope is used by astronomers in the same way as they would a ground-based optical observatory–a novel approach to operating a space telescope and one that works well. The astronomer prepares a list of suitable targets and photographic charts; then at the start of the shift the first target is related to the satellite and the telescope is moved to acquire the target. Once acquired, a quick integration of the telescope's field of view is transmitted back to the ground station and displayed on a colour graphics terminal. The astronomer searches the photographic chart trying to find the same pattern of stars as displayed by the terminals. Once the field is recognised, fine tuning of the telescope's position brings the object into the centre of view. The exposure is then started by command from the ground station. On completion, the spectrum is read down and displayed on the terminal. A quick check by the astronomer and the telescope is off, searching for the next object.

In its three years of operation the IUE has obtained approximately 20,000 ultra-violet spectra of astronomical objects. These images, stored on magnetic tape are kept in the SRC World Data Centre at RAL Ditton Park site and are available for use by astronomers in Britain and elsewhere. The data archive is unique; undoubtedly it is the largest and most important collection of astronomical spectra held by any observatory. Its importance in the future development of observational astrophysics cannot be over-stressed. It will be a major archive for astronomers in the forseeable future.

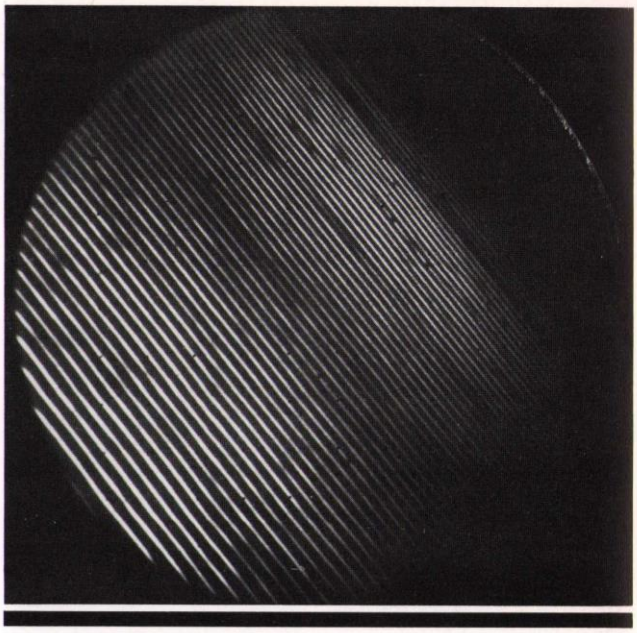
Staff at RAL Chilton site are still closely involved in management of the IUE project as well as in active collaboration with university scientists on astronomical research with IUE. One responsibility that RAL staff have is to ensure that all intending UK observers are fully trained on the use of the IUE, thereby ensuring that telescope time is not wasted or the satellite endangered by unsafe procedures. Staff also make arrangements for the 80 or so visits by UK observers to Madrid that take place each year.

The SRC's share of IUE time in any one year amounts to roughly 160 eight-hour shifts. Telescope time, which is allocated by an Observatory Committee each year, is heavily oversubscribed by UK astronomers. Indeed, to have met in full the demand from British scientists would have required three times our yearly allocation. Instead it was necessary to cut back on the amount of time given to projects and, in some cases, to make no time allocation, even though the research proposal was feasible and worthwhile.

Why is telescope time so sought after? One reason is the flexibility of the instrumentation on board the IUE. The design of the spectrographs is such that it allows the astronomer to study bright objects at very high resolution or–at the press of a button at the ground station–faint objects at lower resolution. Another reason for the success of the mission is that the sensitivity of the UK designed cameras is remarkably high. They allow study of objects that to the (ultraviolet) eye are very faint indeed, such as external galaxies and those enigmatic objects, quasars.

Spectroscopic studies of most of the primary objects in the solar system, including Jupiter and Saturn, asteroids and comets, have been made.

In stellar astronomy a large variety of studies has been made of stars of all types from the very young to the highly evolved. Extensive stellar winds–material driven off the atmospheres of stars–have been detected in the hotter, more energetic stars. This discovery is causing scientists to rewrite the theories of stellar evolution. The IUE has also proved successful in studying the coronae and chromospheres of cool stars– a somewhat unexpected bonus as it was not fully realised at first that these objects would be accessible in the ultraviolet.



A typical ultraviolet spectrum obtained in the high dispersion mode with the IUE. The full extent of the faceplate is shown here, each diagonal bright strip being a small part of the complete ultraviolet spectrum. There is sufficient wavelength overlap between each diagonal to allow a complete image of the ultra-violet spectrum to be built up. Stellar absorption lines, due to atoms in the atmosphere of the star, can be discerned as dark lines in a few of the individual spectra – especially those in the upper, middle and right of the photograph.

Exciting discoveries have been made in the interstellar medium. Perhaps the highlight here is the detection of a hot ($T \sim 10^5$ K) halo enveloping our own galaxy, extending out to perhaps 10,000 parsecs, as well as possible similar halos associated with our nearby extragalactic neighbours, the Small and Large Magellanic Clouds. This work has significance to the long-standing question of the origin of the multiple absorption lines in high redshift quasars and indicate that part of these could be produced in the halos of intervening galaxies.

In extragalactic astronomy IUE has made major contributions. Here the work tends to be truly international in nature. Because of the faintness of many of the targets, astronomers in the UK, in the USA and the ESA countries have shared and combined IUE observing shifts. Such international collaboration is very beneficial to the astronomical community as a whole.

A most exciting observation carried out quite recently was the observation by the IUE of the 'twin' quasar which is believed to be a double image of a very distant quasar formed by a massive intervening galaxy which is acting as a gravitational lens. The ultraviolet spectra of the twin, although faint, are highly consistent with this picture.

The satellite was originally designed to have a minimum life of three years. However, it is clear that as the Observatory is still performing very well indeed, its useful life should extend well beyond this original forecast. It is good news for the astronomical community that all three sponsoring agents have decided to continue operating the satellite as long as is justified by the scientific return. We look forward to more exciting and unexpected discoveries with the IUE in the future.

UK Project Director: Professor R Wilson CBE FRS (UCL)
UK Project Manager: Mr P Barker OBE (RAL)
Deputy Project Manager: Mr M C W Sandford (RAL)
UK Resident Scientist (VILSPA): Dr P Goudhalekar (RAL)
UK Resident Scientist: Dr J C Blades (RAL)

Minister sees the site

The proposed Large Electron Positron (LEP) storage ring at CERN will have a 27 km circumference. Indicating a possible location for the ring on a map of the laboratory region is Professor H Schopper, CERN's Director General, during a visit to CERN in March by UK Secretary of State for Education and Science, the Rt Hon Mark Carlisle, QC, MP. With Mr Carlisle and Mr C M Regan of DES is British physicist Dr Erwin Gabathuler (right) who is the laboratory's New Research Director. Ulster born Dr Gabathuler was a research physicist at SRC's Daresbury Laboratory until he moved to CERN in 1974 to initiate the programme of muon scattering at the SPS by the European Muon Collaboration, in which the laboratory and five UK universities were involved. Since 1978 he has been head of CERN's Experimental Physics Division.

Other new Directorate appointments at CERN are: Research Director: Professor R Klapisch (France); Technical Director: Dr G Brianti (Italy); LEP Project Leader: Dr E Picasso (Italy); Administrative Director: Dr R F Heyn (Netherlands).

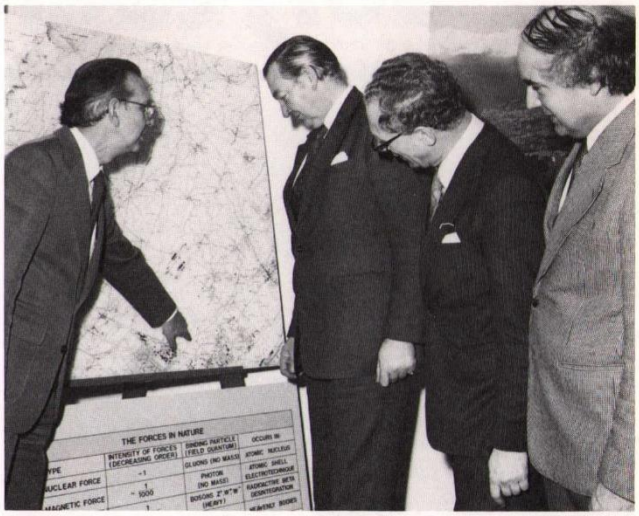


Photo: CERN

Britain on show at CERN

A trade exhibition of British equipment was held at CERN in September 1980, at which 21 UK firms presented their latest technology. The event was organised by the British Electrical and Allied Manufacturers' Association (BEAMA) on behalf of the Group of Associations of British Instrumentation, Control and Automation (GAMBICA). The exhibition, which has now become a regular biennial event, was arranged under the joint venture terms of the British Overseas Trade Board and in association with the commercial department of the British Consulate-General in Geneva.

Apart from any potential 'spin-off' from scientific research of the sort carried on at CERN, there are very clear and immediate commercial benefits that can arise from gaining a supply or development contract associated with the research, as was demonstrated by the willingness of the firms represented at the exhibition to go to CERN and display their goods and services. The high technology involved in research in high-energy physics, where equipment is often required to work at the limits of attainable performance, can lead to a product development for which a more everyday market will exist in a few years' time.

This train of development is of course well known in the electronics industry, where so many new products owe their existence to applicational requirements. Less advantage is taken of the opportunities in other sectors of industry, and SRC is making efforts to publicise to UK industry in general the potential benefits of the CERN market, which range from opportunities to participate in prototype development to the chance to secure a contract that will make some money.

In collaboration with the Department of Trade's European Trade Committee, a seminar was held in October 1980 to introduce CERN's next major capital project (the LEP particle collider) to a group of firms from the civil engineering and heating and ventilation industries.

A similar event for the technical press was held in London in February 1981 and it is hoped to arrange further such events over the next year or so.

West Country broker appointed

Mr Arthur Houghton has been appointed as the SRC's third regional broker, based at Clevedon in Avon. The brief of SRC regional brokers is to involve more firms in the Council's many schemes to support research and postgraduate training in universities and polytechnics in collaboration with industry and commerce. Mr Houghton will cover firms in Avon, Somerset, Gloucester, Wiltshire, Devon and Cornwall.

Mr Houghton is currently chairman of the western branch of the Institution of Mechanical Engineers. His work experience has been in aeronautical, automotive and civil engineering; since 1976 he has worked as an independent consulting engineer.

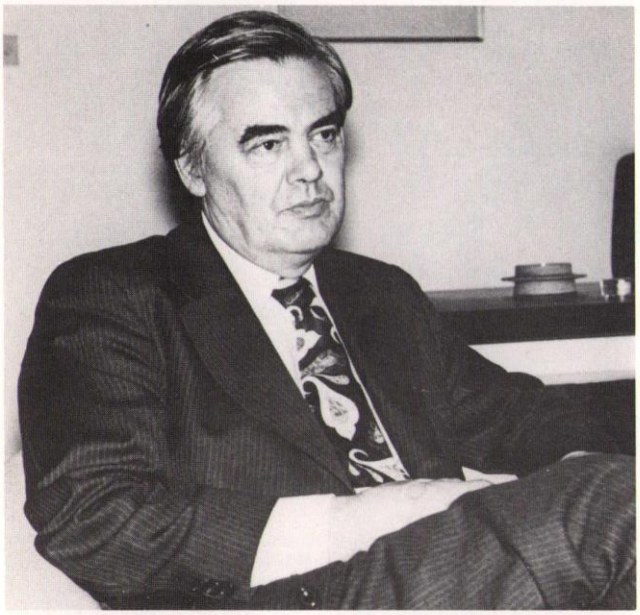
In common with the two brokers appointed in February 1980—Mr Maurice Hughes based in Newcastle-upon-Tyne and Mr Fred Parmenter based in Guildford, Surrey—Mr Houghton will be building up contacts with as wide a range of firms as possible in the region in order to promote the Council's various schemes for collaborative research and postgraduate training, while giving special attention to medium and small high-technology firms. At the same time, he will be establishing contacts with universities and polytechnics so that he can suggest to firms, where appropriate, which institution can best meet their needs for collaborative training and research.

Mr Houghton can be contacted at Beach Avenue, Clevedon, Avon BS21 7XU (telephone Clevedon (0272) 878592).

Mr. Arthur Houghton

More help for polytecnics?

Geoffrey Hall, Director of Brighton Polytechnic and a member of SRC's Engineering Board, gives his views on how the polytechnics must learn to win a bigger bite of the SRC grants cake.



