ISSUE No.4

Portal

CLRC

THE CCLRC – ENABLING SCIENCE AND DISCOVERY

Vulcan's bright future

A tenfold increase in the power output of the CCLRC Vulcan Petawatt Facility gives users of the Central Laser Facility access to the highest focused laser intensity in the world.

Professor David King, chief scientific advisor to the UK Government, inaugurated the Vulcan Petawatt Facility in April 2002. The upgrade has been funded through a £3.3m grant from the EPSRC and benefited from laser components made available following the closure of the Nova Laser at the Lawrence Livermore National Laboratory in California. These amplifiers have increased the laser's output energy to 670 Joules.

The upgraded facility also has a new 500 m^2 target area that can accommodate the metre-diameter pulse compression optics and the experimental chamber in which the experiments will be performed. A new 350 m^2 clean room facility is available for handling and testing large aperture optics and for servicing the new amplifiers.

Vulcan uses Chirped Pulse Amplification (CPA) to stretch low intensity pulses from 100 femtoseconds to 1.2 nanoseconds so that they can be safely amplified before being recompressed. CPA thus enables pulse intensities on the target to be up to a thousand times greater than would be possible using other techniques.

The upgrade will generate 500-Joule pulses with duration of only 500 fsec, corresponding to a peak power of 1 Petawatt (10^{15} W). Special 'adaptive' optics then focus the beam to a spot less than 10 micrometres in diameter, which is near the diffraction limit. The result is an irradiance of more than 10^{21} W/cm^2 on the target's surface.

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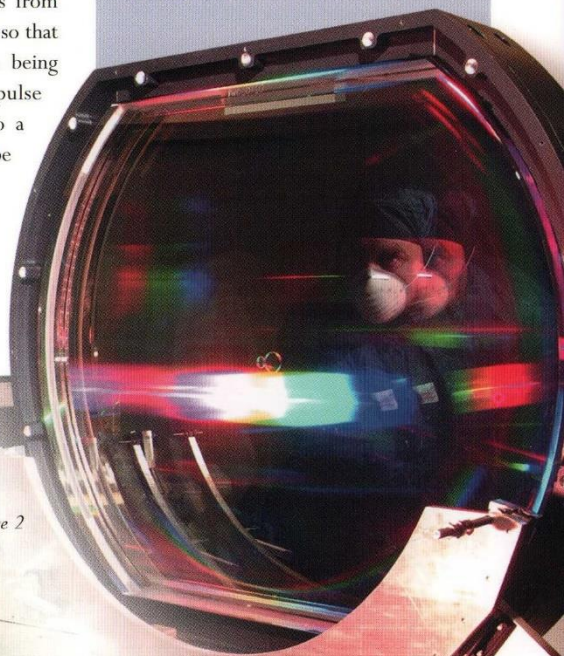

You can view Portal online at:

www.cclrc.ac.uk

DARE is CLIK's first venture

Daresbury and Rutherford Enterprises, the first collaborative venture for CLIK, CCLRC's technology transfer company, is a partnership with seasoned entrepreneurs to turn research into profitable enterprises.

CLIK Knowledge Transfer, CCLRC's technology transfer company, has lined up a heavyweight partner for its first venture, Daresbury and Rutherford Enterprises, DARE. CLIK is collaborating with Anglo Digital Ltd, a group of entrepreneurs specialising in start-ups, to support DARE in its search for new business opportunities that can build on research carried out within CCLRC.

Continued from front page

Colin Danson, Vulcan Group Leader, said: "These ultra-high intensities generated from the Petawatt Facility will open up new regimes of plasma physics to the research communities in the UK and EU and their international collaborators. The first experiment on the upgraded facility is investigating advanced particle acceleration schemes for future laser based accelerators. Other exciting experiments, already in the planning stage, include photon-induced nuclear reactions and advanced fast ignition fusion schemes."

Vulcan is a national user facility for a wide range of ultra-high intensity studies including plasma behaviour in the extreme conditions normally found only in the interiors of stars. Research into the inertial confinement approach to controlled thermonuclear power, capitalising on pioneering work conducted by UK and Japanese researchers on the 'fast ignition' technique, will take place in the upgraded facility.

