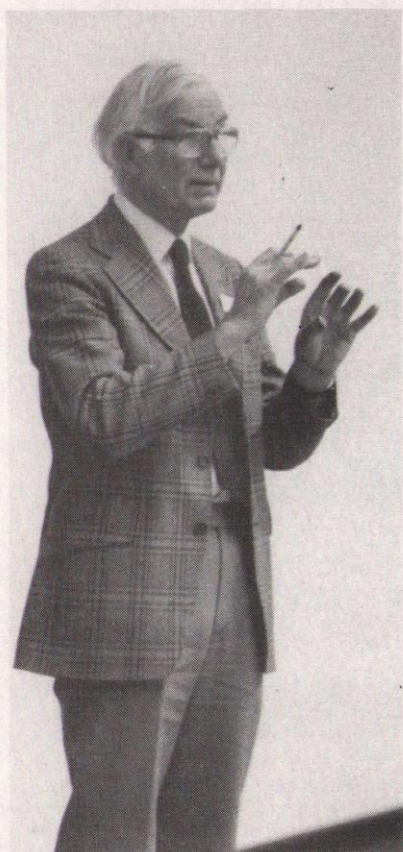


Bulletin

of the Rutherford Appleton Laboratory

6 April 1983 No.5

Dr J D Lawson Elected FRS



Dr Lawson speaking at the Symposium on Heavy Ion Fusion at Darmstadt in 1982. (Photo. CERN).

Though making significant contributions in many specific areas of accelerator physics, perhaps his most notable achievements have resulted from his ability to survey, in both breadth and depth, the underlying theoretical principles of the science, identify where gaps appeared in the theory, and to fill them.

The survey into the problem of fusion power which he undertook in 1955 whilst at Harwell produced the now-famous 'Lawson-Criterion' governing energy "breakeven" in thermonuclear power generation. Work which produced a paper, probably the most quoted in fusion research literature. An exercise done at the Rutherford Laboratory from 1968-72 on the general problem of 'collective' and 'coherent' methods of acceleration with particular reference to the Electron Ring Accelerator, resulted in a review article which is now regarded as a standard reference work.

A study in depth of problems of high intensity beams with the objective of integrating material from widely scattered fields (microwave tubes, electron optics, accelerators, plasma physics, etc) and providing a general unified treatment, was published in 1977 as an 'International Monograph in Physics' by the Clarendon Press. "The Physics of Charged Particle Beams" has since had numerous reprints and been translated into Russian and, perhaps the ultimate accolade, into Chinese!

Dr Lawson's work on the use of lasers to accelerate particles was described as "another example of the way in which he can enter a newly developing field of study and single-handedly bring order where none existed before". Unfortunately the prospects for a useful device do not seem good, but this had to be established.

In 1975 because of his "rather unique" understanding of the physics of plasmas, his services were sought by Culham Laboratory where he spent two years on a design study of a conceptual fusion power reactor based on the 'reverse field pinch' principle, a development arising from the original ZETA experiment, establishing firmly where the limitations in current understanding of the underlying physics lay and providing guidelines for future strategy in this field.

Limitations of space preclude anything but a brief mention of; his early work at TRE Malvern where he made noted contributions to the theory of 'Super-gain' aerials; the IEE prize he shared with a team at AERE Malvern Accelerator group for the first ever extraction of a synchrotron beam, and the successful development of a X-band klystron by a team he led at Harwell in the early 1950s.

We offer Dr Lawson our congratulations on his election to this prestigious Society.

IERE Colloquium

The Institution of Electronic and Radio Engineers is holding a colloquium on "Analogue to Digital and Digital to Analogue Conversion" on 5 May 1983 at the Royal Institution. The meeting begins at 10.00 hrs.

Synopsis: Recent advances have been made in the speed and the accuracy of analogue to digital and digital to analogue converters and in their implementation with integrated circuits. In view of these advances and the current widespread interest in digital signal processing, the IERE is holding a one-day colloquium in which a wide range of techniques and applications will be presented. We hope that the colloquium will provide a good opportunity to hear of the state-of-the-art developments in the subject and to raise questions for general discussion in this important area.

For further information contact Training Section, R20, Ext: 5266.

It is with pleasure that we report the election of Dr John D Lawson as Fellow of the Royal Society, on Thursday 17 March:

"for his contributions to the field of applied electromagnetism, in particular the physics of charged particle beams and high temperature plasma".