When Britain's thirty polytechnics were set up in 1969 and 70 by the merger of a number of regional colleges, the intention was that they should provide an alternative form of higher education, equal to but different from the universities. A decade later, in their pamphlet *The Polytechnics: vision into reality,* the Commiteee of Directors of Polytechnics claim that the polytechnics have more than met their original targets– "despite the presence of a well-endowed alternative tradition, despite increasing stringency in national expenditure, and despite the legacy of complex controls and constraints designed for an earlier era."

How does the SRC's system of grants and awards fit into this pattern? In the battle for SRC's resources, do the polytechnics feel that the universities–the 'well-endowed alternative tradition'–are winning? If so, how can SRC's service to polytechnics be improved?

Geoffrey Hall, Director of Brighton Polytechnic, says bluntly, "I do not think the polytechnics get a fair bite of the SRC cake. Look at the statistics, at the minute percentage of SRC grants and studentships awarded to polytechnics compared to universities." *Bulletin* asked Mr Hall, as a member of SRC's Engineering Board and Polytechnics Panel, if a special case should be made for more aid to be given to polytechnics at the expense of the universities.

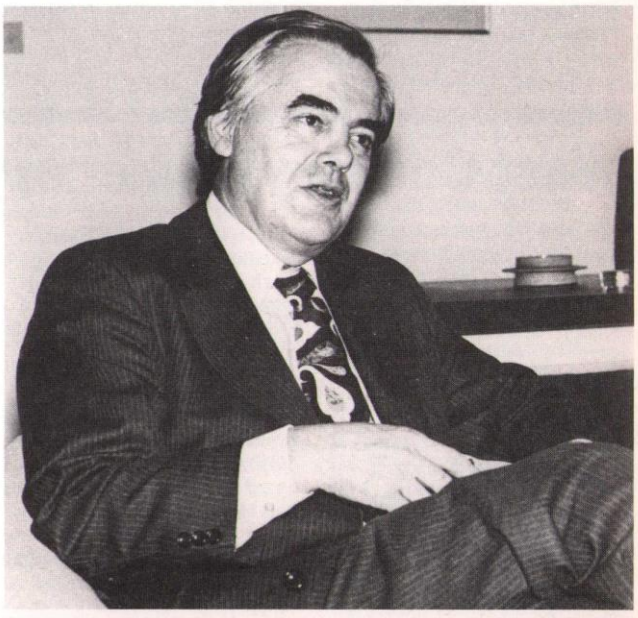
"I do not believe that the SRC should provide funds for research unless a polytechnic can really justify the grant on equal terms with the universities," states Mr Hall. "But there is the question of establishing those equal terms. Traditionally polytechnics have not been involved in very much research; indeed when they were established it was said that research should play a very small part of their role. Now over the last ten years many of us have maintained it is important for the polytechnics to do more research, for two reasons: one, they have enormous technical facilities which can aid industry, aid the locality and aid the country and therefore must be used; and two, because if you are going to be involved in teaching modern engineering, technology or science, you must ensure your staff are kept bang up to date and one way is to encourage them to be more involved in relevant research.

"The polytechnics are now doing this and there has been a great growth of research within the institutions. But where you have institutions that have not had years of concern with research, it really is a very slow process building up significant research schools. One of the things you find at the moment with the SRC is that the more successful a research school is, the quicker it is in gaining further research support–in other words, success begets success. It gets support, not only because it has a good proposal, but because it is highly experienced in presenting its case.

"Presentation is very important. In my view the officers of the SRC are extremely helpful to polytechnic staff in presenting cases but I do not think that polytechnics make anywhere near enough use of the help that is available from SRC. It always has been important to present the case well; it is more important still now that funding is becoming tighter. But one is not just concerned with presentation, one is concerned with identifying which of a number of options is the right one to put forward at the appropriate time. It is easy to see in retrospect that over the last two or three years there were certain areas of work where the SRC could easily have spent a lot more money and, if research workers had been clever enough to put in their applications at that time in those areas, the money would have been forthcoming.

"So I think that 'grantsmanship' is not only the preparation of the application but it is the skillful judgment of at what time and in which areas you should be putting in your proposal.

"There is no doubt there is such a thing as grantsmanship and there is equally no doubt



Some facts and figures...

(as at 31 March 1980)

	Research grants	Research studentships	Advanced Course Studentships
At universities (and university institutions)	£113,991,000	5894	1218
As % of total	94.6	95.5	90.6
At polytechnics	£4,506,000	261	36
As % of total	3.7	4.2	2.9

(The remainder are held by various other institutions)

the polytechnics are not terribly good at it at the moment. Neither are the newer university departments; it comes from experience.

"Now it is a fact at the moment that in most institutions, polytechnics and universities alike,—and it certainly happens in my own—grant applications arise from the initiative of particular research workers. In the universities, these initiatives are in effect coordinated because they generally develop within well-established research schools. In the smaller institutions, and especially in the polytechnics, there is a need for more coordination and selection; coupled with a more skillful approach to SRC committees, I think this should bear fruit.

"What can the polytechnics do? I suspect one way is that a key figure, a senior figure, within each polytechnic might take a greater responsibility for identifying the strengths of that polytechnic and, by cooperating with SRC staff, jointly identify the areas to push hard at the right time. That member of staff should make sure that he nudges the really bright research people within his institution and gets them to put in their applications at the appropriate time. There are good times and bad times for approaching different committees but you only know that if you know the inside of SRC.This may be a way forward for polytechnics seeking more SRC support.

"Which of course comes back to grantsmanship—the more professional you can be the better chance you will have. In the end I think it is going to be the polytechnics that can be the more entrepreneurial that are going to make the big breakthrough."

Mr Hall feels there is also a wider issue: that if the polytechnics had more of the basic resources that universities have acquired, they would be able to compete on a more equal footing.

"It has been extremely difficult within many of the polytechnics to build up adequate libraries—and certainly reference collections—to underpin the academic work. There is also very considerable difference between the average polytechnic and the average university in the level of supporting staff: we do not have the same proportion of technicians or clerical assistants backing up the teaching departments. And once you start putting forward a project that requires a couple of technicians as well as perhaps one or two research staff, you are immediately starting to talk about a very expensive project, because staff costs are so high."

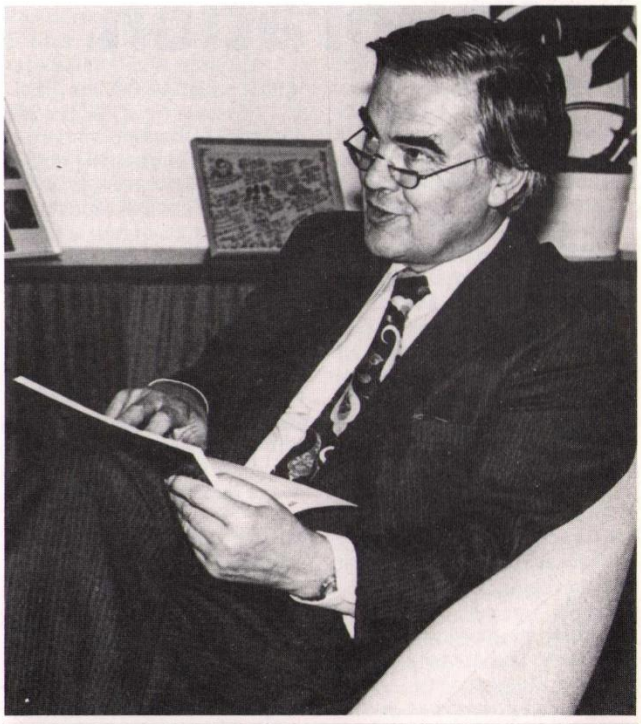
Are the polytechnics adequately represented on SRC's Boards and committees? "In terms of the amount of research done in the universities and polytechnics, I suppose we have about the right percentage of representation," says Mr Hall. "But in terms of overall number of staff and students involved in science and engineering, polytechnics do deserve more. I think the polytechnics must do more to bring forward names for the SRC to consider as members of the various committees and panels. It would be very much in the polytechnics' interests to get more into them; I think we have got to do this.

"As for studentships, it is becoming increasingly difficult to get really good people to embark on research within the educational institutions, whether universities or polytechnics. But I think the present emphasis, certainly within the Engineering Board, on encouraging more schemes that involve partnerships between industry and the institutions is absolutely right: this should provide an increasing opportunity for the polytechnics because of their very strong base of collaboration with industry. But I must say I find the schemes somewhat confusing to describe to others—perhaps the Council should try to streamline the nomenclature a little bit.

"I do not think grants and awards should be handed out on a plate but unless polytechnics are given some encouragement, they are going to find it very difficult indeed to extend their percentage of support.

"I personally think the SRC is doing an extremely good job in what are very difficult conditions," concludes Mr Hall, "and I am sure that as far as the polytechnics are concerned, if SRC can assist them even more in the presentation of cases, if it can guide proposals that fall between committees and be more flexible there, I think the polytechnics will gain greatly, and so I believe will the SRC because you'll get some very good projects that way."

JR



New slow neutron detector system at RAL

A research and development programme on new techniques and devices for use in neutron scattering experiments has been continuing for a number of years at the SRC Rutherford and Appleton Laboratories. One line of development which is now bearing fruit is a new type of 'position sensitive' slow neutron detector system (PSD). It has been recognised for a long time that many neutron scattering experiments would benefit greatly by the use of a detector of large area capable of recording electronically the co-ordinates of each neutron detected. Such a PSD can be equivalent to many thousands of individual detectors (and indeed is sometimes known as a multi-detector) and makes much more efficient use of expensive neutron beams which are comparatively weak even at high flux neutron sources. The RAL work has concentrated on the use of the scintillator technique since this is considered to be the best solution for detectors required by the new generation of high intensity pulsed neutron sources such as the Spallation Neutron Source (SNS). Instruments at these sources use the time of flight technique of neutron scattering exclusively so that one important requirement of a detector is thinness ($\lesssim 1$ cm thick) to avoid uncertainties in the flight path. Another is short dead time ($\sim$100ns) so that high count rates during the short bursts of neutrons can be achieved. A third requirement is adequate detection efficiency over a wide range of neutron energies extending well into the epithermal range. In addition, as for all slow neutron detectors, the system must adequately reject all the other, unwanted, radiations which always accompany the production of neutron beams, for example fast neutrons and gamma radiation.

In the new system neutron sensitive scintillators are optically coupled to a bank of photomultipliers in an unusual way. The neutron sensitive area is a mosaic of separate resolution elements each one coupled by three flexible, coated plastic fibres to a unique combination of three photomultipliers out of a bank of N. Thus by detecting which three photomultipliers have 'fired', the resolution element in which the neutron absorption occurred can be identified. The number of resolution elements (which can be of any shape on a plane, cylindrical or spherical surface) which can be encoded in this way by N photomultipliers is given by permutating 3 out of N; for example 30 photomultipliers are enough for over 4000 resolution elements. By using a scintillator in the form of sheets of cerium activated silicate glass loaded with an isotope of lithium to absorb the neutrons, the detector specification outlined above can be met.

A prototype system, using lithium loaded zinc sulphide as a scintillator, was successfully used in a neutron scattering experiment on the D7 instrument at ILL (the Institut Laue Langevin at Grenoble) in 1980. Economical methods of manufacturing the fibre optic encoders have now been developed. It is expected that these systems will provide reliable, portable detectors with good efficiency and count rate capability at moderate cost, thus enabling the advantages of PSDs or multi-detectors to be much more widely available to neutron scattering scientists than hitherto.

Starlink, the essence of collaboration

Collaboration between research establishments and universities has been the key to the successful setting up of Starlink and will be the key to its successful operation. Starlink, managed by the RAL Computing Division, is an SRC initiative to provide and coordinate image processing and data reduction facilities for use by the UK astronomical community (see *SRC Bulletin*, November 1980).

The Starlink facility, officially launched in October 1980, is based on six linked VAX 11/780 computers at important UK centres of astronomical research. This network allows easy distribution of software, documentation etc between the sites. Hitherto very limited facilities existed in the UK for performing scientific analysis of observations. Astronomers either had to reduce the data manually or devise their own data processing facilities on an *ad hoc* basis. Even the modest facilities that existed were available to only a few astronomers. Adequate image processing facilities have become essential as the majority of astronomy will soon be using data in digital form. Starlink is SRC's response to these demands, in line with its policy to maintain the UK in the forefront of astronomy.

Mr Neil Macfarlane, MP, Parliamentary Under Secretary of State for Education and Science, inaugurating the facility, stated: "Starlink puts the UK ahead of the rest of the world in developing a system for processing astronomical data in such a way that it will enable most university astronomers in the UK to have nearby a terminal link to a powerful computing facility, thus allowing fast analyses to be carried out by university staff and their postgraduate students in their own backyard. This collaboration between the Rutherford and Appleton Laboratories, the two Royal Observatories, the Universities of Cambridge and Manchester and University College London is itself worthy of mention and its success augurs well for the future."