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"DARE is a collaboration in which experienced technically and scientifically aware business entrepreneurs work closely with CLIK's business development managers to rapidly assess and develop selected projects originating within CCLRC, and secure venture capital and other funding for early commercial development," explained Keith Winters, Chief Executive of CLIK Knowledge Transfer.

"We believe that CCLRC's innovative creativity combined with the extensive entrepreneurial experience of Anglo Digital will be extremely effective," added Keith. "This powerful combination is already bearing fruit. DARE is currently reviewing eight technology transfer projects, one of which is being readied for start-up funding."

"CCLRC is a world class source of innovation and creative problem solving," said Douglas, Earl of Dundonald, a director of Anglo Digital. "As a group of entrepreneurs committed to turning ideas into reality, Anglo Digital is very excited to be a part of DARE and to be working alongside both CCLRC's scientific and engineering staff and the CLIK team. "We very much look forward to evaluating further ideas within the DARE framework."

Following commercial evaluation within DARE, suitable projects will be spun out into separate companies which will be promoted to various sources of commercial seed capital funding, including the Rainbow Seed Fund. "The benefit of DARE is that it provides a process whereby world class technology may be commercially assessed by experienced individuals with no cost or risk to CCLRC. Those technologies shown to be commercially viable can then very quickly be prepared for commercialisation as DARE provides a ready made initial management team with relevant skills enabling them to turn patents into profits," explained James Rolfe, Managing Director of Anglo Digital.

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FREEDOM OF INFORMATION

The CCLRC Publication Scheme

The Freedom of Information Act (FoI) 2000 has established a general right of access to all types of recorded information held by public authorities, including Government Departments.

You can access the CCLRC Publication Scheme, containing details of the information we currently make available via the FoI web site at:

www.foi.cclrc.ac.uk

FOCUSING ON THE MICRO-WORLD

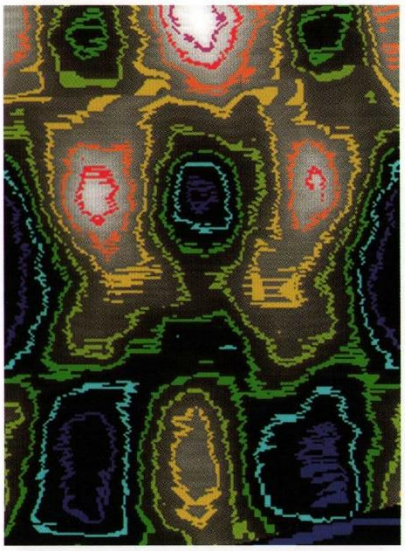
Science minister, Lord Sainsbury, opened the highest resolution analytical microscope in the world at the CCLRC Daresbury Laboratory in Cheshire on 13 December. The SuperSTEM (Scanning Transmission Electron Microscope) project is directed by Professor Peter Goodhew at Liverpool University and involves other scientists from the Universities of Liverpool, Cambridge, Glasgow and Leeds.

The microscope, housed in a new purpose-built low-vibration laboratory at the Daresbury Laboratory, will be followed by a second instrument in 2004. The state of the art microscopes will aid in the development of nanomaterials such as novel catalysts, electronic and optical devices (for example using quantum dots) and new magnetic recording media. These materials will have an impact on industries as diverse as pollution control and drug delivery.

Lord Sainsbury said in advance of the opening, "The SuperSTEM project brings universities and a national laboratory together to provide a world-class research facility. The potential applications arising from the research it supports will be of great benefit to society, and demonstrate the importance of investing in scientific excellence. As the main investor in scientific research, the Government is keen for the UK to retain its position as one of the world leaders, and has therefore substantially increased its science spending over the last few years. World-class facilities such as SuperSTEM are essential if we are to stay at the cutting edge of research."

SuperSTEM microscopes can analyse single atoms and columns of atoms using scanning transmission electron microscopy (STEM) and electron energy loss analysis (EELS). Advances in computing and instrument development have made possible the correction of spherical aberration in the objective lens of the microscope, a key technological breakthrough. The images and analytical results from the SuperSTEM microscopes will be viewed by scientists all over the world via the internet.