Dr Lawson a graduate of Cambridge University received his Sc.D Physics, also at Cambridge, in 1969 and was elected Fellow of the Institute of Physics in 1971. He started his career at TRE Malvern: Micro-wave Aerials Group in 1943, joined AERE Malvern Branch: Accelerator group in 1947, transferred to AERE Harwell, General Physics Division in 1951 and Rutherford Laboratory in 1961.

Industrial Robotics Initiative

In July 1980 the Science Research Council announced a major initiative in Industrial Robotics, involving partnerships between academic groups and industrial firms. Actively guided by the programme co-ordination team based at RAL, the underlying strategy has been to link much of the research in this area to solving particular industrial applications of second generation robots, leap-frogging the present generation and helping to provide the research and training needed to ensure the ability to take advantage of the intelligent robot when it emerges in the mid 1980s.

The programme was also aimed at bridging two serious gaps in UK engineering culture today. First the gap prominent here, but almost absent in countries like Japan and Germany, between engineers in higher education and their counterparts in industry, and second that between information engineering and production engineering. The two latter disciplines are both seen as having a crucial part to play in the development of the factories able to operate unmanned for long periods, expected within the next decade.

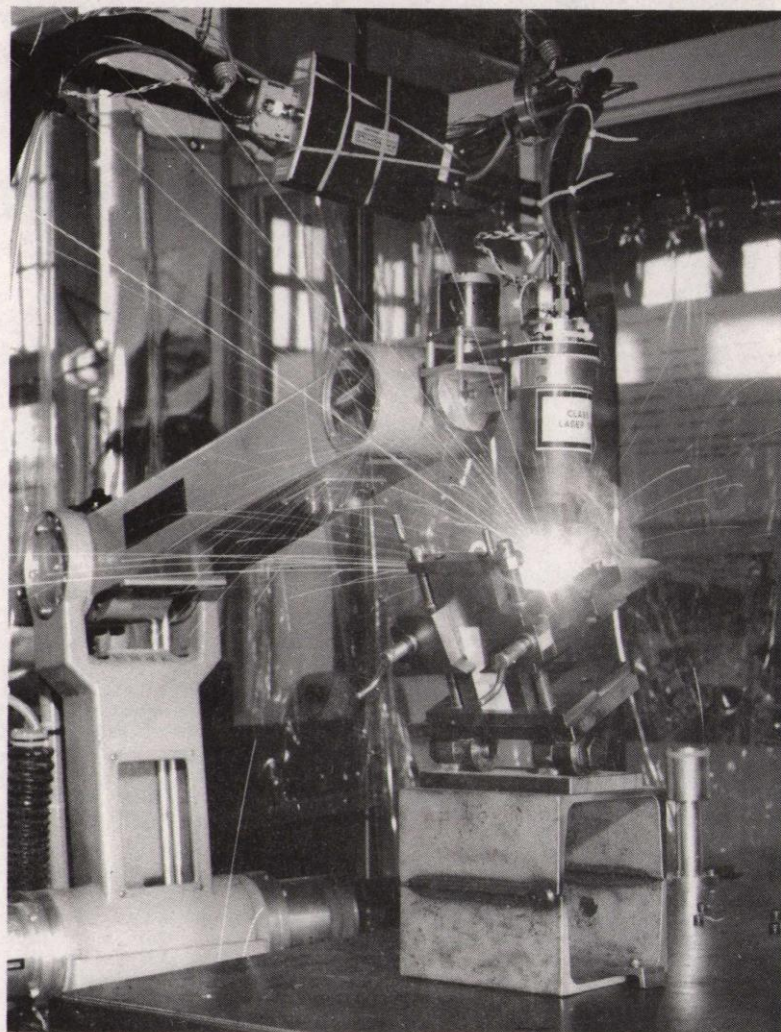
Studies Presented

By the summer of 1982 the programme was sufficiently developed for a closed conference to be arranged at which representatives of those groups which had been funded long enough to be producing results, presented their work to other researchers supported by the Initiative, their industrial partners, and selected representatives from the Engineering Processes Committee, the Department of Industry, the US National Science Foundation, and other bodies.

One of the projects with the shortest time span - the research in the whole programme has a timescale to fruition of 3-8 years - was that presented by Loughborough University. This group has worked with Martonair Ltd to study problems in designing and controlling a modular robot system whose individual elements, both electrical and mechanical, were to be conceived as individual units which could be put together in simple or complex configurations as required by the manufacturing engineer, concerned with a particular application. A product based on this work is about to be launched on the market by Martonair.

