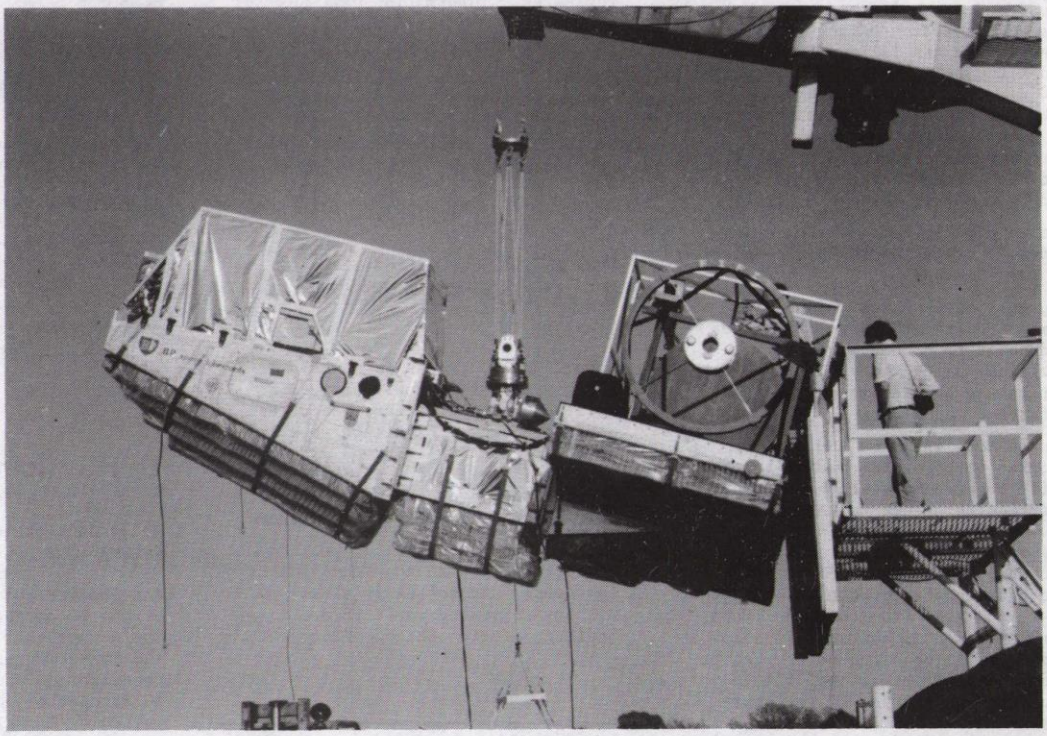
Bulletin
of the Rutherford and Appleton Laboratories
30 June 1981 No.11

Fly RAL



The RAL Stabilised Balloon Platform just prior to launch in the 1979 campaign. 4960/22
The scientific payload was the world's largest Infra-red Telescope from Imperial College.

The latest generation RAL arc second pointing balloon gondola is approaching completion in building R7. This three axis stabilised platform will carry experiments, weighing up to half a ton, clear of the majority of the Earth's atmosphere allowing astronomical observations in spectral ranges inaccessible with ground based instruments. The first flight of the new platform is scheduled for September and will be from the National Scientific Balloon Facility (NSBF) at Palastine Texas, where a 30 million cubic foot helium filled balloon will carry an experiment from Queens University, Belfast to 43 km above the ground. At this height the experiment is above 99.5% of the atmosphere allowing observations to be made in the Ultra-violet part of the spectrum.

Scientific Ballooning

Since 1973 the Appleton Laboratory has been concerned with the uses of balloons for scientific research and has organised flight programmes ordered balloons, arranged the use of ranges and provided major facilities such as the Stabilised Balloon Platform (SBP). The majority of flight campaigns have been at the NSBF Texas although other sites including Australia are used. The balloons range from 3 to 40 million cubic feet in volume and the material is only a few thousandth's of an inch thick. The balloons are open at the bottom and are only partially inflated at launch with helium which expands to completely fill the balloon at the height at which it floats. The time at 'float' altitude varies from a few hours to several days. At the end of the flight the payload is released by telecommand and descends on a parachute.