Awarded as part of the NW Science Review, the total investment in the project is about £4.5m over 5 years. It is expected to benefit the industrial environment of the North West of England, providing opportunities for wealth creation among the industrial companies in the region and beyond.



The image shows the average structure of one crystal cell at the interface. The silicon structure is at the bottom and the interface is oriented horizontally in this image. The grey scale image has colour contours superimposed so that the silicon atoms are enclosed by the yellow colour, whereas the Nickel atoms are enclosed by the red contours. The width of the image is 0.76 nm.

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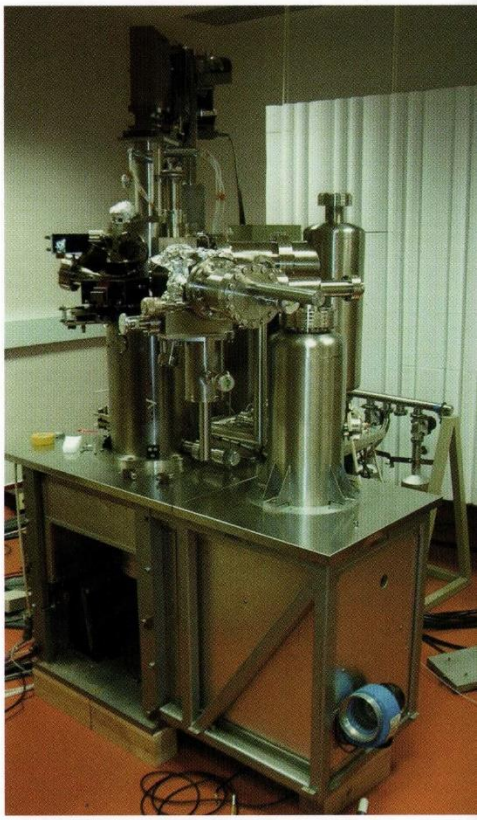
Happy New Year from the CCLRC

Karen Whitaker, Editor



The optical column of SuperSTEM 1.

COUNCIL MEMBERS

The Science and Innovation Minister, Lord Sainsbury, announced two new appointments to the Council for the Central Laboratory of the Research Councils in 2002.

Dr Derek Chadwick, Director of the Novartis (formerly Ciba) Foundation since 1988. A Fellow of the Royal Society of Chemistry, Derek brings with him a breadth of scientific knowledge including structural, synthetic and computational organic chemistry and the development of modern teaching methods in science.

Professor John Durrell is Director of the Physical Laboratories and Head of the Department of Physics and Astronomy, at the University of Manchester.

John is a Chartered Physicist and a Fellow of the Institute of Physics.

Both Dr Chadwick and Professor Durrell were appointed to the council for 3 years, commencing April 2002.

Bright Sparks

An outstanding contribution

Sean Langridge, ISIS, has an invitation to dine at the Savoy in January to collect the 2002 Charles Vernon Boys Prize. Sean joins a line of distinguished recipients of this prestigious award. Given by the Institute of Physics, it recognises outstanding contributions to experimental physics by a scientist under the age of 35.

Sean's expertise is in magnetism. The study of advanced materials, and in particular magnetic thin films, is a major growth area in condensed matter physics and Sean's recent work on the world-leading CRISP reflectometer at ISIS has transformed the study of magnetic thin films using neutron scattering.

Spectroscopic paper

A research paper reporting a three-year research project funded by the EPSRC and carried out at the CCLRC Rutherford Appleton Laboratory has won the 2002 Meggers Award, given each year to the authors of the outstanding publication appearing in Applied Spectroscopy, the journal of the American Society for Applied Spectroscopy. Dr Neil Everall, of the Wilton research centre of ICI, Dr Thomas Hahn, of National Starch and Chemical, New Jersey, a subsidiary of ICI, and Drs Pavel Matousek, Tony Parker and Mike Towrie of the CCLRC's Central Laser Facility have developed a novel laser based spectroscopic technique. The winning paper was "Picosecond Time-Resolved Raman Spectroscopy of Solids: Capabilities and Limitations for Fluorescence Rejection," Applied Spectroscopy, vol 55 (2001) p 1701.