Welding

A group at Oxford University is tackling a classic problem - that of studying sensor systems suitable for controlling arc welding robots so as to make reliable joints in thin sheet metal even when the edges of material to be joined were several mm away from their nominal positions. The group showed that it was possible to build a compact vision sensor, packaged right around a welding torch containing



The picture shows a novel sensor-guided arc welding robot system developed at Oxford University with support from the Science and Engineering Research Council and three UK partner firms. Artificial Intelligence research results influenced the design of the robot's vision software. (Photo: Oxford Univ.)

a laser and semi-conductor camera chip, able to survive within a few cms of the welding arc itself. The original partner in this was BL Technology Ltd who had been joined more recently by GEC Electrical Projects Ltd, and Fairey Automation Ltd, as robot firms which an interest in selling a product based on this technology.

Assembly

Assembly is seen as one of the largest and also one of the hardest growth areas for the application of robots. Current robots move too slowly, have difficulty in assembling parts where the fits must be good to 25-100 microns, and are not able to give the level of control and inspection that people can, almost without realising it. Three groups at Hull, Cranfield and Salford Universities, described

different approaches, ranging from vision-guided assembly of difficult electronic components at Hull (in partnership with Marconi Research Laboratory) through use of a specially adaptive hand originally conceived for prosthetic purposes - at Cranfield in conjunction with several industry partners - to work on design for robotic assembly at Salford (in partnership with Fairey Automation Ltd.) In the latter project, data was presented comparing the cost effectiveness of different types of feeders, and it had been identified that one of the major gaps in the technology for robot assembly lay in the design of a feeder able to handle a wide range of parts, yet at a relatively slow speed and a low price. Substantial progress had been made towards developing a novel kind of feeder to meet these requirements.

Robot Controllers

Several groups, including Edinburgh Artificial Intelligence Department, Newcastle and Liverpool Polytechnic, had obtained important results on the dynamic control of heavily loaded manipulators. Many robots available today have built-in software which automatically converts from the real world (cartesian co-ordinates to joint co-ordinates) by making use of kinematics of the linkage concerned. But so far corresponding software to take into account the loading of the robot and the mass and compliance of its links, has been so cumbersome that it has been impractical to include it in commercially-available robot controllers. At Edinburgh and at Newcastle, new approaches were described which are exciting because they look feasible to compute in real time on the type of processors which will be incorporated into tomorrow's robot controllers.

Language

Finally, most important but long range work on several modules required for off-line programming, was reported by the AI Department at Edinburgh. This work is being steered by the Council's Robot Language Working Party comprising a Club mainly of potential industry users, helping to guide the programme in return to gaining access to early prototypes of the software for assessment. The Edinburgh work is particularly concerned with geometric reasoning, that is, the description of relationships among 3D bodies which may touch, slide, or be locked rigidly to one another at different stages of an assembly process. A comparison organised by Edinburgh in conjunction with Kempf Consultants Ltd, has been made of the strengths and weaknesses of three different off-line programming systems applied to an identical benchmark assembly task. These were VAL, a language already in use in industry which the program is written in terms of movements of the end effector, RAPT, the Edinburgh experimental model-based language concerned with the description of relationships between objects, treating the hand of the robot as one of them, and the Computer Vision CADDS 3 System, a CAD system which clearly has potential towards use in robot programming. Future plans of the Robot Language Working Party were described which it is hoped will lead to joint effort towards developing and eventually standardising parts of a complete off-line programming system between the UK, France and Germany.

(For detailed information of the Industrial Robotics Initiative joint research programme please contact P J Smith, Ext: 6555)

Laser Safety Lecture

Dr John Marshall, Reader in Experimental Pathology at the Institute of Ophthalmology will give a talk on Laser safety on Monday 18 April at 11.00 hrs in the Lecture Theatre.

Dr Marshall's lecture will be concerned with the possibility of damage to the eyes, and it is recommended that the lecture is attended by all who use lasers in their work.

Computing Lecture

IGES - Initial Graphics Exchange Specification

A tool for computer-aided engineering by
Roger Scowen
National Physical Laboratory

This lecture will take place in the Colloquium, Atlas Centre, on Tuesday 12 April at 3.15 p.m.

ASTROPHYSICS SEMINARS

R61 CONF. ROOM 1 - 1400 hrs

30 Mar Dr Joseph Silk/Berkeley
"Dwarf Galaxies: Signposts of Galactic Evolution?"

Lost and

All personal property lost and found on site can be reported to Personnel. They will do their best to help re-unite property and owners.

Found

Royal Naval Association Life Members' Badge - near the wicket gate into the Brown Car Park would the owner please contact Don Collingwood, Ext: 6249.

Thanks

Doris Lewis wishes to thank everyone who contributed to her farewell gift, and also the friends she did not manage to see before she left.