There are now over 100 scientists in 14 research groups in the UK with major involvement in balloon borne research. Most experiments require some stabilisation of their viewing direction and several groups carrying out astronomical observations require the ability to locate and track celestial sources for extended periods with arc second accuracy. After an initial unsuccessful attempt to procure a suitable platform, at a fixed price, from commercial sources, the ASR board charged the Laboratory in 1976 to provide a 3 axes arc second accuracy pointing platform. This has involved five years of progressive, in-house development of two platforms complete with transportable ground station and the setting up of a central facility in R7 for the integration of university payloads at RAL.

The Stabilised Balloon Platform

Unlike most balloon platform pointing systems currently in use the RAL SBP has centrally mounted gimbals operating in three axes and the complete platform is stabilised with respect to the balloon and suspension. This arrangement confers maximum flexibility in choice of experiment weight and size. The orthogonally mounted gimbal torque motors which

(see over)

Fly RAL *(continued)*

drive the platform are attached at one end to the balloon suspension train and at the other to a honeycomb central section. Ballast for altitude control is in a hopper suspended under the gimbal assembly. Two lightweight outer sections also made from aluminium honeycomb are bolted to this frame, one supporting the experiments and the other housing control systems, power telemetry and telecommand units.

The current electronics and servo systems have all been designed in-house and are built and packaged to space standards. During assent the temperature can fall to -70°C and at float the temperature is typically -30°C. Considerable care has been taken in thermal and electronic design to ensure reliable operation at both low temperatures during flight and high temperatures on the launch pad in the full Texas sun.

The control system has the basic modes of operation which are selected by telecommand:

Degree Mode in which the platform is commanded from the ground to move and point to a chosen celestial position, using the on-board magneto-meters and accelerometers for position reference.

Minute Mode in which the platform is 'locked onto' a star and it tracks it while observations are made. The position reference in this mode is given by a two axis star sensor of the type developed for 'Skylark' rockets. An offset mechanism enables the star sensor to be used on objects up to ±5° away from the experiment bore sight in either axis to allow measurements on extended sources or sources too faint in the visible region for operation of the star tracker.

The star tracker allows pointing to be maintained to a few arc seconds during measurement periods of up to an hour. The third (roll) axis is required to maintain the same orientation of the field of view as the earth rotates. This platform is one of the only platforms in the world with this facility. A slow scan tele-vision relays a star field picture to the ground to ensure the star sensor is locked to the correct star. All the ground station equipment for the SBP is housed in a 20 ft x 8 ft x 8 ft sea freight container, equipped with the necessary consoles and racks. This is intended for use by both RAL staff and experimenters and enables remote operation of the platform and experiment to be carried out independently of the NSBF ground station equipment.

Experimental Payloads

The Queens University Belfast payload contains two UV spectrographs employ-ing photoelectric image intensifier detector systems to record spectra of bright stars at a greater resolu-tion than possible with current satellite borne instruments. These flights should determine the structure of several important lines providing information on physical conditions in the interstellar gas and on mass loss processes in the atmospheres of supergiant stars.

The Infra-red experiments from Imperial College and a collaboration involving Imperial College, Queen Mary College and Preston Polytechnic employ the largest balloon borne telescope in the world and the instruments include a two-colour photometer and a liquid nitrogen cooled scanning Fabry-Perot inter-ferometer. Information will be gathered on the birth and death of stars and on the interstellar medium.

We thank Peter Curtis for this introduction to the work of the Stabilised Balloon Platform group.

Induction Course for Ex-Ditton Park Staff

A half-day course is to be held to familiarise staff newly arrived at Chilton with facilities, practices and procedures. Ex-Ditton Park staff established at Chilton who missed the previous course held on 15 January are invited to attend. The course will be held in R22 Lecture Theatre on Thursday 9 July at 9am.

It would help with the provision of 'handouts' and coffee if those wishing to attend would inform Training Section Ext 6285/266.

Library Notice

Would the people who have 'borrowed' our 2 copies of 'New Scientist' for 19 February 1981 please return them.

We should also like our cope of 'The Art of Electronics' by P Horowitz and W Hill to be returned.

