

# Bulletin

of the Rutherford Appleton Laboratory

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## SPACE SCIENCE AT RAL

### Introduction

Against a background of continuing government refusal to increase public spending on the national space programme, this may seem an unusual time to write a piece for the Bulletin on our space programme, but there are two good reasons for pressing ahead and doing so. The first is that it is timely to describe to the rest of the Laboratory the make up and programme of the new Space Science Department; the second is that the government's position does not affect the existing SERC-funded programme of space research, which presents a full and exciting challenge to us all for many years to come.

### Background

The new Space Science Department is made up of two Divisions, themselves relatively new manifestations of our old Divisional structure. These are the BNSC Division, headed by the Laboratory's Chief Engineer, Peter Barker, and the Astrophysics and Geophysics Division, headed by Mike Cruise, a welcome recruit of a few years ago from the Mullard Space Science Laboratory of UCL. The common task of the two Divisions is to implement our programme of astrophysics and geophysics projects in support of university researchers. The Divisions are organised in such a way that BNSC Division takes prime responsibility for planning and implementing our space projects, whilst A&G Division provides project scientist support to those projects, plus taking prime responsibility for our non-space programmes (telescopes, radars, etc), and for our extensive data segment projects. The two Division Heads are supported by three groups in each case: these are headed by Eric Dunford, Mike Sandford and Dick Holdaway in the BNSC case, and David Llewellyn-Jones, Duncan Bryant, and Bill Burton in the case of A&G. A rogues gallery photograph of the assembled team at the start of a recent Departmental management meeting is shown above. Also in the photograph are senior project engineer Ray Turner, and Peter Curtis, responsible for new project studies.

The programme of the SSD still requires extensive support from other RAL Departments, of course, and especially from the



"Rogues Gallery" - A Departmental Management meeting about to commence.

Instrumentation Division of Technology Department and from Central Computing Department. In addition, Technology Department retains delegated responsibility for the concluding phases of the James Clerk Maxwell Telescope project, and stands ready to work on possible future APS Board major facilities such as the proposed Gravitational Wave Detector, or Merlin Telescope extension.

The management of the programme is further complicated by the fact that, whereas just over a year ago we reported to just one SERC Board (the Astronomy Space and Radio Board), now we have to deal with three Boards: the Astronomy and Planetary Science Board of the SERC, and the Space Science Programme and Earth Observation Programme Boards of the BNSC. For the purposes of this note, however, I will not confuse the reader by referring to this complication any further!

Let us turn to the programme. It is characterised by a great diversity and range, and may best be described in four categories:

- Space Projects
- Data Facilities
- Ground Based Programmes
- In House Research

I will deal with each of these in turn.

### Space Projects

The portfolio of ongoing space projects is our major activity. The

number of projects in hand is too great to permit a full description in the limited space available here. Details are available in the 1986 Annual Report.

As an example of a typical space project (though no-one is ever really "typical") let us consider the ROSAT (or Roentgensatellit to give it its full title) is a West German satellite carrying a large X-ray telescope. The US is participating by providing the launch, and will in return share in the scientific data. The UK is providing a "strap on" experiment, the Wide Field Camera. The WFC will operate in the extreme UV between 60 and 300 Å. RAL is responsible for UK programme management, international liaison, procurement, and development of certain sub-systems, including attitude measurement and reconstitution, and EUV filters. In addition, RAL is coordinating the UK data processing and operations software, including provision of a data centre for initial data reduction in the UK. The total mission lifetime is planned to be 18 months, beginning with a systematic 2 arc-minute resolution all-sky survey, followed by an observatory pointed phase of observations. Universities involved in the hardware phase are Leicester, MSSL, Birmingham and ICST, though the wider UK astronomical community will also be able to access the processed and archived data. This range of activities on a space project is typical of the support given to universities. In addition, our astronomers expect to play a full role (see over)



(cont'd from P1)

in the scientific interpretation of the data: judging by our publication to date, we can expect to contribute fully to the data exploitation.

Our capability to study new space mission and instrument proposals is vital to our future programme. Characteristically, future space projects studies have a high 'wastage' rate, since missions are often modified, descoped or changed radically during the tortuous route to approval. However, without the expenditure of effort on studies there would be no programme of missions in the future. This also is an area in which universities have to rely heavily on RAL expertise.

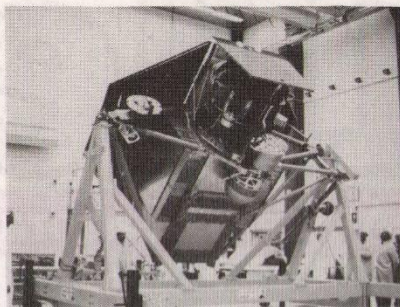
### Data Facilities

The best known of our several data facilities is probably the Starlink astronomical network. Starlink is a national facility coordinated by RAL, and is the primary computing resource of the astronomical community. The system comprises ten VAX computers sited at universities and institutes throughout the UK and serves some 800 users. Some 0.5 million source code lines have been written for Starlink, and the system has been emulated in several other countries.