Top of the net

Professor Michael Wilson, CCLRC Business Information and Technology and manager of the UK Office of W3C, featured in the Internet Magazine list the top 50 most influential people in the internet business in the UK.

Vic Suller OBE

Vic Suller, Director of the Accelerator Science and Technology Centre (ASTeC), was awarded an OBE for services to science in the Queen's Birthday honours list for 2002.

Chris raises to the ALARM

Chris Hall, CCLRC's Corporate Governance Advisor, was one of four risk managers short-listed for the 'ALARM Risk Manager of the Year Award'. The accolade, from the Association of Local Authority Risk Managers (ALARM), arose from his work on a major project to introduce a Government-acclaimed Risk Management Policy for the CCLRC.

Chris says that he was greatly honoured to be selected as a finalist for such a prestigious award. He found the real satisfaction "in seeing the recognition and development of innovative (i.e. risky!) ways of working that benefit from the new climate in Government of maximising opportunity. This is particularly important in the scientific environment, where new ground is literally being broken every day. Which, of course, makes the development of Risk Management an ongoing project."

Grants and Contracts

Julian Gallop and Juan Bicarregui, of CCLRC's Business Information and Technology (BITD), have won a grant under the EPSRC e-Science programme for research into 'Visualisation Middleware for e-Science'. The project, a collaboration with Oxford, Oxford Brookes and Leeds Universities with support from IBM UK, NAG and Streamline Computing, has a total value of over £500,000, approximately half of which is from the industrial sponsors.

The Information Science and Engineering Group of BITD is also a part of consortia that have won five grants for new collaborative projects under the Information Society Technologies Programme of the European Union. The new projects are on: Semantic Web Advanced Development for Europe; Grid architecture for Application Service Provision; An Agent Based Platform for Organisationally Mobile Public Employees; Trust Management in Dynamic Open Systems; and e-Learning within a Grid environment. The CCLRC's share is e1.25 million of the total funding of e7.1 million.

Other recent grants include:

£1,638,528 awarded by the MRC to **Instrumentation Department** for Basic Medical Imaging Technology;

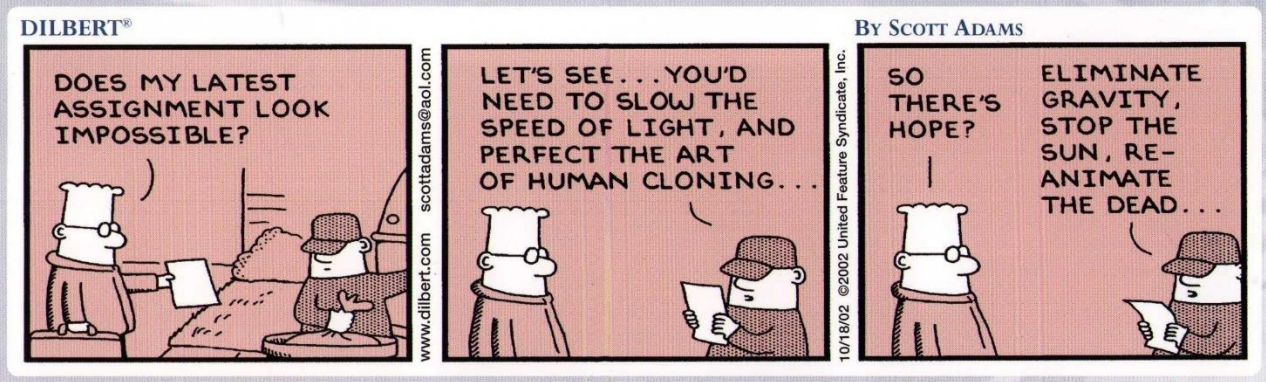
£234,153 from EPSRC to **Computational Science and Engineering** for 'CCP5: The Computer Simulation of Condensed Phases' - Renewal Proposal for Support 2002 - 2005;

£150,052 from BBSRC to the **SRS** for 'Synchrotron Radiation Probing Conformational Dynamics in Signalling EGF Receptors via Multi-dimensional Single Molecule Fluorescence Microscopy';

£75,353 from EPSRC to the **Central Laser Facility** for 'From Physics to Biology and back again - theoretical and practical analysis of multiphoton interactions in Cellular DNA'.

