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Fusion Business

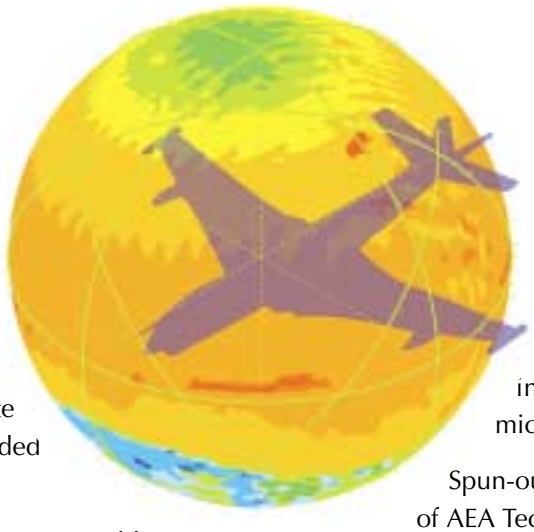
tomorrow's technology for today

INSTANT SUCCESS FOR FUSION SPIN OUT COMPANY

A company, which was spun out of UKAEA's Culham Science Centre, is playing a leading role in developing software, which could become a key component of the communications revolution.

Developed in an industrial collaboration* by CEL (Culham Electromagnetics and Lightning), the ray tracing modelling software, called INSTANT, handles the analysis of general curved surfaces to contribute to an accurate picture of the microwave power needed for communications systems.

Antenna pattern generated by INSTANT for a large aircraft



It means that for the first time it is possible to accurately predict the microwave power needed for wireless LANs, and the so-called "Bluetooth-based communications revolution", using standard CAD packages.

CEL computer modeller, Dr Wayne Arter, says: "The software effectively addresses the issue of how to avoid using excessive microwave power to compensate for curved surfaces. INSTANT allows engineers to design and optimise antennas to peak performance, as well as avoiding the cost and time penalty of using `trial and error' design methods."

One of the first applications to benefit from the technology will be antenna for satellites. INSTANT allows the size of antenna to be reduced, without compromising performance, reducing the antenna payload and cost of the project.

Culham Electromagnetics has also developed innovative "time domain particle-in-cell" software to design microwave devices. To date the software has been used to develop high power microwave sources used in tests to assess the susceptibility of electronics equipment to high power microwave and nuclear effects. However, Dr Arter sees other applications for the technology in developing high-powered microwave sources in oil prospecting.

Spun-out of UKAEA Fusion in 1996 as part of AEA Technology, Culham Electromagnetics and Lightning (now part of the Chelton Group) also provides a lightning test service for aerospace companies and their suppliers. More details from wayne.arter@culham.com or www.culham.com

*INSTANT has been developed by Culham Electromagnetics jointly with BAE Systems and FEGS Ltd, as part of the Antenna Modelling Facility.

Any comments? Do you have any subjects you would like to see covered in future editions of Fusion Business, or any comments on this edition? Would your company or one of your associates or suppliers like to be added to our database of those interested in tendering for work in the European fusion community? If so, please contact miriam.mason@ukaea.org.uk or call (01235) 464104.

UKAEA

Fusion Working with Europe

LASERS SEEK THE HEAT

To get the most out of fusion, the temperature of the plasma must be optimised and measured. However, at temperatures over 100MºC, few technologies can cope. Research at the Culham Science Centre uses advanced laser techniques to provide the answer.

Several different types of laser measurement can provide information about the plasma and its behaviour. Interferometry is used to measure the density of the plasma; spectrometry can establish the amount of impurities in the plasma; polarimetry uses polarised light to measure the strength of the magnetic field; Thomson Scattering uses lasers (Ruby or YAG) to measure the temperature of the plasma. Lasers can be used because they provide a directional, monochromatic bright light source of suitable wavelength.

Directing the laser into the plasma and capturing the resultant signals requires innovative engineering. This technique is used on the MAST project at Culham with great success. The lasers are fired, usually from a distance, through specially constructed windows in the tokamak, down a tube-like structure to avoid parasitic interference with the plasma. Collecting data from a Thomson Scattering experiment has required the construction of a special, very large camera lens to photograph the very small number of scattered photons.

Walsh Scientific (WSL) is a company that works closely with UKAEA's fusion team at Culham to develop methods of measuring the condition of the plasma. The company has developed turn-key detection technology and techniques to examine the behaviour of the plasma when fusion is taking place.