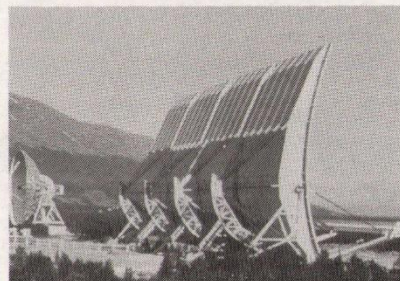
In geophysics, the Laboratory houses the embryonic Geophysical Data Facility, which is intended to provide UK users with efficient access to the large data sets that are to become available from the next generation of satellites such as ERS-1 and UARS. RAL, in addition, houses a World Data Centre C1 for solar-terrestrial physics data: this provides a service world-wide to the geophysics community and represents an important international highlight for the Laboratory.

### Ground Based Projects

Many readers will be aware that RAL has been responsible for the design and construction of the James Clerk Maxwell Telescope on Mauna Kea in Hawaii. Responsibility for operating this 15m diameter telescope for use at short sub-millimetre wavelengths has now been transferred to the ROE, and it is performing extremely well. It was completed on time, within cost and to specification.



XUV Wide Field Camera mounted on ROSAT (photo Dornier Systems).



The 120m by 40m VHF antenna at Tromsø (Norway).

In Scandinavia, RAL is responsible for UK participation in the European Incoherent Scatter Radar, EISCAT. Incoherent scatter is a powerful technique for studying both electron and ion properties in the ionosphere, and EISCAT is specially sited to study polar processes. A team based at RAL is responsible for organising the utilisation of the two radars (one VHF, one UHF) which make up EISCAT, and for ensuring the effective exploitation of the data. Staying with the ionosphere, we also operate three ionosonde sites at Slough, South Uist, and in the Falklands and make this data available to the scientific and applications communities.

### Research

As part of their work on maintaining the facilities and projects that I have outlined above, many of our staff engage in some personal research, though often at a low level. Such involvement is essential in order to keep staff well tuned to the requirements of the community we support, as well as a personal incentive (sometimes even as a personal protection against the

total insanity brought on by too much administration). Our scientists are making important contributions in areas such as quasars and active galactic nuclei, galactic systems, stellar physics, atomic spectroscopy, magnetospheric physics, auroral studies, ionospheric and atmospheric physics and molecular spectroscopy.

### Concluding Remarks

The Space Science Department programme is a diverse one, as is dictated by the range of current problems in astrophysics and geophysics, but it has one unifying theme, which is the study of the external universe from the Earth's surface to the limits of the universe. In satisfying our primary goal, which is to provide specialist and professional support to university and polytechnic scientists in space, astrophysics and geophysics projects, we have to maintain the highest standards required of a national centre of expertise, and this we do. Staff are often hard-pressed in providing this support, but respond to the excitement and challenge of the work, and have scored a long list of successes over recent years that I am proud to acknowledge.

The future programme which features in the approved SERC Forward Look is an exciting and demanding prospect. We expect approval within the year of a major new programme with ESA in solar-terrestrial physics: British groups are planning major hardware contributions to SOHO, a solar observatory satellite, and CLUSTER, a group of four identical, 'roving' magnetospheric probes. Also within the year it is anticipated that British involvement in an X-ray astronomy mission, Spectrum-X will be agreed with the Soviet Union. Looking slightly further ahead present plans include a solar physics mission with the Japanese, an atmospheric science mission with NASA on the Space Station, and X-ray and UV astronomy projects with ESA. We hope that the national space programme will receive the increased support from central government that it deserves, but in the meantime we have a challenging job ahead of us to support the planned space science programmes and we will get on with that job.

J E Harries

### Film Badge Notice

It is period 11 colour strip GREEN

Please ensure you are wearing the current dosimeter and return all old ones to Jenny Coates, R12.

### Sales to Employees

The sale of scrap materials to RAL staff will take place from 1200-1230 hours in R24 Scrap Compound on 4 and 18 December.

### Astrophysics events

These seminars are held at 2pm on Wednesdays in the R61 Conference Room.

- 9 Dec "Active Galactic Nuclei: Star bursts or monsters?"  
Dr Roberto Terlevich
- 9 Dec "Exploring the Atom and its behaviour"  
Dr Brian Fawcett (RAL)

### Christian Fellowship

The fellowship usually meets in the R2 Conference Room on Thursdays at 12.30pm. All are welcome.

- 2 Dec Coffee Lounge R1 12.30pm onwards
  - 3 Dec Prayer Meeting - Rodney Tillotson
  - 11 Dec CAROL SERVICE - Lecture Theatre R22 12.30pm - Rev. Jeff Taylor
- For further information contact Frank Smith, Ext: 5540.