On the same occasion, Professor Malcolm Longair, Director of the Royal Observatory Edinburgh, outlined exciting new plans for the facility's future, but sounded a note of caution on the crucial years ahead: "The easy bit is finished," he said. "Now all our expertise will be needed in the future to respond rapidly to technological change; this can be done."

Mr Neil Macfarlane, MP, activates a special Starlink display, as Dr Godfrey Stafford, RAL's Director General, looks on.

Starlink's installation programme was substantially completed in January with the delivery of the final image display systems to the six sites.

Bridging the gap between lecture theatre and shop floor

A new joint venture aimed at improving the supply and development for top-calibre science, engineering and technology graduates in key engineering functions in manufacturing industry is being pioneered by an SRC scheme known as the Integrated Graduate Development Scheme. The first two projects have been launched, one a collaboration between BL Cars, Lucas Industries and the University of Warwick; and the second based on Cranfield Institute of Technology and Ransome Hoffman Pollard Ltd.

The scheme, designed to help bridge the gap between academic studies and the realities of the shop floor, is experimental; four initial projects are planned and further expansion will depend on results.

A seminar to announce the BL/Lucas/Warwick scheme was held at the University in January. Under the scheme 60 handpicked graduates, who will be full-time employees of the participating companies, will undergo a period of training and study during a 2½-year period which will blend academic tuition with practical industrial experience at factory level. It will provide for the graduates, during their first years of employment, a coherent set of short courses designed to deepen and extend their technical knowledge in the context of their firms and prepare them for early managerial responsibility.

Modular courses covering 26 specialist subject areas, from production to processes and computing to man management, will take up 16 weeks of each graduate's time in the scheme and several tutors will provide a blend of academic stimulation and practical experience.
Of particular importance will be the scheme's ability to 'convert' science graduates to the specific skills of manufacturing engineering—an area in which industry suffers from a serious shortage of high quality recruits. The scheme will interlock with existing company-based training schemes at BL Cars and Lucas, both of which have gained high reputations.

Dr S K Bhattacharyya, who was appointed Professor of Manufacturing Engineering Systems at the University of Warwick in October last year, will direct and co-ordinate the scheme. He will work closely with training and engineering management of BL Cars and Lucas. At the seminar Professor Bhattacharyya commented, "We are delighted to take the lead role in this pioneering venture because it fits so well with the University's policy of improving its service to and links with manufacturing industry."

Quasar questions at Edinburgh

The enigmatic quasars that first burst upon the astronomical scene in the early 1960s were the subject of discussion by a group of astronomers who met at the Royal Observatory, Edinburgh (ROE) in November 1980.

Soon after the first quasars were discovered it was realised that these objects are probably some strange type of very compact and very distant galaxy, extraordinarily bright and near the limits of the observable universe.
Astronomers then thought that the quasars would quickly be understood, but as some tens, then hundreds, and now over a thousand of the objects were discovered, the fundamental mysteries have remained.

What is their source of power? Why do they vary so violently? Where do the absorption lines in their spectra originate? Are they really at cosmological distances and receding from us at nearly the speed of light, or do we have to invoke some sort of 'new physics' to understand their very high redshifts? It was with these questions in mind that the astronomers met to discuss some specific problems in quasar research.

It had been apparent for some time that the 1.2m UK Schmidt Telescope (UKST) in Australia is a very powerful tool for identifying quasars, capable of increasing the sample of known quasars by at least a factor of ten. It was also clear that to make systematic use of the Schmidt photographs requires use of automatic measuring machines such as COSMOS because each photograph contains about 100,000 images. However only a very small proportion of these images (a few hundred objects on each photograph) are actually quasars. The real problem is to try to develop techniques by which both the searching and the subsequent measurement of these few quasars can be automated. Since both the UKST and COSMOS are ROE responsibilities, it seemed natural to arrange a workshop in Edinburgh, at which astronomers involved in this work could report on their progress so far and discuss future plans.

The two-day workshop was attended by three dozen astronomers including representatives of six different University groups active in quasar research. The topics discussed fell into two categories: practical and technical problems related to obtaining data; and astrophysical problems which can be tackled using the data.

The most exciting astrophysical problems are the possible use of large samples of quasars, found in systematic and carefully controlled searches, to study the very large scale structure and early evolution of the universe, to try to explain some very surprising and striking pairings and alignments of quasars (are all quasar redshifts really cosmological?), and to search for quasars beyond the long-standing $z = 3.5$ redshift limit.

RC

NSF progress

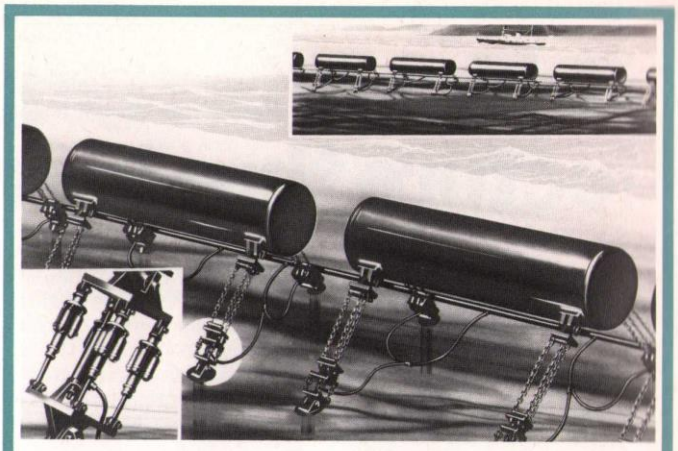
Construction of the Nuclear Structure Facility (NSF) at Daresbury is now at an advanced stage and final voltage tests prior to the installation of the accelerating tube are under way.
The NSF will be capable of accelerating the full range of ions from hydrogen to uranium and will provide high quality beams of small energy spread at easily varied energy.

Because of financial restrictions, initial operation will be on a limited scale using a one-metre scattering chamber and two general-purpose gamma ray detection stations. Other equipment, including a high-resolution magnetic spectrometer, an on-line isotope separator, and a recoil separator, will be brought into operation as funding permits.

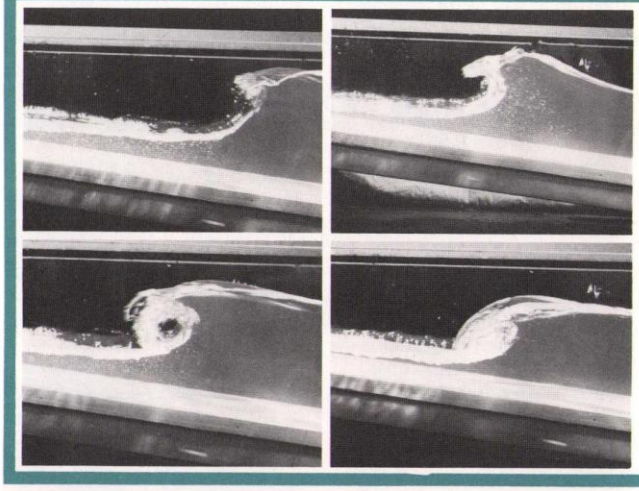
In anticipation of the start of the programme, first experimental proposals have been provisionally approved. Further information can be obtained from Dr H G Price, Daresbury Laboratory, telephone Warrington (0925) 65000 ext 307.

Marine technology research: university with industry

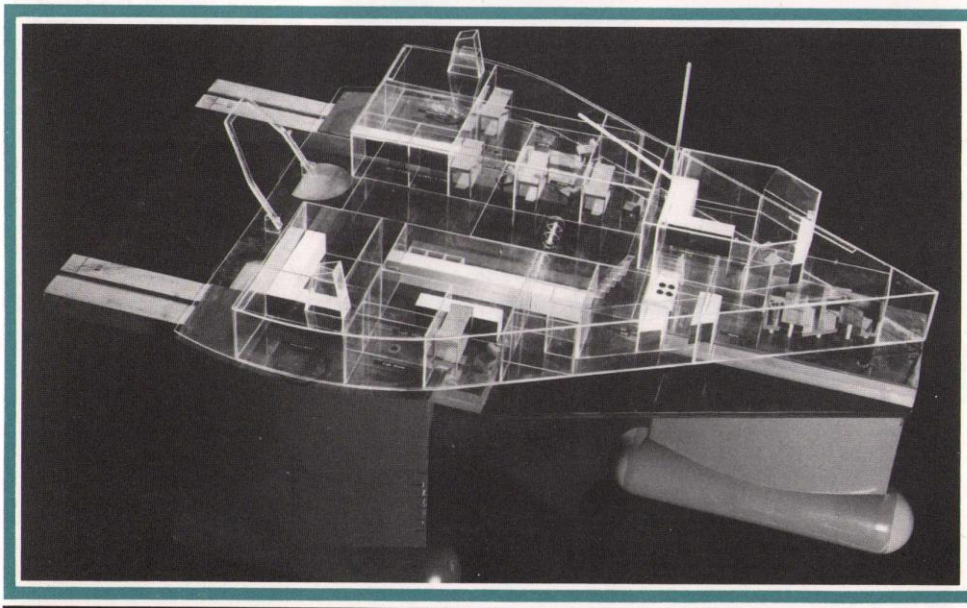
Research into the technology of marine exploitation is currently being carried out in 25 British universities and polytechnics, grouped into six Centres. SRC's Marine Technology Directorate provides support to the value of £8 million to these Centres. The relevance of the academic research to the needs of offshore and related industries was demonstrated at SRC's stand at the EUROPEC '80 Exhibition at Earl's Court in October 1980 with the theme 'Research: University with Industry'. We show here a few examples taken from the EUROPEC stand, of the work currently being supported.



The Bristol Cylinder
The Bristol University device for harnessing wave energy by using hydraulic pressure to generate electricity. An array of massive cylinders, each 40 - 50 m long and 10 - 12 m across, is anchored about 10 km offshore just under the sea surface; the action of the waves sets them in motion and this energy is transferred to pumps and hydropneumatic springs on the seabed. Fundamental investigation at the university continues under SRC sponsorship while feasibility studies are being funded by the Department of Energy under contract with Sir Robert McAlpine & Sons. (Photo: Department of Energy)

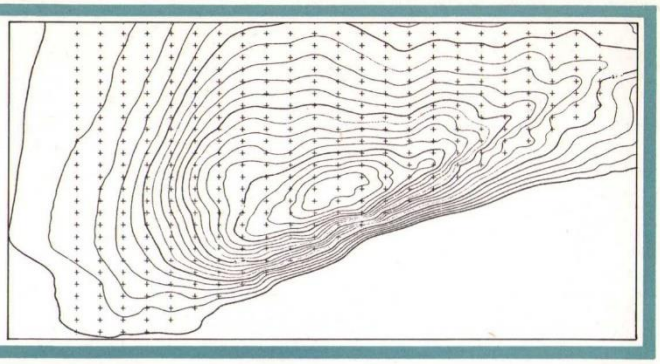


Wave action research
The breaking and run-up processes of waves remain among the most difficult wave phenomena to describe mathematically – a prerequisite for optimum design of coastal defences.
Researchers at Liverpool University are producing a computer program that will simulate the behaviour of random waves interacting with a beach. Relevant experimental data is being collected, both on a laboratory scale and in the field, against which the computer program may be validated.

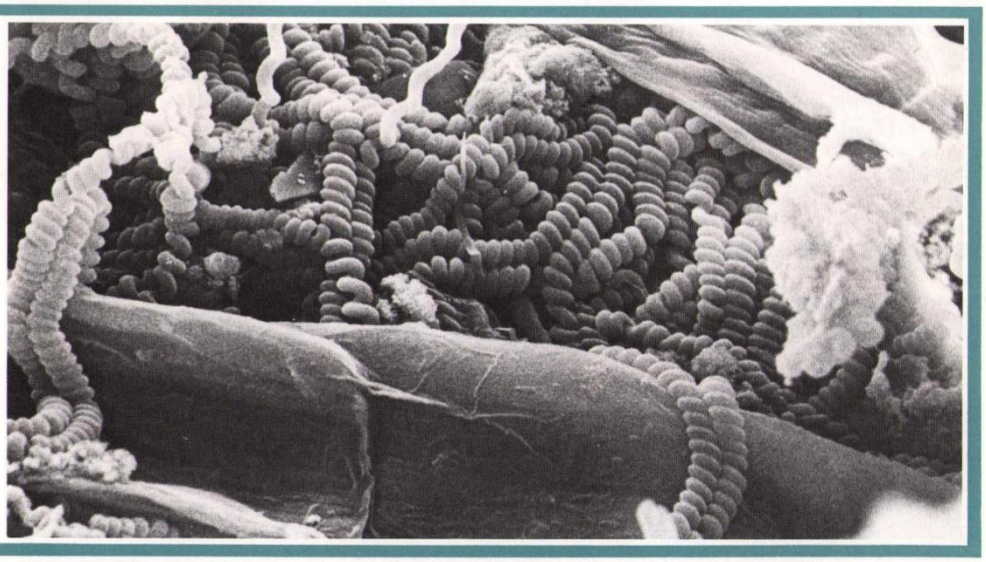


Ship of the 80s
Described as the 'ship of the 80s' by British Shipbuilders, a new semi-submersible inshore and coastal general purpose research vessel, developed at Glasgow University. The three-hull design has several advantages including low 'motion response', or heave, which makes work easier in bad weather. The large deck allows for spacious laboratory and accommodation areas and the ends of the forward hull have viewing domes for underwater observation by both life scientists and engineers.