Acknowledgements

Mrs J A Wooldridge, niece of the late Margaret Athawes would like to thank all at RAL for their generous donations to the 'Ken Thomas Scanner Appeal', in memory of her aunt. She was able to forward £117 to the appeal.

Sylvia and Pat Butterworth wish to thank everyone for their support and messages of sympathy.

New Chairman for SERC

5060/9

The new Chairman of the Science and Engineering Research Council will be Professor J F C Kingman, FRS it was announced on 15 June.

Professor Kingman is at present Professor of Mathematics at the University of Oxford and Chairman of the Science Board. He takes up his new duties on 1 October 1981.

SERC Joined by ZWO

On 18 June the collaborative project between Spain, the UK, Sweden and Denmark to provide a new European Astronomical Observatory was joined by the Dutch Research Council ZWO. The new partner will provide 20% of the man-power and costs of the construction and operation of the four telescopes planned for erection on the island of La Palmas in the Spanish Canaries. Known as the Roque de Los Muchachos Observatory the site will house 3 optical telescopes and a radio telescope; a 4.2 metre telescope called the William Herschel which will be one of the world's largest, the refurbished 2.5 metre Isaac Newton from the Royal Greenwich Observatory, a 1metre support telescope and the millimetre-wave radio telescope under construction at Chilton.

ZWO: The Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek.

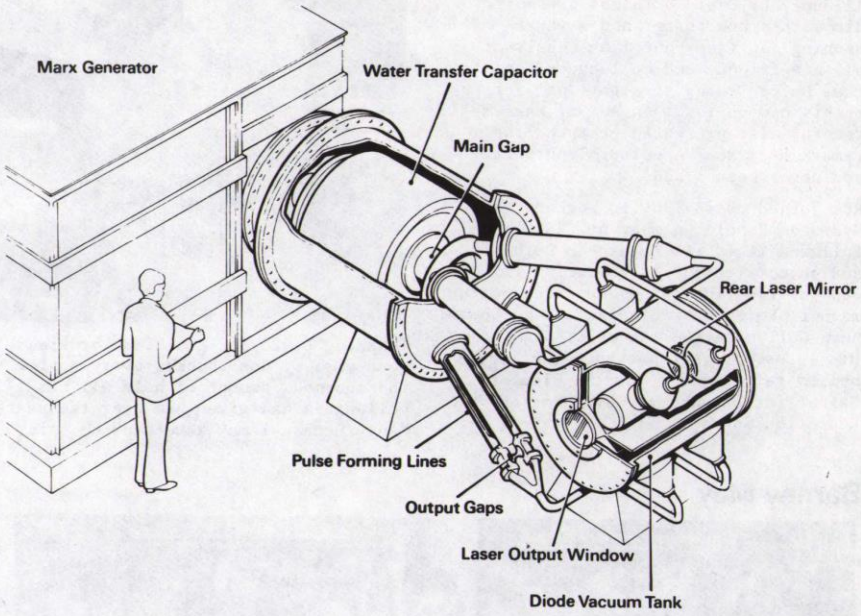
Internal Event

HEP TECHNIQUES SEMINARS
R61 CONF.RM.

30 June 1100 hrs	Dr P P Haskell/RAL 'GRACES: SNS Control Language'
9 July 1400 hrs	Mr M Edwards/Birmingham 'Interactive Graphics for UA1'
14 July 1100 hrs	Dr I F Corbett/RAL 'Cathode Readout'

Introducing SPRITE

The design of the RAL second generation high power KrF gas laser is now almost complete and construction of the machine has just started. It is planned to bring SPRITE into operation before the end of the year. An artists impression of this new laser is shown in the diagram.