Sales to Employees

Sales of scrap metal and plastics will take place, subject to the usual conditions, on 8 and 22 April in the R40 Scrap compound from 12 - 12.30 pm.

Missing

The following items are the subject of loss reports. All information concerning them should be transmitted to the enquirers named.

Bell and Howell Microfiche Reader
Small portable " "
Contact: E Marsh, Librarian, Ext.6668.

Christian Fellowship

Due to illness, Professor R L F Boyd was unable to give his talk on "Creation" on Tuesday 15 March. A new date is to be arranged for Professor Boyd's talk, and we apologise for the cancellation to those who had intended to come.

Library Notice

The Library is giving away superseded editions of books, starting at 9 am on Monday 18th April, in the Main Library Reading Room. In order to be fair to everyone, books may not be reserved and there is no prior viewing.

Spare copies of the annually cumulated "Picked up for you this week" are now available in the Library.

Obituary

Mr WH Dormer

It is with regret that we have to report the sudden death, at home on 9th March 1983 of Mr W H Dormer of R2 Workshop.

Wally was for many years, a well known personality in most areas throughout the Laboratory. He had an important role in the building and maintenance of the Nimrod Accelerator being a member of the shift team throughout its life.

In recent times, as chargehand of the workshop, he established himself as a person we all came to rely on. He was held in high regard by all his colleagues in SNS Division and his cheery and helpful manner will be missed by all who knew him.

We offer our sincere condolences to Mrs Dormer and her family in their sad loss.

Thank You Gentlemen - Good Luck

John Wheatley

John Wheatley's twenty three year career at RAL has covered a wide and varying range of experimental projects and this was reflected in the many friends from all divisions who gathered in the R12 Conference Room on Wednesday 16 March to say farewell and to wish him a long and happy retirement. John joined the Laboratory in 1960 to work on the Proton Linear Accelerator. He specialised in modulators, was a member of the electrical design staff and was eventually given charge of machine operations and development. In 1970 he joined the Department of Engineering Science where he was involved with the development of the High Field Bubble Chamber and the Frozen-spin Target. With Technology Division, he worked on Laser detectors, the Rapid Cycling Vertex Detector and power supplies, and when a re-organisation brought him to Instrumentation Division, turned his talents to super-conducting magnets and the Millimetre-wave telescope.

Gordon Walker making the retirement presentation made it clear that though the work had been demanding it had always had its lighter moments. He thanked John for his contribution to the work of the Laboratory, wished him well in his retirement and presented him with a decanter and one of the highly prized "Roberts" cards



depicting, in cartoon form, events in John's life.

Ron Newport added a few words of thanks to John for his work on the Millimetre-wave Telescope and asked John to convey everyone's best wishes and a bouquet of flowers to his wife.

John, in reply, said he had not realised he had so many friends. He thanked them all for coming to say

farewell and for the gifts which he would treasure.

He also thanked them for the flowers which would, he said, be much appreciated by his wife who though unwell "has a marvellous spirit".

"I have enjoyed my time at RAL", he said, "and have made many good friends - I hope to keep in touch with you all".

Ernie Russell

Being a Security Warden Ernie Russell was of course extremely well known at RAL. Judging by the size of the crowd gathered in R1 Coffee Lounge on Thursday 24 March to wish him good luck on his retirement, he was also extremely well liked. David Rawlinson making the Retirement Presentation thanked Ernie for being such an extremely helpful and cheerful colleague, held in high esteem throughout the Laboratory.

Ernie's life had been an interesting one, we were told. For eight years he had been a Bullion Messenger! He had spent seven years in India and Burma with the Royal Artillery, been head groundsman for Aladin Industries Limited and an Inspector at United Dairies. In 1967 Ernie "saw the light" - and joined RAL (or Rutherford as it then was).

On behalf of everyone at the Lab, David wished Ernie a long and happy retirement and presented him with a pile of parcels. Mrs Russell was given a large bouquet of flowers and also wished health and happiness.

In his inimitable style, Ernie started his speech of thanks with the remark,



"Never knew so many people were intent on getting rid of me!" "Thanks very much" he continued, "I'll open the presents while I get my breath back. Its all too much".

The presents revealed themselves as a set of woods (the throwing kind), a cased billiard cue and the largest

card most of us had ever seen, crammed with signatures. "I've had a great time here", said Ernie, "You're the best gang I've ever worked with - helpful, friendly and, most important, we've had a laugh. Thank you for coming to see me off. Goodbye and God bless!".

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Deadline for insertions:

Bulletin