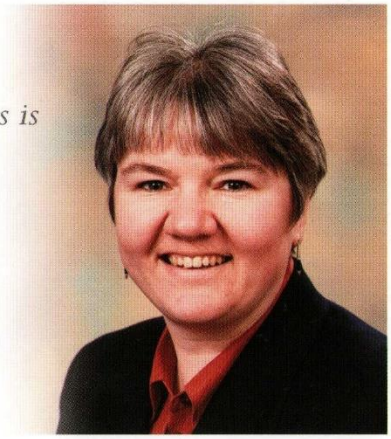
Contract won for DASH-E detector system

The European Space Agency has placed a contract with the CCLRC Instrumentation Department for a complete DASH-E detector system. ESA will use this to evaluate new detector materials intended for their next generation of X-ray satellites. This could be the first of several contracts to build electronics for ESA's hard X-ray science programme. DASH-E is an energy-resolving, pixellated detector designed for spectroscopy applications. A semiconductor detector is bump-bonded to a readout chip designed in house. Software running on a PC captures and stores data from the detector.



Good connections

With a combination of science and management Liz Towns-Andrews is helping to keep the CCLRC on target for its new strategic role.



It was supposed to have been a six-month contract, but 17 years later Liz Towns-Andrews is still at Daresbury Laboratory (DL). "I never reached escape velocity," she says. Far from it, she now has a major role in reshaping the CCLRC.

Liz joined DL in 1985 and after training in small molecule crystallography she gained experience in the relatively new field of protein crystallography on the Synchrotron Radiation Source (SRS). After a "really good" year in protein crystallography the invitation came to stay on to help to set up a new instrument on the SRS for the Medical Research Council by running the facility for users and managing internal research programmes.

Although Liz enjoyed managing people and making things happen, she did sometimes wonder if she could do a better job. With this in mind, she signed on to do a Masters in Business Administration. "It was one of the most rewarding things I have ever done. After that, I made the decision to manage people and to enable the science."

When the chance to run DARTS (Daresbury Analytical Research and Technology Services) came in 1999 however, there was one problem. As the relatively new head of ultraviolet and infrared work at DL, Liz was reluctant to leave her current role. "We were just starting to get somewhere after a year", she explains. But Liz's passion to combine science with business brought the answer; do both jobs on a 50:50 basis!

Working in both worlds brought major benefits. "I still understand the science and I can see connections that other people can not", she explained.

Making connections was an important part of Liz's strategy. DARTS has already come a long way with connections between industry and researchers and another important link, of course, is with the academic community. "I wanted to build a much more solid trust in the academic community in working with industry and DARTS," says Liz.

In 2002, the desire to create connections pointed Liz to a wider target. No longer interested in achieving "escape velocity", Liz was given a new challenge, no less than implementing the recommendations made in the Quinquennial Review (QQR) for the evolution of the organisation into a beacon of excellence in science, engineering and technology.

Liz's passion for science and management, combined with the skills developed at DARTS, are now ensuring the highest possible service for the research community at facilities both in the UK and Europe. Her new role, as a member of the Strategic Planning Group, in the CCLRC Directorate, utilises both internal and external connections. "Consultation with the research community and other Research Councils is key to successful implementation of the QQR", explains Liz.

The new QQR web site will keep you updated on her progress.

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www.qqr.cclrc.ac.uk
www.srs.ac.uk/srs/
www.darts.ac.uk

Daresbury's new supercomputer

CCLRC Daresbury Laboratory now hosts one of the world's most advanced high performance computing centres. The next generation high performance computing service, HPCx, began full operations in December. The HPCx system is currently number nine in the "Top 500 Supercomputers" list.

Researchers in the UK will use HPCx to solve previously inaccessible problems. Costing £53 million over six years, the service is funded by three research councils, with EPSRC contributing £48 million, and operated by DL and Edinburgh University.

Based on IBM POWER4 technology, HPCx will provide an initial capability of 6.7 teraflops/s. This performance will be upgraded to more than 11 teraflops/s in 2004 and to 22 teraflops/s in 2006. the service will provide the most powerful high performance computer for academic researchers in Europe.