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Aims

The overall aim of the gas laser research effort is to develop a high power, short wavelength gas laser to complement (and possible eventually replace) the present Neodymium Glass Laser system for use in laser compression studies. Advantages of a KrF gas laser over glass include shorter operating wavelength, higher efficiency, a laser material that is not prone to damage, easier cooling, and cheapness. ELF, the Electron-beam-excited Laser Facility, was the very successful forefunner of SPRITE and was used to solve many of the design problems posed by the new laser. In particular, ELF was used to show that the 248mm KrF laser was the most efficient rare gas halide (RGH) laser medium. The ELF experiments indicated that with the right conditions of laser gas mix and electron-beam pump rate a large KrF laser could be expected to achieve an overall efficiency of a few percent. These experiments pointed the way to the new laser which will generate an order of magnitude more energy (200J versus about 20J from ELF) in the same 60ns laser pulse duration. The main aim of the SPRITE project is to demonstrate that high power KrF lasers can be scaled to high energy and can operate at an overall efficiency of more than 1%.

Computer Assisted

The diagram shows that the primary energy store in SPRITE is a 19KJ Marx generator (incidently the same one used to power ELF). This in turn charges four 60ns 5Ω pulse forming lines (PFLS) in 250ns. The four PFLS are used to apply 500KV pulses to cold cathode electron-beam diodes which pump the 25cm diameter laser cell from all four sides. Because of the complexity of this machine, extensive use has been made of computer codes to aid its design. A KrF laser kinetics program has been used to predict the optimum laser gas mixture and electron-beam pump rate for SPRITE and an electrostatics field plotting program has been used to design the shape of complex insulators and conductors in SPRITE. Finally a 2D electron trajectory code has simulated the behaviour of the large area SPRITE field emission diodes to investigate magnetic pinch and space charge effects on the electron beams.

Building Begins

The photograph shows assembly work already underway in the Laser Division electron-beam laboratory. In this instance one of the 5Ω pulse forming lines is being test fitted to the high speed water capacitor. Three holes are visible in the dome end plate of the water capacitor - these are for the other three PFLS which will be installed in the near future.

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We thank the members of the gas laser development group for the information in this article.

Sales to Employees

The sale of scrap metal and plastics as set out in RLN 12/73 will be made on 3, 17 and 31 July. Sales are now at the rear of R24 Store from 1200 - 1230 hrs.

Film Badge Notice

It is PERIOD 7 Colour Strip RED. Please check that you are wearing the correct film badge and that all old ones are returned.

NEXT FILM CHANGE
Monday 13 July

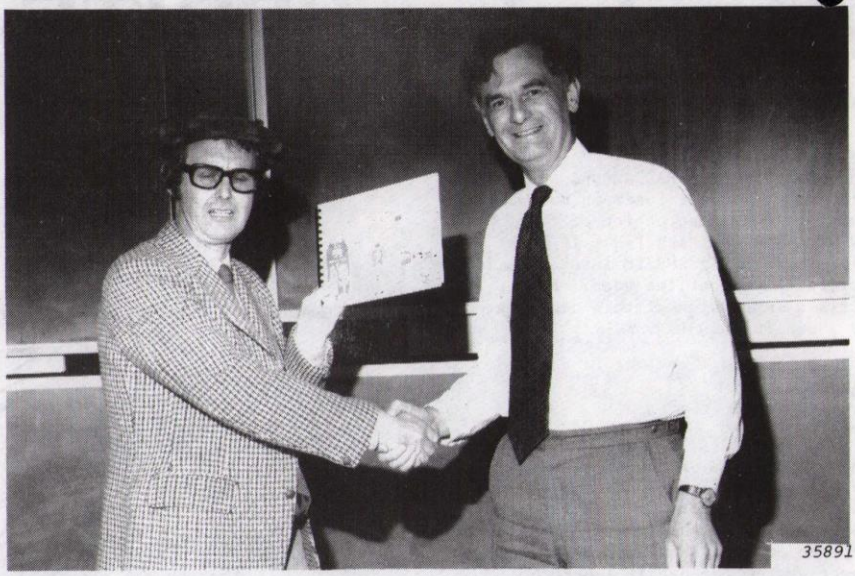
Goodbye and Goodluck

Ron Roberts

Ron Roberts has gone to join the JET set. After 17 years as one of our cryogenic experts the lure of a better Golf Club (or so he would have us believe) has enticed him away!

At a farewell ceremony on Thursday 11 June, Dr David B Thomas presented him with a new putter and a very dashing cap (see photo) on behalf of all his friends and colleagues, so that he can swing straight into action on his new course. A set of Wagner records also presented prompted the remark from Ron "A cultural pursuit you never knew I had!"