WSL is currently involved in the design and implementation of a number of exciting leading edge projects, one of which involves the provision of a scattering system which accesses high time resolution and high spatial resolution simultaneously. UKAEA is keen to share some of the expertise that it has developed in the wider industrial field.

For more information on any topic covered in this article please contact Dr Michael Walsh at Walsh Scientific on 01865 408071 or through WSL's website on www.walshscientific.com.

This article is an abstract of a report by Maria Harding for the November 1999 edition of the journal Engineering.

INNOVATION 150 YEARS ON

London based Leybold Vacuum UK Ltd marked its 150th birthday by becoming the latest company to hold an exhibition at the Culham Science Centre.

Leybold has had a close relationship with the Culham site for many years and has been a major supplier to UKAEA, JET and AEA Technology.

Sales Manager Brian Pugsley says: "The exhibition allowed us to show some innovative new products including a wide range of turbo molecular pumps with pumping speeds of 700ls-^{1} and a maximum backing pressure of 15mbar, a dry piston pump with an ultimate pressure of 3x10-^{2} mbar with no oil and a gauge head that will record pressure from 1000 to 5x10-^{10} mbar. We met some old friends and made new contacts."

More details from Brian Pugsley on 020 8971 7000. If your company is interested in exhibiting at Culham please email deniese.willis@ukaea.org.uk or call 01235 463296.

CONFERENCE & EVENTS DIARY 2001

17-22 June - 28th IEEE International Conference on Plasma Science, Las Vegas, Nevada, USA; **18-22 June** - European Conference on Controlled Fusion & Plasma Physics, Funchal-Madeira, Portugal; **2-6 July** - 3rd International Symposium on Applied Plasma Science (ISAPS '01), Alaska, USA; **16-27 July** - 38th Culham Plasma Physics Summer School; **1-4 Oct** - IEEE 19th Symposium on Fusion Engineering, New Jersey, USA; **29 Oct – 2 Nov** - 43rd APS Division of Plasma Physics Annual Meeting, California, USA.

ARE YOU THE MISSING LINK?

Following the twinning trip featured in Fusion Business 11, Industry Liaison Co-ordinator Miriam Mason is continuing to explore ways of forging business links and technical partnerships between UK and French companies and organisations. She plans to draw up profiles of UK companies who would like to take part and exchange the details with our colleagues in France, who will be invited to go through a similar process. Companies in the same technical fields can then be matched and meetings organised to explore opportunities for collaboration.

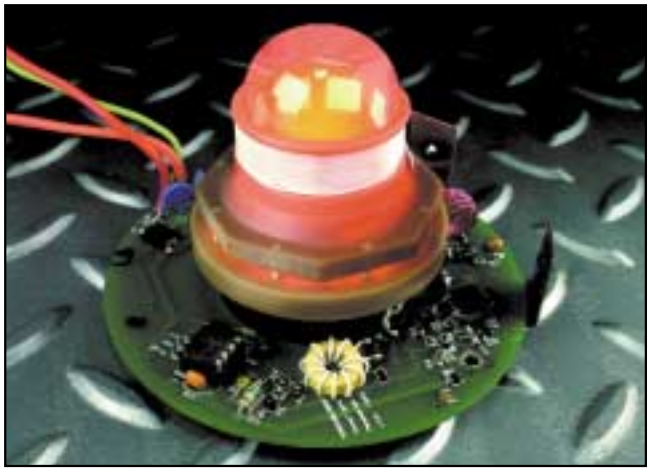
As part of the project, Miriam attended a symposium in Lyon called 'Towards a European Innovation Area' which involved more than 600 delegates from across Europe, and, she says, "demonstrated the enthusiasm with which the European Commission is supporting innovation and entrepreneurship".If your company would like to take part please contact miriam.mason@ukaea.org.uk or call 01235 464104.

JOHNNY BALL AT CULHAM

More than 150 children plus head teachers, local councillors and business people visited the Culham Science Centre for our 'Campaign to Promote Engineering' day. The aim of the event was to encourage young children to think about engineering as a career.

The children, from schools in Oxfordshire, Berkshire and Buckinghamshire, spent time at exhibition stands, toured the JET facilities and enjoyed a lecture by the television presenter Johnny Ball. (Pictured with, from L-R: Simon Turner, Lucy Caw and Rachel Jones of Foster Wheeler.)