HPCx CAPABILITY COMPUTING

The computing capacity of HPCx will address a wide range of problems from the very small, such as the nature of matter, through to simulations of whole systems from cells and organs to global simulations of the Earth. It will also enable new advances in the human genome project, help engineers to design new and safer structures and aircraft and assist in opening up completely new fields of research, such as biomolecular electronics.

Paul Durham, Director of Computer Science and Engineering, said, "The HPCx service will be a massive step forward for the UK. It will provide a benefit for the nation's researchers that matches our needs, now and in future years. Those benefits will be felt most keenly as we begin to address problems of the highest quality and difficulty that only a service of this immense capacity and sophistication can tackle."

www.hpcx.ac.uk

ASTeC STEPS ON THE ACCELERATOR

A star studded cast turned up to the launch of ASTeC, the CCLRC's Centre of Expertise in Accelerator Science and Technology

If the UK wants to get the most out of its collaboration in international accelerator projects, then it has to contribute more than just money. As Dr John Taylor, Director General of the Research Councils, said at the launch of ASTeC, "the UK needs meat that it can bring to the table". For that to happen, said Dr Taylor, the UK has to play an instrumental role in new national and international accelerator projects and "we have to retain a critical mass of accelerator science in the UK."

This is where ASTeC comes in, drawing together accelerator experts in the UK, from across a range of academic departments at the Daresbury Synchrotron Light Source and the ISIS neutron source at Rutherford Appleton Laboratory. Vic Suller, head of ASTeC, explained at the launch event in London that the centre will carry out "exploratory R&D on new ways of accelerating things".

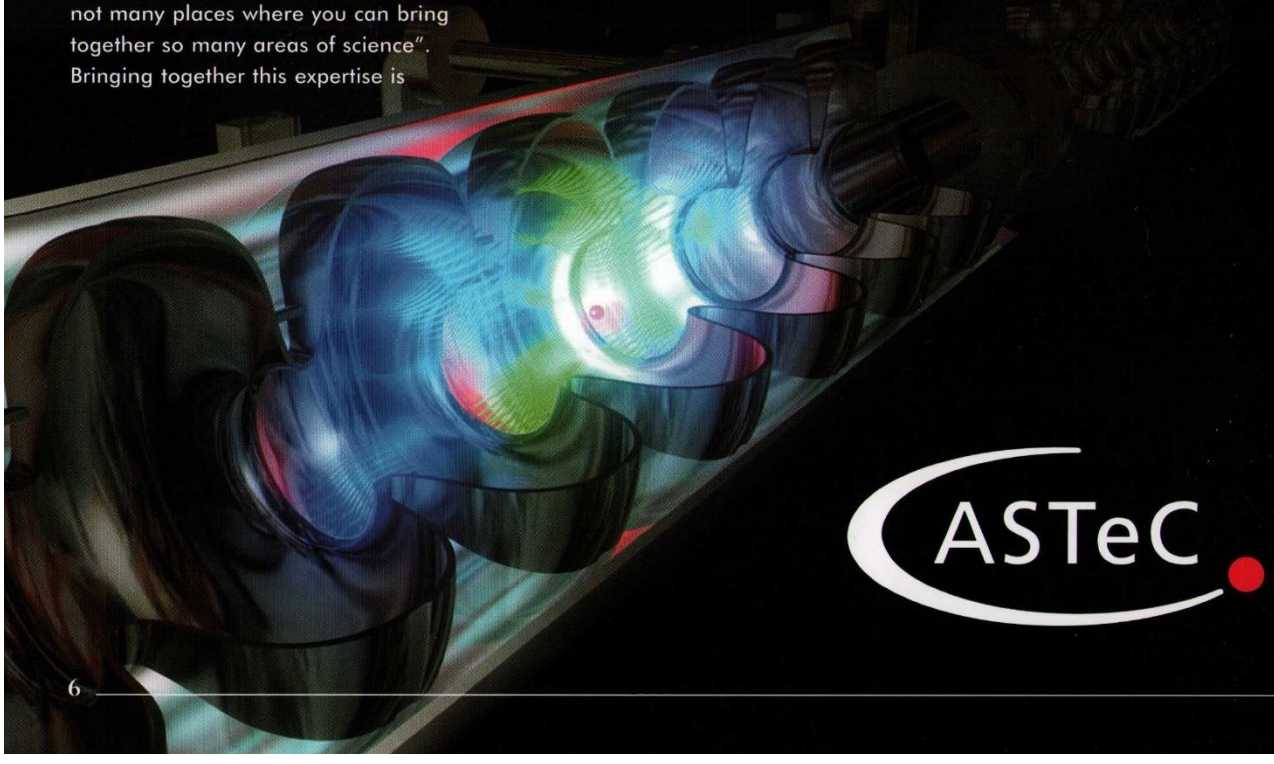
As John Wood, chief executive of the CCLRC said at the launch, "there are not many places where you can bring together so many areas of science". Bringing together this expertise is helping to position the UK among the leaders in the groundbreaking global accelerator projects of the next 20 years. These include ideas for a fourth generation light source in the UK along with international proposals for neutrino factories and new linear colliders.