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## Obituary

### J A Ratcliffe

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J A Ratcliffe, CB CBE FRS, who died on 25 October 1987 at the age of 84, was Director of the Radio Research Station at Ditton Park, Slough, from 1960 to 1966. Under his leadership the Station enjoyed a productive and exciting period of activity in radio research and the new field of space science. The Station's first involvements with space - satellite tracking and the World Data Centre - had started with the International Geophysical Year in 1957, but Ratcliffe brought the Station into the rocket programme, the ionospheric topside sounder project and other new developments. RRS was, for him, a research station

first and foremost, and his programmes of seminars, lectures, literature discussions and progress reviews were devoted single-mindedly to that end. Several present members of RAL staff, recruited to Ditton Park in Ratcliffe's day, may well recall his meetings scheduled for 0835 on Mondays (a five-minute concession was allowed for signing the attendance book and lunch list; at Cambridge the favourite time had been 0900 on Saturdays).

Apart from his distinguished wartime services in the field of radar, Ratcliffe's previous scientific career was at the Cavendish Laboratory, Cambridge. He pursued many aspects of radio science and ionospheric physics, initially under the tutelage of his great mentor, Edward Appleton. Ratcliffe had a great interest in the physics of waves and Fourier analysis, and it might well have

fallen to him to discover holography. Above all he was a physicist; he sought physical explanations and experimental proofs; he distrusted mathematical and computational results unless he could see the physics behind them. His lectures and expositions amply demonstrated his gifts of clear thinking and clear writing. In retirement he devoted himself to writing books, editing the *Journal of Atmospheric and Terrestrial Physics* (a task he inherited from Appleton) and caring for his ailing wife. As a pastime he turned his attention to new fields, such as computing and solid-state electronics. Visitors to his Cambridge home could expect an interesting and wide-ranging conversation. The countless colleagues, students and friends whose lives he enriched will always remember him with gratitude and affection.

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## Obituary

### Colin Thomas

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We deeply regret to announce the sudden death on Saturday 31 October 1987 of Colin Thomas of ISIS Division.

Colin began his apprenticeship with the National Coal Board in 1955 and was a shift chargehand fitter when he left to come to AERE as a craftsman in 1965. He came to RAL in 1966 as a Technical Grade III on Bubble Chambers. He was appointed a PTO II Shift Leader in 1969 and moved on to the installation, commissioning and operation of liquid hydrogen and polarised targets in the Experimental

Halls support team in 1973. When Nimrod closed down in 1978 he became a key member of the dismantling and disposal team until 1980 when he became involved in the design and construction of shield walls for ISIS and the Target Station, also taking control of the site heavy gang. He took an increasing load of work on the Target Station, supervising construction and installation, leading to his promotion to PTO I (SPTO) in 1984 since when he has become the mainstay of the mechanical operation and maintenance team, playing a leading role in improving the reliability and serviceability of the cryogenic system and water services.

Colin, who had just passed his 49th birthday, was always active, giving

service freely and with extreme good will. He never delayed tackling a difficult or unsavoury task on the principle that if he had finished it, he could only get something better to do!

His knowledge and expertise in the specialised fields in which he worked will be sorely missed in ISIS Division and difficult to replace with anyone of equal skill and dedication.

To his wife June, daughter Michelle with her husband and Colin's grandchild, and son Kevin, the family of which he was so proud, we offer our sincere condolences.

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## Visitors

On 22 October, a group of 10 university chancellors from Guangdong Province, China visited RAL. Heading the party was Wang Pingshan, Vice-Governor of the Province and Minister of Education. Guangdong Province is the richest province in China and has been leading educational reforms in China. It is developing advanced research activities in universities and the party was visiting the UK to study our experience, and problems in combining teaching and university research. In particular, the party was very interested in the RAL type system of a central laboratory providing facilities for a large number of external academic users. The Vice-Governor was keen to establish contact between institutes in his province and RAL. His eyes really opened wide when on the tour of RAL he learned that a team on ISIS was studying the oil and water concentration in clay. He explained that there was a strong possibility of significant oil deposits in his province. He expects that Guangdong Province could become even richer in the future. What chances a Chinese investment in ISIS?

A group of senior Chinese scientists visited RAL on 5 November in order to see RAL's programme of science and technology involving Earth Observation from space, and to explore possibilities for future collaborations. Following an introduction to RAL by David Llewellyn-Jones, they were taken on a tour of projects, and the visit concluded with a discussion with Peter Barker, the RAL Chief Engineer and deputy director of the Space Science Department. The visitors were led by Prof. Ma Jun Ru, who is Deputy Director of the Department of High Technology in the State Science and Technology Commission of China (SSTC) and the new head of China's National Remote Sensing Centre.