'Fingerprinting' oil
The source of an oil slick has hitherto seldom been detectable. But this new computer technique devised at Heriot-Watt University shows that crude oil carries a unique identifying 'fingerprint'. The computer produces a print from a sample of the spilled oil which is then compared with reference prints; in this way the source of pollution at a number of incidents has already been successfully identified, even after oil has been weathered. The technique is based on the oil's luminescence: molecules excited by ultra-violet light return to their ground state via several pathways, one of which is fluorescent. Each oil has a different total fluorescent spectrum – its 'fingerprint'.

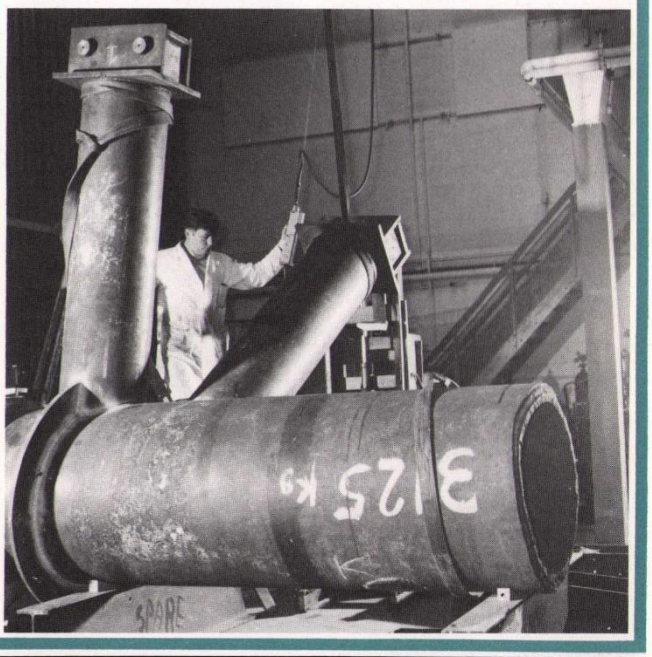


Microalgae and corrosion
Microalgae, such as the diatoms and blue greens seen in this photograph taken under the Newcastle University's scanning electron microscope, are some of the first colonisers on structures put into the North Sea. Mats of algae build up with time and, together with the mucilages they exude, they consolidate the rust particles on unprotected steels. The algae photosynthesize and give out oxygen during the hours of daylight. Measurements have been made of changes in pH between the algal mats and the substratum, to determine their possible effects upon the rates of corrosion.



Strengthening concrete
At the University of Salford researchers are introducing polymeric materials to cement and concrete samples in order to increase tensile strength without diminishing compressive strength. The work is specifically directed to the use of cement and concrete in the sea, and so polymer-modified samples are being tested after curing in both sea water and tap water. The work is also being extended to grouting and to the use of sea water as mixing in polymer-modified cement and concrete.

Structural stress
A brace-to-leg intersection which for 12 years supported the West Sole WE Platform under the North Sea, now under close examination by researchers at UMIST. Their work is linked with projects at Imperial College, London, Glasgow University and Cranfield Institute of Technology. They measure stress concentration effects and deliberately introduce defects into the weld area to confirm the growth predictions obtained from small scale tests. The results of this work will enable realistic defect design curves for tubular joints to be produced.



Telescope moves to Sierra Nevada

The 30-inch (.8m) Steavenson telescope was finally assembled in its new observatory 3,000 metres high in Sierra Nevada, Spain, in October 1980, after many delays. Testing of the telescope and photometric equipment is now under way and it is hoped the telescope will be ready for use towards the end of 1981.

The observatory, designed to house a .6m French telescope as well as the Steavenson, was built by the Spanish. Construction took two years, delayed by weather, but the building was finally ready to receive the telescopes in August 1980.

It was decided to move the Steavenson telescope from the Royal Greenwich Observatory, where it had been refurbished, as nearly completely assembled as possible, in order to save time both with the dismantling and with the subsequent re-erection, and so only optical components and electronics were removed. All parts were transported on one 'low-loader' lorry but an eleven day delay in Spanish customs and a blizzard the day before the telescope's arrival caused delays with the actual installation. Nevertheless by mid-October all parts had been successfully placed in the new observatory and erection of the telescope begun.

The final phase was the responsibility of a team from RGO—electronics engineer David Walters, design engineer Carl West, mechanical engineers Alf White, Brian Hucklesby and Dennis Goring, and astronomer Norman Walker. Valuable assistance was provided by both French and Spanish astronomers and technicians who in their turn were helped with the move of the French telescope. A good international camaraderie was thus established early on and it is hoped that this will carry through to future research projects. By the end of October the assembly of the telescope was completed and alignment of both optical and mechanical axes was satisfactory.

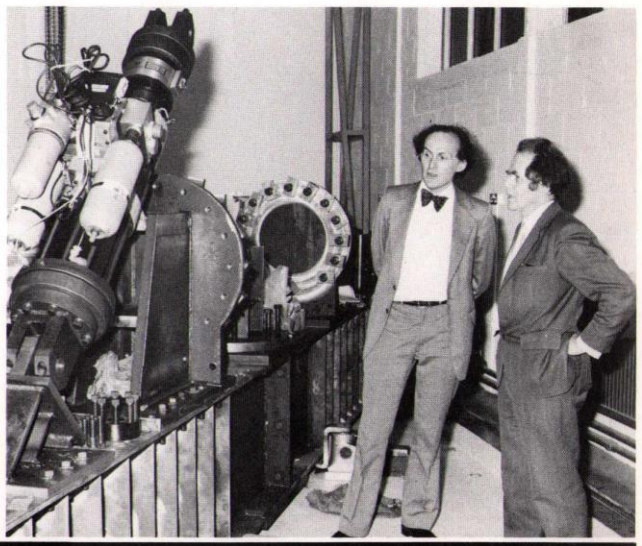
Academics welcome SRC visitors

Mr. Brian Oakley, Secretary of SRC, on a tour of University College London. Left: with the Provost, Sir James Lighthill (on the right); Below left: in the laboratory for Planetary Atmosphere; and Below right: with Dr Stephen Montgomery in the SRC-supported Marine Technology Centre.

The visit to UCL, in November 1980, was part of a programme of visits begun in 1978 to UK universities and polytechnics made by the Secretary and headquarters directors of SRC. Since the programme began, they have visited some sixty institutions.

The purpose of the visits is threefold: to enable senior officers of the Council to explain and discuss current SRC policies and how these affect the academic community; to ensure that the Council remains fully in tune with the difficulties that universities and polytechnics are experiencing; and to ensure that Council retains a clear view of the research and training being carried out at the various centres.

The academic community has for its part welcomed the visits both as a channel for the exchange of views and as an opportunity to extend personal contacts.



UK role on Halley's Comet mission

UK scientists will be playing an important part in Giotto, the ESA mission planned to encounter Halley's Comet in 1986 (see *SRC Bulletin* November 1980).

Giotto's passage through the tail of Halley's comet will only last about 4 hours, but during that time the spacecraft will travel a distance greater than that from the Earth to the Moon. High speed observations will thus be required. These present technical problems on the radio link to the 60 m Parkes antenna in Australia, but such a short encounter will have the advantage of providing a relatively static sample of the physical conditions in the tail.

Costing more than £50M, Giotto will be the first ESA mission into deep space well beyond the Earth. Nevertheless, the mission gives an outstanding and unique chance for Europe to observe the comet at close quarters and to determine its constitution, especially because it probably contains some of the most primitive material in the Solar System. Thus, in addition to imaging the cometary nucleus (if it exists) the UK scientists recently chosen by ESA for the mission are particularly interested in investigating the cometary dust. The interaction of the solar wind with the cometary plasma in the tail also presents some fascinating problems, not unrelated to the development of heating processes in fusion plasmas in the laboratory. Working with Professor Keller of Lindau in Germany, Dr G E Hunt at the Laboratory for Planetary Atmospheres, is a Co-Investigator on the camera team with Dr D W Hughes of the University of Sheffield. Giotto will be equipped with a telescope with electronic colour imaging and with automatic microprocessor control to unravel the effects of the spinning spacecraft. The resulting two dimensional tinted image of the comet will be accurately defined in contrast and transmitted to Earth in real time via the telemetry channel. The pictures will be used to direct the spacecraft on its course; real time processing is vital because the spacecraft may be damaged during hazardous parts of the encounter. Dr Hunt intends to be involved with the provision of the two dimensional imaging and also with the development of associated software. Principally this software will be for the analysis of the images so that the mass flows subliming from the nucleus into the coma and the tail can be quantified.

The spacecraft will streak through the cometary dust with a velocity of 68 km/s– at that velocity a 0.1g dust particle will explode like an artillery shell through 8 cm of aluminium. A shield of 8 cm thickness would of course be far too massive for the mission and so an ingenious solution has been adopted to safeguard the spacecraft against dust impacts. Two relatively thin shields, well separated, will suffice. In the first, the dust particle will be completely vapourised to burst on to the second shield, 25 cm behind the first, as a diverging blob of ionised plasma, so streaming the impact momentum safely over a wide area. Correlated acoustic analysis of the impacts on the two shields and of the plasma at the rear can quantify the dust particle number spectrum even for very large impact masses.

Dr J A M McDonnell of the University of Kent is leading an international collaboration, including Dr D W Hughes of the University of Sheffield, and is himself a key member of another international collaboration which intends to make these impact observations. The two teams hope to determine the dust to gas ratios and the densities of the dust grains in the comet. An enormous dynamic range of dust has to be covered, from 10^{-17} g to 10^{-3} g, or maybe even bigger as Giotto ploughs into the denser parts of the tail.

Dr A D Johnstone of MSSL (University College, London) and Professor H Réme of CESR-CNRS Toulouse in France have been encouraged by ESA to lead an international team to make observations of the cometary plasma. Collaborating with Dr D Bryant of RAL, and with theoretical guidance from Dr M Wallis (at one time at University College, Cardiff), the team will use plasma analysers to provide space-time resolution of the velocity distributions of the ions and electrons in the plasma and the impacting solar wind. An onboard microprocessor disentangles the relative motion of the spacecraft and discriminates against any interference from the effects of local plasma from impacts.

Finally, Dr Wallis is also a Co-Investigator with Professor F Neubauer at Braunschweig, West Germany, in a magnetometer experiment to study the bow shock, and the plasma flows and instabilities set up where the ionised atmosphere of the comet interacts with the solar wind. Other European investigators selected by ESA will determine the neutral gas species and the masses of various ions in the comet, while photometric remote sensing from Giotto of the comet in the UV will complement astronomical observations way back on Earth or nearby.

Other agencies are also sending space missions to Comet Halley. The Russians intend to look in on the way back from Venus, while the Japanese are sending a lightly instrumented probe. Time is running out for a decision from NASA. However, none of these exceed the scientific scope and sheer technical excellence of the European mission, a fitting tribute from the twentieth century to a great British astronomer–Edmond Halley, FRS, 1656-1742, Professor at Oxford University and Astronomer Royal at the Royal Greenwich Observatory. The chance to make such a tribute will not occur again until 2062.

RMP

Marine conference

The Second International Conference on the Integrity of Offshore Structures is being held at the University of Glasgow on 1 - 3 July. Some 25 papers will be presented, covering dynamics and loading; fatigue and fracture; limit state design of buckling and joints; reliability and inspection; damage and repair. Much of the work to be discussed has been carried out with SRC and Department of Energy support as part of their offshore research programmes.

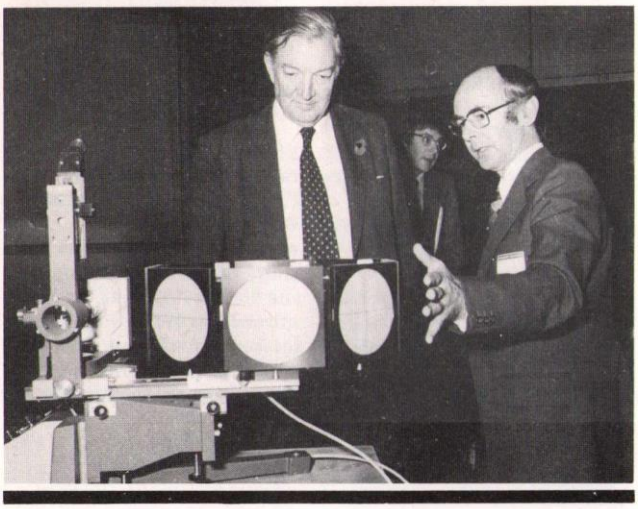
Those interested should apply to: Dr P A Frieze, University of Glasgow, James Watt Engineering Building, Glasgow G12 8QQ, telephone 041-339 8855 ext 330.