"Centres of excellence such as ASTeC are extremely important in enabling us to take advantage of our world-class science and engineering base," Lord Sainsbury, Minister for Science, said at the official launch. "Facilities and equipment are important," Lord Sainsbury added, "but advancement in research is not based only on the amount of money being spent, there must also be the exchange of ideas and collaboration with others for progress to be made."

The design and construction of the diamond synchrotron is already part of ASTeC's programme. Diamond will provide a wide range of capabilities upon its completion in 2006. A particular area of interest will be the analysis of protein structures from the human genome project, allowing scientists to correlate the function of known genes with their location on the human genome. This valuable information will have implications in the treatment of genetic disorders, health risk factors and targeted drug development.

Large-scale high power proton accelerators, another area of expertise for ASTeC, may be able to solve the problem of the transmutation of nuclear waste in the future. Accelerators could speed up the decay of medium half-life substances. There is also potential for use in sub-critical nuclear reactors, where 'critical' generated power can be subjected to significantly higher levels of control via the accelerator.

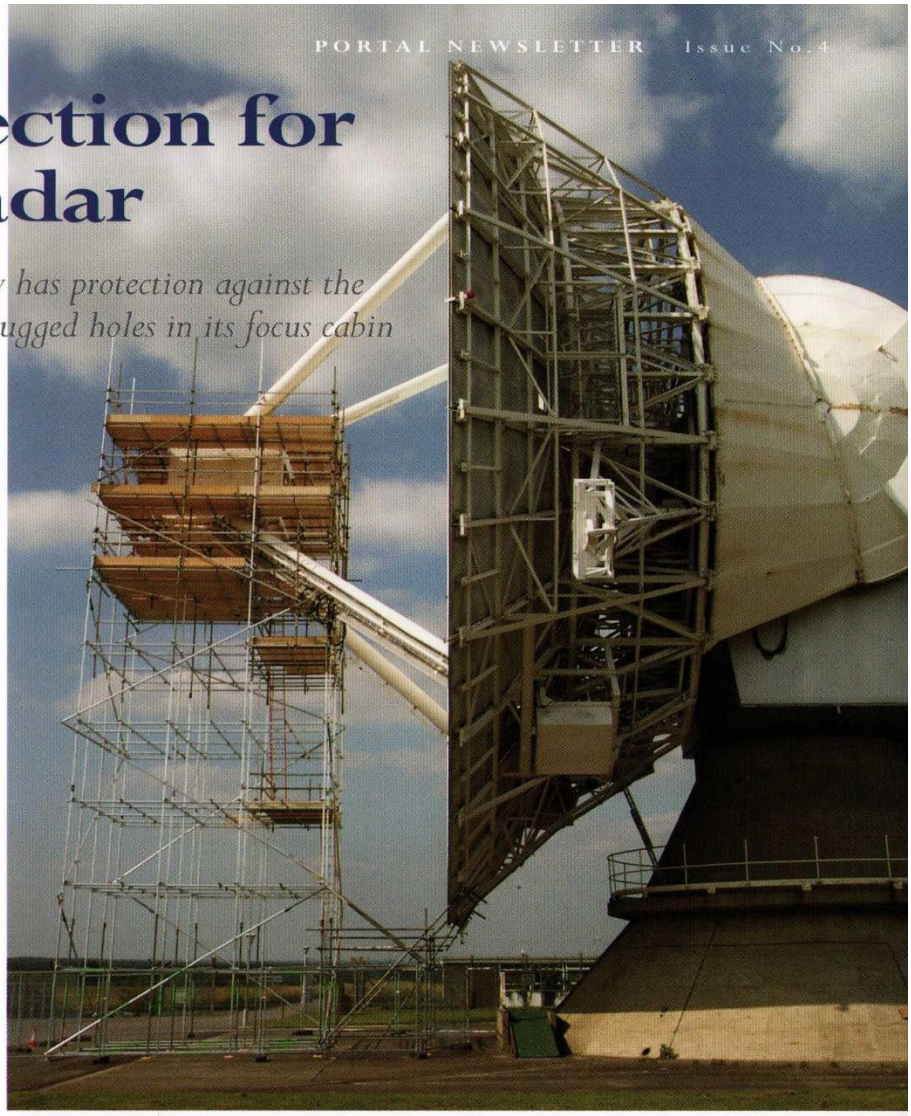
www.astec.ac.uk



ASTeC

Rain protection for weather radar

Chilbolton's weather radar now has protection against the elements after refurbishment plugged holes in its focus cabin



After five months hidden behind scaffolding, the wrappings came off the Chilbolton Advanced Meteorological Radar (CAMRa) in the middle of November. The 30-metre tall antenna, with its 25-metre diameter dish, is the world's largest fully steerable radar devoted entirely to studying the weather.

During the summer, engineers refurbished and rewired the focus cabin that houses the sensitive equipment that acts as the 'eyes' of the radar. "The work, which cost about £40,000, was essential", explained John Goddard, Head of the CCLRC Chilbolton Facility. "The cladding around the focus cabin dated from the '60s, and was prone to leaking during heavy rain."