Ron joined us in 1964 to work on the Hydrogen Bubble Chamber at CERN. He followed it on its return to Rutherford and on completion of its useful life was involved in various superconducting magnet projects, including the European Muon Collaboration magnet at CERN. His latest project has been the liquid helium refrigerator for the Wiggler Magnet for Daresbury's Synchrotron Radiation Source.



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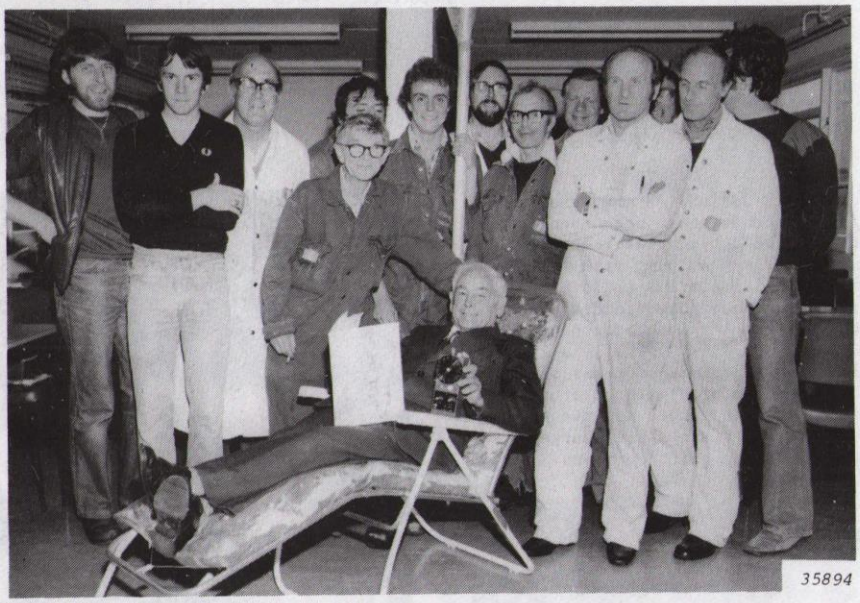
Thanking David for his kind words and good wishes, Ron thanked everyone for the enormous amount of help all his colleagues had given him over the years, "Any success I may have had" he said, "can be attributed to you. Now whenever I find myself having to sink a 20 foot putt, I shall think of my RAL friends - particularly if I miss! The cap is part of my new image to be seen but not heard!"

Barney May



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Barney May, the only man in the history of the Labs to use his mining skills in the casing of an alternator, retired on Thursday 18 June.

This story was retold by David Gray at Barney's retirement presentation, when on behalf of all his friends and colleagues, he was given a radio mast, a wave-meter, and a garden lounger, an indication of the high regard in which he is held.

The incident happened in the very early Nimrod days when on breakdown of the alternator, Barney's ability to work in confined spaces, won him a trip into the casing, from whence he emerged carrying a flat iron bar. This turned out to be the flattened head of a 1½" x 11" Vee Coil Support Bolt that had sheared off and partially jammed between rotor and stator. Modifications followed!

Barney's mining experience started in a Welsh coalmine when he was 14 years old. At 15½ he came to the surface and worked on waggon repairs whilst cycling 21 miles a night, 3 nights per week to pass his 1st Class City and Guilds in "Technical Electricity". In The Army he continued his education, was posted to the Orkneys to service AA guns, searchlights and lorries, and to Egypt, maintaining X-ray equipment.

A spell back at the coalface as an electrician followed before he joined us in 1966 to work in the Nimrod Magnet Power Supply Group. He was involved in building a considerable quantity of prototype and final equipment to improve the reliability of the plant. After the closure of Nimrod, he helped in the dismantling work, and then on installation of the SNS 70MeV injector.

Speaking of his life at RAL, Barney said that after experiencing 15 years at the Labs, he was only sorry he hadn't come sooner. The work had been very interesting and varied. He had been happy in his work, made many friends, had appreciated their sense of humour and enjoyed working with them all. "Thank you all very much for your gifts and good wishes."

Bulletin

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