Polymer review 1981

The second major review of programmes funded by the Polymer Engineering Directorate was held at Loughborough University on 14/15 April 1981. Fifteen of the PED funded projects were presented, with particular emphasis on their industrial relevance. The audience of several hundred consisted of grant holders, representatives from the collaborating companies and others from academe and industry not currently involved in PED sponsored programmes.

A document prepared for the conference containing summaries of PED funded projects is available from PED at 3-5 Charing Cross Road, London WC2H 0HW.

University groups ready for new source



Dr Jerry Thompson (right), head of the SRS project, demonstrates an x-ray diffraction camera, which will use the radiation from the SRS to investigate the structures of protein crystals, to the Secretary of State.

Daresbury Laboratory's SRS, the world's first purpose-built source of synchrotron radiation, was inaugurated in November by the Secretary of State for Education and Science, the Rt Hon Mark Carlisle, QC, MP.

This national scientific facility was completed close to programme and within its financial target (£5.4M), with the first circulating beam observed on 30 June 1980 (see *SRC Bulletin,* November 1980). Two beam posts feeding six experimental stations are now being commissioned.

By the time of its inauguration, more than 50 groups of university scientists were ready to start work on a wide variety of problems in physics, chemistry, biology and materials studies.

Synchrotron radiation can be used to investigate the structure and behaviour of matter at all levels from atoms through large molecules to crystals and bulk materials. It can be applied to the study of molecules in chemical reactions, in living matter or outer space; single cells and viruses; solid surfaces, liquids and gasses; semiconducting and magnetic materials.

It is being used to understand such diverse problems as the molecular mechanism which drives muscle; characterising the properties of chemicals used in drugs; watching crystals growing and determining their structure; making measurements of chemical changes in times shorter than a thousand millionth of a second (10^{-9} s) and as a standard for calibration of other light sources and detectors.

After the inauguration ceremony, the Secretary of State made a tour of the facility.

Ionospheric anniversary

Examining the present day Ionosonde are (left to right, foreground): Sir Granville Beynon, Mr J A Ratcliffe, Dr W R Piggott and Mr A F Wilkins, with Mr K Feldmisser.

Half a century of ionospheric observation was celebrated in January at RAL (Ditton Park site) by some of the fathers of ionospheric science. Sir Granville Beynon, CBE, FRS, Mr J A Ratcliffe, Dr Roy Piggott and Mr A F Wilkins were among those gathered to observe the noon run of the present day Slough Ionosonde, fifty years to the hour after the first measurement in a regular programme of ionospheric soundings was made there.

The aims of the early work at the then Radio Research Station were purely scientific but in the years before the second world war the experiments were to prove highly important in the development of radar. Those early days were described vividly by Sir Granville Beynon to a packed audience at Ditton Park.

"Our record is a proud one," he said. "The station has been fortunate in its leadership. Radio as an experimental tool should not be underestimated today."

Much of the Geophysics and Radio Division is moving to RAL's Chilton site but the Ionosonde will remain at Ditton Park, where the hourly measurements from a world network of more than 100 stations, each with its own sophisticated radio equipment, are used for planning radio communication services and for upper atmospheric research.

Newcastle propeller research boosted

With the formal opening of the refurbished cavitation tunnel by SRC's Marine Technology Director Mike Adye, the Department of Naval Architecture at Newcastle University now has a greatly enhanced capability for dealing with the problem of cavitation, which can seriously affect the performance of ships' propellers.

The major reconstruction of the tunnel took 18 months and has been jointly funded by the SRC (50%), the University (25%) and Stone Manganese Marine Ltd (25%). Since its original commissioning in the early 1950s the tunnel, which has been responsible for testing among other things the propellers of the QE2, has been operated in close collaboration with the British propeller manufacturers; this collaboration will contine with the costs of running the tunnel being shared equally between the University and Stone Manganese.

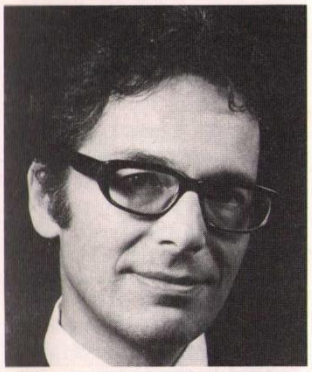
At the opening cermony, University Vice-Chancellor Professor Laurie Martin said, "It has been one of the most productive facilities of its kind in helping the designs of marine propellers." He went on to describe the project as a 'perfect example' of the way the academic and industrial worlds could cooperate.

The tunnel has been named the Emerson Cavitation Tunnel in recognition of the considerable contribution to propeller research made by Dr Arnold Emerson, who commissioned the original tunnel at Newcastle.

Mr Mike Adye, Director of Marine Technology Directorate, presses the button to commission the cavitation tunnel at Newcastle University.

New Directors for RGO and Daresbury

Professor Alexander Boksenberg is to succeed Professor Graham Smith as Director of the Royal Greenwich Observatory on 1 October. As previously announced, Professor Smith is to become Professor of Radio Astronomy at Manchester University and Director of the Nuffield Radio Astronomy Laboratories (Jodrell Bank).



Alec Boksenberg, who is 44 and has been Professor of Physics at University College London's Department of Physics and Astronomy since 1978, is regarded as an outstanding astronomer by his contemporaries. He gained his BSc in physics in 1957 and PhD (physics of atomic collisions) in 1961, from the University of London. In 1960 he joined the UCL's department of Physics and Astronomy and he has remained there since as, successively, research assistant, lecturer in physics, head of ultraviolet and optical astronomy group, reader in physics and professor. He is currently an SRC Senior Fellow.

He was elected a Fellow of the Royal Society in 1978 and is a Fellow of the Royal Astronomical Society. He has served on many SRC working groups and panels, is currently a member of the Council's Astronomy Space and Radio Board and chairman of the Council's Astronomy II committee (which has responsibility for infra-red, optical and ultraviolet observations from space and the ground).

Professor Boksenberg has strong links internationally: he is an associate of the Palomar Observatory in the USA (which allows him observing time in collaboration with the permanent staff) and he has been elected a Sherman Fairchild Distinguished Scholar at the California Institute of Technology. He has recently been spending at least two months each year with the European Southern Observatory (ESO) in Munich and at the ESO observatory site at La Silla.

Professor L L Green has been appointed Director of SRC's Daresbury Laboratory in succession to Professor Ashmore.

Leslie Green, who is 56, is Pro-Vice-Chancellor of the University of Liverpool, head of the Department of Physics and a leading authority on the structure of nuclei. He is serving his second term on the SRC's Nuclear Physics Board and has chaired one of the Board's committees.

On obtaining his PhD from Cambridge (where he held a research studentship at the Cavendish Laboratory from the SRC's forerunner the DSIR) he joined the staff at Liverpool University in 1948, where he was responsible for installing a 1MV high voltage accelerator and starting up the research programme.

In 1960 began his commitment to the installation and then the work of the 6 MV tandem Van de Graaff in Liverpool. Since 1974 he has been on the

SRC's Nuclear Structure Facility Management Committee and so his knowledge of Daresbury is already considerable.

Professor Ashmore retires

Professor Alick Ashmore, CBE, Director of the Daresbury Laboratory, retires in June this year. Alick Ashmore was appointed Director of the then Daresbury Nuclear Physics Laboratory in 1969 in succession to Professor Alec Merrison, FRS. Previously he had been Professor of Nuclear Physics and Head of the Physics Department at Queen Mary College, London. He took up his appointment in the middle of 1970 and from the outset gave a strong and determined lead to the Daresbury high energy physics programme and to the provision of research facilities for the northern universities.

In his period as Director he guided the Laboratory through momentous changes from a high energy physics laboratory

to a multi-disciplinary scientific establishment. He did much to stimulate the use of synchrotron radiation from NINA for a wide range of scientific studies. When the decision to close NINA was taken Alick Ashmore was at the centre of discussions to define the future role of the Laboratory, and he pressed vigorously for the construction of two completely new, and indeed unique, facilities. One of these was a successor to NINA for synchrotron radiation, the first machine designed specifically for this purpose. The resulting 2 GeV storage ring was inaugurated in November 1980 (see page 18). The other was a 30 MV tandem electrostatic accelerator, the biggest of its kind, for nuclear structure research. This is due to come into operation later this year (see page 13).

His outstanding contribution to British science was recognised in 1979 when he was appointed CBE.

Glazebrook medal for Dr Stafford

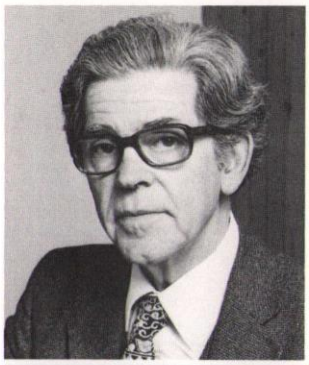
Dr Godfrey Stafford, CBE FRS, Director General of Rutherford and Appleton Laboratories, has been awarded the Glazebrook Medal and Prize for 1981, in recognition of his "outstanding contribution to the organisation of experimental high energy physics particularly through the direction of the Rutherford Laboratory", of which he was Director until his present appointment in 1979.

The Institute of Physics set up the annual award in 1965 in honour of Sir Richard Tetley Glazebrook, President of the Institute of Physics 1920-21.

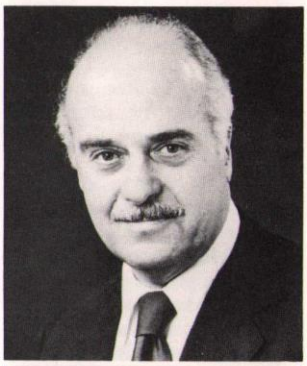
Director and deputy appointed for Technical Change Centre

Professor Sir Bruce Williams, Vice Chancellor of the University of Sydney, Australia, has been appointed Director of the Technical Change Centre; Deputy Director is Dr James Kennedy, CBE, Director of Research for the Delta Metal Co Ltd and Managing Director of Delta Materials Research Ltd.

The Technical Change Centre was set up in late 1980 with the support of the SRC, the Leverhulme Trust and the Social Science Research Council (see *SRC Bulletin* November 1980). The function of the Centre is to develop a major programme of research on the choice, management and acceptability of technical change relevant to the advancement of the national economy. The Centre is governed by a Board with an independant chairman, members from the three main sponsors, from both sides of industry, from government and the academic community.



Professor Sir Bruce Williams



Dr. James Kennedy

The Centre will produce analyses and suggest policies which will be independent of, but complementary to, those generated by government, industry and other interest groups. The programme of work will deal with a range of policy issues but particular emphasis will be placed on resource use, technological change and scientific development. A continuing theme will be the way in which obstacles to the creation and sensible use of wealth can be removed. Types of issues addressed will include: the optimisation of energy and materials use and conservation; the problems associated with the expansion of the country's manufacturing base; the extent to which substantial domestic capacity in certain base industries should be maintained and how technological innovation can be introduced without major social occupational disruption.

New Zealand born Sir Bruce Williams, who is 62, lectured in economics at Adelaide University and Queen's University, Belfast, and became professor of Economics at the University College of North Staffordshire in 1950. From 1959 he was professor at Manchester University until his appointment as Vice Chancellor at Sydney in 1967, at which time he was also Economic Adviser to the Minister of Technology. Sir Bruce is a scholar of international reputation and author of several books including *Science and technology in economic growth.*

Dr James Kennedy (aged 59) has successfully combined the academic and industrial worlds. Having been head of the British Iron and Steel Research Association (1954-57) and Professor of Materials at the Cranfield College of Aeronautics (1957-66), he became Director of BNF Metal Technology Centre, Wantage, in 1966 and, since 1978, has been Director of Research for the Delta Metal Co Ltd and Managing Director of Delta Materials Research Ltd. Dr Kennedy is former member of the Science Research Council and the Engineering Board.

Satellite and ocean experts meet

An important step in the planning of a 20-year World Climate Research Programme (WCRP) took place during the week 26-30 January, when many of the world's leading experts in satellite remote sounding, oceanography and climate research met at RAL (Chilton site) to discuss the coordination of plans for future satellite observing systems and ocean experiments. The meeting had been called by the Joint Scientific Committee of the WCRP, together with the Coordinating Committee on Climate and Oceans, and was chaired by Professor John Houghton. Professor Houghton is Director, Appleton.