During the tour of projects Paul Dickinson and Dave Matheson showed them work connected with the three major Earth Observation space projects that RAL is involved in: ATSR, ISAMS and MLS, all of which are satellite instruments designed to study the Earth's Atmosphere and Surface. They also saw two examples of advanced technology associated with these and other space projects, namely closed-cycle coolers, demonstrated by Tom Bradshaw and



Tom Bradshaw explains the construction of cooler diaphragm.

Anna Orłowska; and millimetre-wave devices, including Charles Cunningham's work on SIS receivers, a completely new development which will greatly increase the power of the JCM Telescope in Hawaii.

They were enthusiastic for future collaborations, and will follow up several possible leads. In fact they saw that one collaboration is underway, when they met Mme Huang Mei Yu, who is working at RAL as a visiting RA in Dave Matheson's laboratory.



## Farewell

### Bart Fossey



Bart delves into the 'software packaging' in 'search' of his gift.

A farewell party given by Mr and Mrs Bart Fossey for all Bart's friends and colleagues was also the occasion for the presentation of gifts to him from those friends.

Thanking Bart for almost 40 years as 'Programmer extraordinaire' with the Atlas Centre (in one or other of its guises), Brian Davies recalled some of Bart's more individual accomplishments. As a recognised expert in hand calculators, he had, in the early days taken on a Decatron machine and beaten it - over the first 20 minutes, anyway. Later he had gained the reputation as the Mercury autocode guru. Over the years he had mastered every computer that the Atlas Centre had thrown at him.

He has been Head of Resource Management, User Support, Grants Support and Technical Secretary to both Central Computing Division and Informatics Division with responsibility for estimates and the 'Five Year Forward Look' - a task he completed for the current year only days before his retirement.

"We wish you all the best for a very happy retirement", said Brian presenting Bart with a thick Ray Roberts card and a set of luggage. "Do please drop in to see us - especially at 'Forward Look' time".

Bart thanked everyone for the gifts. He and his wife had thought they might take a trip to Australia now that they had time - the luggage was very welcome. He had, he said, very much enjoyed his career at the Lab.

Finally, to get everyone into the party spirit, Bart provided an entertaining party-piece lecture, featuring a program of the day in the life of a programmer. Well I'll GO TO ....

## RecSoc

### Triumvirate Trophy Triumph

During late September and October a three cornered competition took place on a home-and-away basis between RAL Rec Soc, Harwell Rec Soc, and Harwell Police Club. The "friendly" competition took the form of singles and pairs in Darts, Crib and Pool, points being awarded for a win in each event. These evening events proved very successful for the Rec Soc with some 27 members taking part on one or more occasions. Notable performances coming from: Andy Napper played 8 won 8, Andy Leech played 9 won 8, Steve Stoneham played 9 won 7 and Steve Hancock played 9 won 7. When all the results were added together RAL Rec Soc ran out comfortable winners.

The trophy (donated by Ushers) was presented on final's night in the Police Club on 3 November. The Single's competition for each event resulted in Rod Hadly winning the darts shield and Mark Wheeler unfortunately losing in the pool final. At the end of "play" the single's trophies were evenly distributed, one to each club - a fitting finale to the competition.

My thanks go to all Rec Soc members who played in and supported our team to victory and to the stewards of the Harwell Rec Soc and Police Club in making each evening an enjoyable event.

S Hancock  
(Bar Manager).

## DELPHI Solenoid

After over 1100km by sea and river the Solenoid is once more back on terra firma. It arrived in Strasbourg in the early hours of the morning of Sunday 8 November after a fairly uneventful crossing.

## RAL Fund

In his retirement week, Dr John D Lawson made yet another contribution to the Laboratory. This time in the form of a substantial farewell gift to the RAL Fund.

We thank him most warmly for his generosity.

## Arts & Crafts 1987

The 1987 Arts and Crafts Exhibition took place on Tuesday, Wednesday and Thursday the 13, 14 & 15 October.

The model makers were there in force and some very interesting collections and beautiful single items were shown. The photographs were also of high quality and great beauty, including some stunning black and white studies. The knitted exhibits were a bit spectacular too.

The quality of the exhibits was as high as ever, but the variety was sadly down. What has happened to our potters, our artists, our needlepersons? You surely can't all be glued to your home-computers.

The organisers have volunteered to mount another show next October, so this will be your chance. Now is the time to start to produce the work that is going to knock us speechless with admiration. Join in the fun as doers not just spectators, though we are truly grateful for the support which helped to raise £30.50 for Shelter.

The next exhibition will be on 18 -20 October 1988. You have been forewarned.



Getting down to the finer details.

## Missing

Drilling Machine  
Lab No. DR 13326  
Removed from µSR Beam Line Area  
Information to P Surtell, Ext: 6100.

# Bulletin

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