SEEING THE LIGHT



Experimental Neon inductive lamp and drive circuit

Consultancy from UKAEA's fusion scientists has helped the company CRL throw some light on a problem they had encountered in their work on lamp technology.

In inductively coupled fluorescent lamps the electrodes you normally find are replaced with a coil driven by a high amplitude RF signal. Truly amazing lamp life can be achieved, because there are no failure mechanisms associated with the electrodes.

In fluorescents, a discharge is maintained in a mercury vapour buffered by a noble gas. The UV light produced from the discharge is converted by phosphors coated onto the walls of the lamps into visible light. Ageing of the lamps is mainly due to mercury bombardment of the phosphor, which leads to a gradual decline in brightness. Fluorescent lamps work well at normal temperatures, but take a long time to warm up from cold.

CRL has recently developed a new inductive lighting technology for vehicle, traffic and rail signalling, based on a Neon discharge. Because of its characteristic orange/red colour, there is no need for mercury or phosphor and it fires up just as quickly at any temperature. The key to achieving a long lamp life is controlling the plasma interaction with the lamp wall. CRL discovered that lamp life can be extended by using certain electrical drive schemes on the RF coil – but didn't know why.

UKAEA fusion scientists were able to explain the effect in terms of the diode action in the plasma close to the inner lamp wall. CRL's Neon lamps have now been operating for around 20,000 hours (and counting), and achieve outstanding brightness maintenance. The major US automotive parts supplier, Federal Mogul Corporation, is now working with CRL to develop the technology as a vehicle brake/tail lamp. Details at www.crl.co.uk or email gwright@crl.co.uk

INDUSTRY TEAM

Cleve Forty
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Responsible for the day-to-day management of UKAEA's Fusion and Industry Programme, together with strategic planning of the initiative.

The programme aims to maximise the involvement of industry in the international fusion programme and the benefits to industry resulting from all forms of technology transfer from fusion.

Miriam Mason
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Generally the first point of contact for the Fusion and Industry Programme, Miriam is responsible for maintaining the Industry database which lists companies that are qualified to be nominated in response to tender enquiries from European fusion associations. Miriam is also responsible for Fusion Business and for the programme's website:

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Responsible for the event management side of the programme, Deniese co-ordinates industry visits and events, at Culham and elsewhere in the UK, and organises international exhibitions. Deniese says: "We can offer companies the use of our conference facilities at Culham for meetings and our foyer for exhibiting products."

Tender & Contracts update

During the year 2000, ten UK companies were nominated for work on European fusion projects. Through its Industry initiative, UKAEA nominates UK companies for work on a range of projects in European fusion laboratories. Nominations this year included projects in Germany, Spain, Italy, Switzerland and France as well as in the UK. Two UK companies were nominated for work on the latest project.

PEOPLE SPIN OFF

Part Two: Dr Ruth Bamford

In this edition of Fusion Business we continue our series, profiling people who started their careers in fusion and are now using the skills they developed in other areas.

Dr Bamford studied applied physics at Essex University and did her PhD at Culham. Her subsequent work at Culham included experience of optics, lasers, particle detection, high-resolution spectroscopy and programming data acquisition systems. She now works at Rutherford Appleton Laboratory on ionospheric plasmas where she is involved in the measurement and modelling of how this ionised part of the Earth's upper atmosphere affects radio propagation in medium, long and short wave radio bands.

It was through this experience that Ruth developed a series of unique radio experiments that involved other scientists, radio amateurs and the general public during the 1999 UK total solar eclipse.

Ruth is now working in the expanding area of "Space Weather", the name given to all aspects of space plasmas that eventually affect man made systems such as telecommunications, navigation, satellite control and national power grids.

Dr Bamford says: "Fusion training is an exceptionally good training in physics because of both the breadth of understanding you need for successful experimental work in such a complex technical environment and the practical management skills you learn.

I learned a great deal about finance, design and project management responsibilities, well beyond those to be found in academia. These skills will always be highly transferable."

Dr Bamford also believes that the experience she had at Culham, working on a large experiment with exceptional criteria, would always engender a professional approach useful to any future area of work. Overall, she feels that the smaller size of Culham projects enabled the UK fusion programme to offer a great breadth of experience at a relatively junior level and to be, therefore, an ideal training ground.

 This work is funded by EURATOM and the UK Department of Trade and Industry. Please visit our web site at: www.fusion.org.uk/industry