Scientists from many countries including the USA, the USSR, Japan, Canada, France were present. The UK was represented by scientists from the Natural Environment and Science Research Councils. Several international agencies also sent participants. The meeting was highly successful, with wide-ranging discussions on the ocean-climate system and its observation; by the end of the week a draft report had been produced recommending action on scientific studies, instrument development, data processing, and international coordination.

RAL was delighted to be able to act as hosts to such a distinguished group of visitors, experienced in this growing and exciting field of research.

Polymer characterisation service extended

New equipment updating and extending its basic gel permeation chromatography (GPC) service has recently been commissioned by the Polymer Supply and Characterisation Centre (PSCC). The Centre is an SRC supported unit based at the Rubber and Plastics Research Association, undertaking molecular weight characterisation of polymers for university and polytechnic research projects.

The Centre can run GPC measurements for a wide range of polymers on its low temperature (ambient) equipment. The selection of detectors (refractive index, ultraviolet and infrared) permits the analysis of most polymers soluble in the solvent THF. A high temperature instrument is available for the analysis of polyolefins, using 1, 2 dichlorobenze and an infrared detector.

Low angle laser light scattering (LALLS) equipment has been purchased to allow absolute molecular weights to be determined, principally for the GPC work. This should be particularly useful for the less common polymers. The LALLS will also be used in series with other detectors attached to the chromatograph for the characterisation of copolymers.

Prospective users of the GPC service should contact Dr Steve Holding, Rubber and Plastics Research Association, Shawbury, Shropshire SY4 4NR, telephone Shawbury (0939) 250383. The service is free to projects eligible for funding by the SRC.

Short courses round-up

• IHES—Paris-based maths and physics centre

The Institut des Hautes Etudes Scientifiques (IHES) is an independent organisation financed primarily by a subsidy from the French Government but the UK, through SRC's Mathematics Committee, is among a number of other European countries which also contribute to it.

The Institute is located at Bures-sur-Yvette just outside Paris. Its purpose is to support fundamental research in pure mathematics and theoretical physics at the highest level. Visitors to the Institute are able to pursue their research interest in an ideal intellectual and physical environment and they benefit from the opportunities for collaboration with the distinguished permanent staff and with other visiting researchers. Many British mathematicians have made extended visits to the Institute in recent years.

All non-scientific, administrative decisions concerning the Institute are taken by a Council on which the SRC is represented.

Mathematicians and theoretical physicists interested in visiting the Institute are encouraged to write to Professor N H Kuiper, Director, Institut des Hautes Etudes Scientifiques, 35 Route de Chartres, 91440 Bures-sur-Yvette, France. Professor Kuiper will be able to supply details of the financial assistance which the Institute can make available for such visits.

• Numerical analysis summer school

The Numerical Analysis Panel of the Mathematics Committee is organising a Summer School and Workshop at Lancaster University. The school will be for postdoctoral Numerical Analysts within five years or so of having gained their PhD and will present a unique opportunity for young numerical analysts to work together with internationally renowned experts.

The School and Workshop will take place from 19 July to 21 August 1981. For a large part of the time participants pursue their own research in a stimulating environment where they will be able to draw on the expertise and guidance of the many invited experts. There will also be four courses of ten lectures.

Places are available for a limited number of participants from universities or industry and SRC support may be available for the full cost of the school and up to half of travel and subsistence expenses. Full board accommodation will be available at the university, with the possible alternative of self-catering family accommodation.

Further details may be obtained from Dr P R Turner, The Department of Mathematics, the University of Lancaster, Bailrigg, Lancaster. Tel: Lancaster (0524) 65201.

• CREST courses in computer science

Short residential courses on topics within the field of informatics have for some years been sponsored by individual EEC member countries and the Scientific and Technological Research Committee (CREST) of the EEC.

The SRC's Information Engineering Committee is responsible for selecting suitable topics for the courses held in the UK. The two-week courses are designed to introduce postgraduate students and younger academics to the latest developments in computer science. The three main areas covered are advanced theory, practical computing science and computer applications in other disciplines and processes.

The courses offer places to about 60 students, half of them being available to students from Community countries other than those of the host country. The EEC contributes 35% of the net cost of running the course, the remainder being provided by the host country. For courses held in the UK the SRC pays costs for its research students and the registration fee for those young academics attending from EEC countries. When the courses are held in other countries the SRC pays for students' accommodation and fares only.

In 1981 one CREST course will be held in the UK at the University of Newcastle on Functional Programming and its Applications from 19 July to 31 July 1981. Details may be obtained from Professor B Randell, Computing Laboratory, Claremont Road, Newcastle-upon-Tyne.

The Information Engineering Committee wishes to invite new proposals for CREST courses to be held in the UK in 1983. Courses on all aspects of data processing will be considered but proposals are particularly invited on data bases, distributed systems and software technology. Proposals should be addressed to Miss J A Spring at SRC Central Office,Swindon (tel 0793 26222 ext 2401) and must be submitted no later than 31 December 1981.

• Summer school in polymers

Once again this September, the Polymer Engineering Directorate will be holding a one week summer school. The aim of the school will be to give students engaged in polymer research an understanding of polymer processing and technology and an awareness of how industrial problems are related to their own research work. In addition, it is hoped to encourage engineering students who are not currently engaged in polymer research work but who are interested in extending their knowledge to the field of polymer engineering.

This seventh national summer school will broadly follow the pattern of previous years: it will be residential and will again be held at Loughborough University of Technology under the aegis of the Institute of Polymer Technology. As in 1980, the emphasis will be on the practical side of processing, and a number of industrial visits will be included.

The course is designed to cater for the needs of first and second year students. Priority will be given to SRC students and their full attendance costs will be borne by the Council. Any surplus places may be allocated to non SRC supported students on a first come, first served basis but will not be funded in any way by SRC.

Nominations for students to attend the course should be made as soon as possible.

Dates 6 - 11 September 1981
Contact Mrs H Lennon, PED, Garrick House, 3 - 5 Charing Cross Road, London WC2H 0HW, telephone 01-930 9162.

• After graduation, what next?

The Joint Committee of the Science Research Council and Social Science Research Council recently sponsored a new experimental course to help undergraduates plan their postgraduate training. The course consisted of three intensive days of discussions, case studies, seminars, and business games run by expert tutors including academic supervisors and young engineers and scientists from academe and industry. It was designed to present students with information about the options available both in industry and in higher education, to ensure that they fully understood the Councils' special studentship schemes and were in a position to make well-informed and realistic choices about their postgraduate future. The course, for about 80 final year undergraduates from a selection of northern universities, was held from 6 to 9 January 1981 in Manchester University.

Initial feedback from students indicates that there is a need for a considered and coherent approach to information dissemination in this area.

• Short courses in marine technology

The SRC has launched a new venture in short courses designed to present research in marine technology to ocean related industry. The first portfolio of courses and seminars contains a wide range of subjects.

These are available at the Marine Technology Centres.

The Marine Technology Directorate is encouraging activities in this area by underwriting courses as appropriate. Further portfolios will be compiled. If you wish to propose a course for inclusion, you should approach Dr K D Crosbie on 01-930 9162, who can also supply brief accounts of the courses and seminars in the first portfolio.

Studentships 1980/81

1980 report

The number of awards on offer in 1980 was 3600, of which 760 were specifically allocated to the CASE scheme. Over 5300 applications (eligible and ineligible) were received, compared with 4360 in 1979, an increase of 22%. The stringent financial situation facing the Council meant that, even when allowance had been made for students withdrawing before taking up their awards, it was possible at the Appeals stage to make available only 100 awards to meet the demands of nearly a thousand eligible applicants, 143 of whom were first class honours candidates. The Council's first priority—achieving as closely as possible its original allocations—was met in full but the second priority was only partly satisfied.

Eventually, some 850 applicants, including 58 first class honours graduates, had to be refused awards.

There was a buoyant demand for CASE awards, with the new arrangements in operation for the first time. The number of Science Board applications considerably exceeded availability and so some awards could only be made following withdrawal of other applicants; in other cases, deferred awards have been given for take up from the start of the 1981/2 financial year (April 1981). In contrast to other areas, the demand for CTA and the Ex-part-time scheme was very low. Advanced Course Studentships in Engineering were again awarded on a first come, first served basis and demand was such that 270 eligible applicants were refused awards. A similar number of original applicants subsequently withdrew or did not take up their awards.

The table below compares the distribution of studentships taken up on 18 November 1980 with the original target allocations for 1980.

DISTRIBUTION OF AWARDS TAKEN UP AT 18 NOVEMBER 1980 (1980 ALLOCATIONS IN BRACKETS)

	RESEARCH STUDENTSHIPS						ADVANCED COURSE STUDENTSHIPS		TOTAL AWARDS	
	QUOTA*		CASE*		TOTAL					
QUOTA AND CASE ALLOCATIONS										
ASR Board	66	(65)	7	(8)	73	(73)	24	(29)	97	(102)
NP Board	56	(52)	2	(5)	58	(57)	–	–	58	(57)
Science Board (including Science-based Archaeology and Pharmacy)	797	(769)	433	(430)	1230	(1199)	449	(455)	1679	(1654)
Engineering Board (including Total Technology and Engineering Maths)	414	(435)	300	(300)	714	(735)	554	(530)	1268	(1265)
Joint SRC/SSRC Committee	35	(37)	5	(15)	40	(52)	90	(70)	130	(122)
Energy Committee	10	(12)	1	(2)	11	(14)	12	(5)	23	(19)
TOTALS: QUOTA AND CASE	1378	(1370)	748	(760)	2126	(2130)	1129	(1089)	3255	(3219)
OTHER SPECIAL SCHEMES										
Polytechnics Committee					18	(21)	13	(15)	31	(36)
Instant					97	(110)	146	(160)	243	(270)
Ex-part-time					4	(10)	–	–	4	(10)
Collaborative Training Awards					13	(40)	–	–	13	(40)
Awards Tenable Overseas					18	(20)	–	–	18	(20)
Appeals reserve									–	(5)
GRAND TOTAL					2276	(2331)	1288	(1264)	3564	(3600)

**Take-up includes appeals awards*

Plans for 1981

As a result of general financial constraints and the heavy existing commitments on its funds for 1981/2, the Council has determined that only 3240 awards can be offered in 1981. The number of quota research studentships and CASE awards available will remain the same as in 1980 and the bulk of the reductions from 1980 will therefore fall on Advanced Course Studentships. In determining the number of ACS allocated to the Engineering Board, Council has taken account of the availability of the new experimental Integrated Graduate Development schemes, which will provide alternative means of securing advanced training for some 100 graduates in 1981. Some reductions have also been made in the number of Instant awards available, and in the allocations to CTA and the Ex-part-time scheme. Council wishes to encourage a small number of good students to take advantage of training opportunities overseas, especially elsewhere in Europe, and a special allocation of 20 awards has been set aside for this purpose.

The table below sets out the distribution of the awards which will be available in 1981.

ALLOCATION OF STUDENTSHIPS AVAILABLE IN 1981

	RESEARCH STUDENTSHIPS			ADVANCED COURSE STUDENTSHIPS	TOTAL AWARDS
	QUOTA	CASE	TOTAL		
QUOTA AND CASE ALLOCATIONS					
ASR Board	65	8	73	23	96
NP Board	52	5	57	–	57
Science Board (including Science-based Archaeology and Pharmacy)	769	430	1199	362	1561
Engineering Board (including Total Technology and Engineering Maths)	435	300	735	374	1109
Joint SRC/SSRC Committee	37	15	52	55	107
Energy Committee	12	2	14	4	18
TOTALS: QUOTA AND CASE	1370	760	2130	818	2948
OTHER SPECIAL SCHEMES					
Polytechnics Committee			21	12	33
Instant			89	140	229
Ex-part-time			10		10
Collaborative Training Awards					
Awards Tenable Overseas			20		20
GRAND TOTAL			2270	970	3240

Priorities at the Studentship Appeals stage, 1981

The 1981 Appeals pool will consist of unused quota awards and any additional awards that can be made available by making due allowance for failure to take up offers. The Appeals awards will be offered, as far as possible, before the end of August in accordance with the following priorities:

First: to achieve as closely as possible the original allocations made by Council (including sub-allocations by Boards and Committees);

Second equal (a) Candidates for CTA and other collaborative schemes and studentships in Council's 'special areas' (microelectronics, biotechnology, marine technology, polymer engineering, energy and manufacturing technology), with preference going to the academically best qualified; (b) Candidates for ordinary studentships with first class honours degrees and with preference for those migrating to a different institution from

their first degree or changing from pure to applied work;
Third Candidates for advanced course studentships with a 2(i) honours degree and with preference for those migrating to a different institution from their first degree or changing from pure to applied work;
Fourth Other qualified candidates for ordinary studentships and with preference for those migrating or changing from pure to applied work.

The onus rests with the Head of Department to describe the project adequately, when making an Appeals application on the ground of 'project of an applied nature', where the research training will be carried out in a science department. It may be anticipated that the reduced availability of awards and the absence of any initial reserve will again lead to severe competition for Appeals awards in 1981. In these circumstances, the Council is unable to guarantee that awards will be available for all first class honours candidates.

Academic qualifications of Advanced Course students

The Council is concerned about the quality of some of the students being awarded Advanced Course Studentships, and has therefore decided that priority should be given to the academically best qualified. It has considered the possibility of amending its regulations to require an upper-second-class honours degree but has accepted, for the present, that there may sometimes be justification for making awards to lower qualified candidates.

Thus, no changes are being made either in the regulations or the awarding procedures for 1981, but the Postgraduate Training Committee, subject committees and Council will be examining the outcome in the autumn. Attention will be paid then to the academic qualifications of the students who have obtained awards in each subject area and for particular courses, bearing in mind any special circumstances. The results will be taken into account in determining the approval of courses and the allocation of quotas to subjects and, where appropriate, to courses in 1982.

The Council will keep this matter under review, as it is concerned that the best possible use be made of the limited number of Advanced Course Studentships that it is likely to be able to offer in future. As much notice as possible will be given if it is found necessary to introduce more stringent regulations or changes in administrative procedures. In the meantime any problems that arise in this context should be notified to Dr D V Thomas, Head of Secretary's Department, tel Swindon (0793) 26222 ext 2205.

New policy on engineering advanced

The Engineering Board has recently reviewed its policy towards the advanced postgraduate courses it supports in engineering. The prime purpose of the Board in providing studentships for such courses is to encourage the provision of specialist training for graduates in engineering subjects to prepare them for careers in industry. It has been the practice for many years to review the courses periodically to discover whether they have maintained their quality and continue to demonstrate they are meeting the needs of British industry for highly trained manpower.

The Board has concluded that relevance to industry should be the dominant consideration in deciding whether a course continues to receive SRC studentships.

Course organisers have therefore for the first time been required in 1980 to provide returns showing the type of employment secured by former students on the course, and those that can demonstrate a consistently good record of sending their graduates directly into British industry will continue to receive SRC support. Those failing to do so however would cease to be recognised by SRC: that is, would no longer be eligible to receive its studentships. It is hoped in this way to arrive at a package of engineering courses all of which can demonstrate good track records as sources of industrial recruitment.

The 1980 review has recently been completed with the following result. Of the 209 courses supported by the Board in 1980, 59 have been rejected (28%). Those remaining are distributed as follows across the six committee areas coming under the Board:

Machines & Power	25
Information Engineering	44
Engineering Processes	26
Environment	35
Materials	13
Marine Technology	7

The Board will continue to monitor these courses by the same criterion in 1981 and beyond, with the aim of ensuring that they are all continuing to serve the purpose to which the Board and Council attach such high priority: that is, producing postgraduate manpower trained in the specialisms that industry requires.

Holographic Bubble Chamber

Tests are currently well advanced at RAL (Chilton site) towards an experiment using a small Lexan Holographic Bubble Chamber (HOLEBC) planned to be built and used at CERN this year to look for the shorter-lived charmed particles. This follows a successful test carried out at CERN in the summer, when a small heavy liquid bubble chamber, the Bern Infinitesimal Bubble Chamber (BIBC), was equipped and run with holographic optics.

Bubble chambers have always excelled in making clear what happens near the collision point when elementary particles interact, with studies of 'strange' and then 'charmed' particles, throughout the '60s and '70s. But some charmed particles have lifetimes so short that their tracks will be only a fraction of a millimetre long.

Hitherto bubble chambers have depended upon conventional photography and in trying to increase their optical resolution, their depth of focal field decreases; thus in photographing very short tracks made up of bubbles of diameter about 5μm, the volume which is in focus is reduced to a thickness of less than 1 mm.

Holography, however, records the interference between light scattered by an object and a coherent beam which undergoes no scattering. The coherent light needed to do this is produced by a laser. On reprojecting a hologram, again using coherent light from a laser, the original wavefront of light from the object is reproduced, just as though the object were still there producing it. The resolution is determined essentially by the size of the hologram (allowing resolution of about 2μm to be achieved) and within very broad limits, objects at different depths can be equally well constructed giving a 3-dimensional image.

Thus the problem of decoupling the image resolution from the depth of field is greatly alleviated, and in a bubble chamber experiment the whole volume of the chamber can once again be used to study particle interactions with a much higher resolution than before.

PhD success rates

The success rate of research students in obtaining a PhD or D Phil, and the time taken to obtain the degree, have been the subject of debate for more than a year; particular attention having been drawn to the issue by the Public Accounts Committee and the ABRC's Working Party on Postgraduate Education. The Science Research Council has always taken the view that its awards are made for the purpose of research training and that the actual award of a degree is a matter for the student and his academic institution. However, every research student needs to acquire the ability to communicate the results of his work in the form of a thesis, report or paper. The award of a PhD or D Phil is a readily-available indicator that he has succeeded in this and so, in the early summer of 1980, a survey was undertaken of a sample of institutions in receipt of SRC research studentships awarded in 1974 and 1975. The result revealed a seemingly unsatisfactory situation. A full-scale survey of all institutions was therefore undertaken.

The questionnaire

In July 1980, a questionnaire was sent to each institution, together with a list, obtained from the SRC computer records, of SRC research students who took up awards in 1974 and 1975. These records are incomplete as a new computer system was set up in 1976 and only those students who were currently in receipt of awards at 1 April 1976 were entered into the new system. With possibly a few exceptions, therefore, students who withdrew from their studies before 1 April 1976 were omitted from the lists. Institutions were asked to make returns broken down by department, year of award and quality of first degree; in each case entries were requested in the following categories:

PhD awarded; failed; withdrew; presentation of thesis still awaited (expected within 12 months; expected, but timing uncertain; or unlikely to complete).

The replies

In their replies, some institutions added students who had been omitted from the computer lists. Many institutions supplied details of students on the lists who had been awarded Masters degrees, but it is not clear how many of these degrees were awarded on the basis of the students' researches and how many were obtained as a result of a switch from research to advanced course studies. It was intended, although not stated, that the 'withdrew' category should refer to students who had not completed the full term of their SRC award. However, it became clear in later correspondence with the institutions that most institutions included in this category all students who were no longer registered for a degree and who had not been awarded a degree of some kind or failed. Including subsequent correspondence, the replies from institutions were received over the period July 1980 to February 1981.

In view of the unauthorised publication in the press of a 'league table' showing PhD success rates of institutions, based on a preliminary analysis of the returns, it has been decided that the data should be published, despite the deficiencies and inconsistencies indicated above and differences in practice and timing both as regards registration for and awarding of degrees. The data contained in the accompanying tables should be treated with considerable caution, especially when making comparisons between institutions.

TABLE 1 – PhD SUCCESS RATES OF SRC RESEARCH STUDENTS
INSTITUTIONS WITH 20 OR MORE NOTIFIED STUDENTS
(1974 AND 1975 STARTS: DATA COLLECTED JULY 1980 – FEBRUARY 1981)

	Students notified No	Awarded PhD/D Phil No	Thesis still awaited No
Aberdeen	30	23	4
Aston	100	68	20
Birmingham	101	84	17
Bath	36	20	11
Bradford	77	33	35
Bristol	147	105	33
Brunel	23	12	8
Cambridge	296	248	30
City	25	14	11
Durham	55	30	11
E Anglia	48	37	9
Edinburgh	75	48	20
Essex	30	12	14
Exeter	49	23	19
Glasgow	69	44	21
Heriot Watt	36	22	10
Hull	43	24	18
Kent	47	26	20
Lancaster	48	25	18
Leeds	165	101	61
Leics	55	40	9
Liverpool	124	80	38
London: Chelsea	29	15	13
ICST	197	115	71
KCL	44	35	7
QEC	39	24	14
QMC	53	32	19
RHC	26	16	10
UCL	84	49	30
UMIST	85	49	30
Manchester	169	102	43
Newcastle	72	35	25
Nottingham	136	85	32
Oxford	204	142	40
Reading	46	19	17
St Andrews	31	17	10
Salford	52	37	11
Sheffield	122	91	31
Southampton	108	69	29
Strathclyde	64	45	18
Surrey	43	32	8
Sussex	104	56	20
Warwick	46	30	12
York	45	24	17
Wales: Aberystwyth	42	20	14
Bangor	45	27	17
Cardiff	63	37	23
Swansea	60	35	23
Polytechnics & CT's	113	47	39

TABLE 2 – PhD SUCCESS RATES: SUBJECTS

Subject (1)	Students notified No	Awarded PhD/D Phil No	Thesis still awaited No
Biology	867	592	223
Chemistry	965	725	181
Physics	612	373	187
Maths	324	182	79
Astronomy	53	31	13
Engineering	1066	556	415
Science/Social Science	101	39	36

TABLE 3 – PhD SUCCESS RATES: INITIAL ACADEMIC QUALIFICATIONS

Initial Qualification	Students notified No	Awarded PhD/D Phil No	Thesis still awaited No
Honours (I)	1309	959	258
Honours (II (1))	2132	1261	668
Honours (II (2)) + MSc	357	184	130
Others (2)	190	94	78

TABLE 4
PhD SUCCESS RATES OF SRC STUDENTS
(Data collected July 1980 – February 1981)

	Started 1974	Started 1975
Students taking up research awards	2271	2227
Students included in survey (generally, those current at 1 April 1976)	1910	2072
Successful(3) (awarded PhD/D Phil)	1299	1199
Unsuccessful(3) (research award taken up, but student subsequently withdrew, failed or awarded lower degree)	511	363
Unfinished (submission of thesis still awaited)	461	665
Successful(3) (% of original take-up)	57%	54%
Unsuccessful(3) (% of original take-up)	23%	16%
Unfinished(3) (% of original take-up)	20%	30%
Successful(3) (% of those not otherwise terminated)	74%	64%

Table 1 summarises the returns obtained from all institutions where 20 or more students in aggregate were listed for 1974 and 1975. In view of their special position, polytechnics, Scottish central institutions and colleges of technology have been grouped together, although none of them had as many as 20 students individually. The institutions tabulated represent 72% of the institutions with 1974 or 1975 students and account for 95% of the number of students notified. The table gives the number of notified 1974 and 1975 students (generally, only those taking up research awards in 1974 or 1975 whose awards were still current in April 1976), the number reported as having been awarded a PhD or D Phil, and the number from whom a thesis was still awaited at the time of the report.

Table 2 shows the data of Table 1 (including those institutions with less than 20 students in 1974-75) against subject headings. It should be emphasised that these headings are not precisely defined, as students have been allocated largely according to departmental title. Thus, Physics includes nuclear physics, and astronomy students working in departments of Mathematics or Physics are entered against these headings.

Table 3 displays the same data for students with different academic qualifications.

The number of students included in this survey is only 89% of the number known to have taken up research awards in 1974 and 1975. Unfortunately, because of the deficiencies of the computer records, it is not possible to determine easily the number of awards taken up in each institution nor, consequently, the number by subject (department) or initial qualification. Thus, it is not possible at this time to determine institutional success rates (in obtaining a PhD or D Phil) as a proportion of those who took up their awards. Success rates expressed as a proportion of those whose awards have not otherwise terminated have not been tabulated, because a high figure could be the result either of a high rate of success of those who started (which might be regarded as 'good') or of a high rate of termination (which might be regarded as 'bad')—both rates being indeterminate within wide margins.

The overall results of the survey are given in Table 4, separately for 1974 and 1975 students. In order to avoid a cumbersome notation, students who have been awarded a PhD or D Phil have been denoted as 'successful', and students who failed, withdrew or were awarded a lower degree have been termed 'unsuccessful', although it is emphasised that SRC awards are not given for the purpose of obtaining degrees and thus that these words do not necessarily denote the extent to which the objectives of SRC and the students themselves have been achieved in individual cases.

The recommendations

The data produced by this survey have been considered at a special meeting of the Council's Postgraduate Training Committee (see page 3). The Committee's main recommendation was that the preparation of a full report of the research which has been done should be regarded as an essential component of the training for which the award has been made and should normally be completed under supervision before expiry of the award. This, and the Committee's recommendations for implementing this policy, will be considered by the Council at a forthcoming meeting. Early intimation will be given of any changes in the regulations or procedures relating to SRC research studentships which may result.

1. Subject determined largely by departmental title (see text).

2. Qualifications, or combination of academic qualifications and relevant experience, accepted as equivalent of a level of attainment at least equal to a lower second-class honours degree.

3. The words 'successful' and 'unsuccessful' should be interpreted only in the special sense described in the text.

Fellowships

Closing dates and application forms

Senior Fellowships–
30 November 1981 (SRC Form SF2)

Advanced Fellowships–
30 September 1981 (SRC Forms AF2, 3 and 4)

Postdoctoral Fellowships (except in Europe)–
31 December 1981 (SRC Forms RF2 and 3)

Postdoctoral Fellowships (Europe)–12 January and 10 May 1982 (Royal Society Form)

Royal Society/SRC Industrial Fellowships–Application at any time (SRC Forms IF 1, 2, 3, and 4)

Special Replacement Scheme–Proposals may be submitted at any time.

Royal Society/SRC Industrial Fellowships

Much interest is being expressed in the potential benefits of this scheme both by industrial concerns and academic institutions, and a number of promising projects have been suggested to Dr David G Jones, the consultant engaged in promoting the fellowships. RS and SRC are encouraging the development of these ideas and hope that more good candidates will apply for the awards.

So far 11 applications have resulted in the offer of two fellowships involving transfers in each direction between the academic world and industry:

Mr W C Pike, the Manager of the Lubricants Branch of the BP Research Centre at Sunbury, is spending the whole of 1981 with the Department of Engineering at the University of Reading studying the industrial application of tribology research;

Dr A D C Grassie, lecturer in experimental physics at the University of Sussex, is using his fellowship to enable him to work for two years from April 1981 at the Philips Research Laboratories investigating III - V compounds grown by Molecular Beam Epitaxy.

Enquiries about the scheme may be directed either to Dr Jones on Knutsford (0565) 51576 or to SRC Swindon office (0793) 26222, ext 2403.

First awards from the SRC Special Replacement Scheme

The Council has now studied the first group of package proposals put forward by universities under the Special Replacement Scheme and has offered support for four of these. The scheme requires a university or polytechnic to give a tenured appointment to a promising young scientist or engineer, thus enabling a senior worker to spend more time on research.

SRC will underwrite the net cost for up to five years. The younger scientist would ideally be research orientated preferably in a promising new area. SRC must be convinced that in total it is supporting scientific work of outstanding worth. The two academics involved need not be of the same discipline.

Successful proposals which have been announced are:

University of Bristol: Physical Chemistry, assisting the work of Professor D H Everett and others upon thermodynamics and statistical mechanics.

University of Kent: Physics, contributing to the research of Professor J G Powles and his group on the theory of liquids.

University of Leicester: Chemistry, releasing Professor M Symons to concentrate on solvation and ESR spectroscopy of unstable species.

University of Southampton: Civil Engineering, enabling Professor R Butterfield to continue his soil mechanics research.

Proposals of this nature take some time to assess in competition with others and so Vice Chancellors or Directors are asked to submit applications at least four months before they wish to know the result.

SRC has also stressed that the scheme is extremely flexible and that universities and polytechnics should submit proposals appropriate to their own circumstances.

Petroleum reservoir research

The Marine Technology Directorate has awarded £248k for research into aspects of petroleum engineering. Most of the research is being undertaken at Heriot Watt University. The aim of much of the work is to provide information to improve reservoir performance, concentrating at present on well damage. This can be caused by drilling and completion fluids and by the injection of sea water to maintain pressure. A large part of the initial research involves reservoir rock characterisation. Other studies include permeability reduction and modelling of plugging.

Related projects are looking at the mechanisms of scale formation within the reservoir rocks, the characterisation of suspended solids in sea water and the development of seawater filtration systems. Offshore operating companies have shown much interest in these and other petroleum engineering projects, including investigations into the fluid displacement problems that arise in deviated wells, techno-economic modelling of offshore petroleum production systems and borehole directional surveying by acoustic sensing.

Major new grants

ASTRONOMY, SPACE AND RADIO BOARD

Radio astronomy
A consolidated grant of up to £331k for one year to Professor Sir Martin Ryle (University of Cambridge) for continuation of the programme of radio astronomy research at the Mullard Radio Astronomy Observatory and to develop the research capability at millimetre wavelengths.

NUCLEAR PHYSICS BOARD

Film analysis centres
Rolling grants of twenty months for the film analysis centres at Birmingham University (up to £380k), Glasgow University (up to £384k), Imperial College (up to £579k), Liverpool University (up to £263k) and Oxford University (up to £499k).

ENGINEERING BOARD

Microwave and millimetre wave antennae, image diagnostics and digital image processing
A special grant of up to £250k over four years to Drs A P Anderson, J C Bennett and B Chambers at Sheffield University.

SCIENCE BOARD

Electron and phonon energy levels in crystalline and amorphous materials
A continuation of a special rolling grant of up to £234k over four years to Drs A D Yoffe and W Y Liang at Cambridge University.

Structural phase transitions
A standard grant of up to £283.4k over three years to Professor R A Cowley, Drs A D Bruce, R J Nelmes, G S Pawley and W Taylor at Edinburgh University.

Artificial intelligence

The SRC continues to welcome grant applications in the field of artificial intelligence. Research in this field may be categorised into three discrete areas of investigation:

- those aspects of cognitive science which attempt to understand the information processing mechanisms underlying the human faculties of perception, memory and reasoning in computational terms;
- the application of artificial intelligence techniques in computer systems, for example, expert systems, natural language understanding and symbolic computing;
- the application of artificial intelligence in the design of automation systems, specially robots.

In assessing these applications the Council will be advised as appropriate by the Biological Sciences Committee, the Computing and Communications Subcommittee of the Information Engineering Committee and the Engineering Processes Committee, the latter having responsibility for the development of the Council's robotics programme. In the area of cognitive science the Biological Sciences Committee has this session assumed responsibility from the Cognitive Science Panel which the Science Board decided had fulfilled its initial objective of encouraging more research in the field.

It is recognised that, because of the interdisciplinary nature of some applications, advice will have to be sought from more than one of the above Committees. Arrangements have also been made for regular communications between the three Committees to ensure the proper advancement of research and training in the fields of cognitive science and artificial intelligence as a whole.

Some new publications from SRC

SRC annual report 1979-80

Report of the Science Research Council for the year 1979-80 was published in November 1980. Copies are available from HM Stationery Office, from Government Bookshops or through booksellers (ISBN 0 10 027909 0), price £7.10.

Amendments to the statistics concerning research grants that appeared in this report have been found necessary. A correction slip is available, free, from the Publications Officer at Swindon (0793) 26222 ext 2254.

Appleton triennial report

Radio and Space Research 1977-1979 is the laboratory's final triennial report and marks the end of the Ditton Park era, following the merger of the Rutherford and Appleton Laboratories. Copies are available from HM Stationery Office, from Government Bookshops or through booksellers (ISBN 0 901660 40X), price £4.

Biological Sciences Committee annual report

Copies of the 1980-81 annual report on the Biological Sciences Committee's activities are available from the Committee's secretariat, telephone Swindon (0793) 26222 ext 2368.

Physics Committee annual review

The 1979-80 review of the activities of the Physics Committee, including statistical information, is available from the Committee's secretariat, telephone Swindon (0793) 26222 ext 2215 or 2262.

Science-based Archaeology Committee annual review

The review outlines the Committee's activities for the academic year 1979-80 and is intended as a source of general information. It is available from the Committee's secretariat, telephone Swindon (0793) 26222 ext 2362 or 2262.

PED publications

Two reports have been produced recently by the Polymer Engineering Directorate relating to the skills and training needs in the plastics processing industry – *The in-house moulder: his skills and attitudes* and *Implications of the SPRU study on the use of skills within the injection moulding sector of the plastics industry*. Both of these reports are available from PED, 3 - 5 Charing Cross Road, London WC2H 0HW (01-930 9162).

Review of radiation effects in solids

The Physics Committee regularly undertakes reviews of selected subject areas within its remit. During the academic year 1979-80 a panel set up by the Committee completed a review of work in the field of radiation effects in solids, including ion implantation. Copies of a summary of the panel's conclusions and recommendations are available from the Committee's secretariat, telephone Swindon (0793) 26222 ext 2215 or 2262.

Balloon programme report

The Balloon Programme Steering Committee Report 1977-1980 is available from the Steering Committee's Secretariat, telephone Swindon (0793) 26222 ext 2239.

Engineering Committee reports

The annual reports for the year 1979-80 of the Engineering Board's four committees are now available from the relevant committee secretariat at Swindon (0793) 26222. They are: *Engineering Processes Committee* (ext 2250); *Environment Committee* (ext 2123); *Information Engineering Committee* (ext 2115); *Machines and Power Committee* (ext 2116); and *Materials Committee* (ext 2277).

Computer networking

The Computer Board and Research Councils Joint Network Team has produced the first review of its activities since its formation in April 1979. Copies of the *Joint Network Team Report for the period April 1979-August 1980* are available from the Joint Network Team, Rutherford and Appleton Laboratories, Chilton, Didcot, Oxon OX11 0QX, telephone Abingdon (0235) 21900.

More firms join Teaching Company Scheme

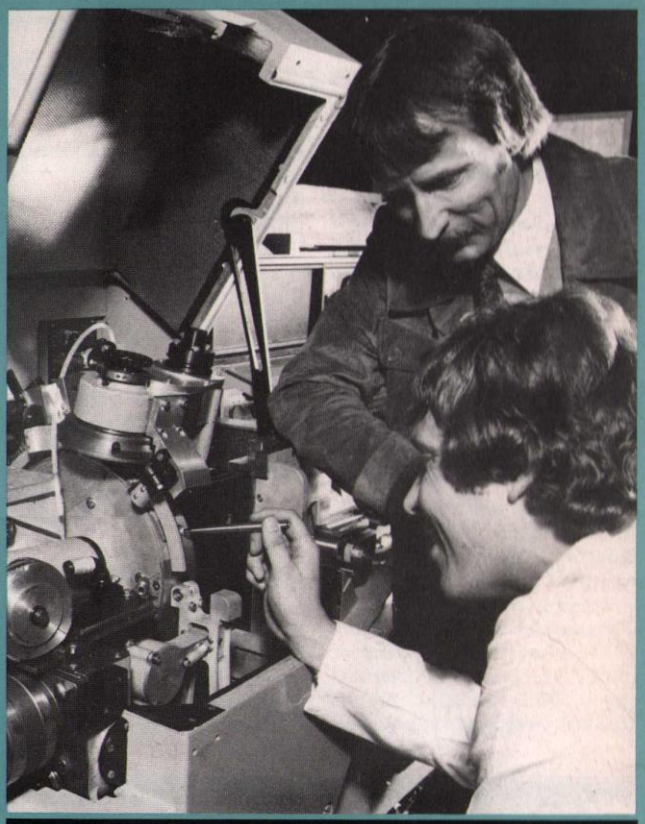
The Teaching Company Scheme has more than doubled its target of 20 company programmes under way by 1981; the announcement of 15 new programmes in February brought the total to 45 programmes and as many more firms interested in taking part, while the scheme remains within its original budget.

Programmes are undertaken jointly by a company and a university or polytechnic and are tailored to the needs of each participating company. An SRC/Department of Industry award covers academic support, travel funds and the basic salaries of able and ambitious graduate associates who work within the joint company-academic team.

The first programmes were set up in 1974-5. Some of the original programmes have now been completed; some have been extended beyond their planned lifespan into a second generation.

In the Molins Ltd (Tobacco Machinery Division) programme, for example, two young graduates have now completed their term as Teaching Company Associates and have joined Molins in management positions while a second pair are now mid-way through their assignment.

Seen here are Peter Bevan, one of the former associates and now Chief Inspector (Assembly) (foreground); and Professor Ray Wild of the Administrative Staff College, Henley and Brunel University—the senior academic involved. The project provided Mr Bevan with experience in the design and installation of a numerical control system and in project management and he was able to see it through to its completion.



SRC's schools for graduates

Each year since 1968 the SRC has sponsored, in co-operation with the Careers Research Advisory Centre (CRAC), schools for holders of SRC research studentships. The schools are specifically designed to make students aware of career opportunities in industry, commerce and the public service as opposed to academic research.

Each school, which lasts five or six days, is staffed by a director and tutors drawn from a wide range of occupations, and caters for between 80 and 100 research students mainly from their second postgraduate year.

A typical school programme includes small group participation in case studies and role playing exercises.

The students also participate in discussions on job prospects and receive advice on giving oral presentations, being interviewed and how to organise and control meetings. Most students find the work demanding but enjoyable and speak highly of the value of what they have learned.

To date more than 6,000 students have attended schools at various locations throughout the country. The first 1981 school was held in Durham in March and six more are planned between June and September, in Stirling, Guildford, Hull, York, Exeter and Hertford.

Further details are available from Mrs L Clark at Swindon (0793) 26222 ext 2153.

Picture shows informal discussions during a summer school at Hull.