The CCLRC's Radio Communications Research Unit (RCRU) operates CAMRa at the Chilbolton Observatory. RCRU uses radar images of rain, snow and hail to develop and test propagation models for terrestrial and satellite communications systems, while the Natural Environment Research Council (NERC) Centre for Atmospheric Science (NCAS) uses the facility for meteorology, cloud physics and climate studies.

The NERC's Joint Infrastructure Fund supported the repair through the University of Reading. Chilbolton's refurbishment was completed by the end of October, just before the autumn weather set in. After all, the last thing weather researchers want is to share their equipment with the rain they are studying.

The Chilbolton Weather Web carries live data from the facility. Check it out at: www.rcru.rl.ac.uk/weather/

What's on

DL Lecture series

28 February 2003 — **'Storms from the Sun'**
(Dr C Davis, CCLRC Rutherford Appleton Laboratory)
7pm, Merrison Lecture Theatre, Daresbury Laboratory.
Follow an enormous gas explosion on the Sun and the subsequent journey of the gas cloud across interplanetary space into the Earth's atmosphere.

21 March 2003 — **The Quality of Wine is not strained - or is it?**
(David Bird, Master of Wine)
7pm, Merrison Lecture Theatre, Daresbury Laboratory.
"A glass of wine (especially red) a day is good for you because it contains antioxidants." Just one of the many fascinating facts about wine disclosed in this lecture.

25 April 2003 — **Ancient Egyptian Mummies: a resource for studying disease**
(Professor Rosalie David of Manchester University)
7pm, Merrison Lecture Theatre, Daresbury Laboratory.
Manchester's mummies are unlocking secrets of 3000 year-old diseases which may provide clues to solving modern illnesses.

Contact: Marg Jacks *Email: m.jacks@dl.ac.uk*

ISIS helps to catch them young

It is no easy task bringing to life the excitement of condensed matter science for A-level students, but the CCLRC's ISIS Facility is helping to do just that. During 2002, ISIS hosted a two-day 'Materials World' conference for teachers and educational resource professionals.

The event, sponsored by EPSRC, was a part of the 'Living in a Materials World' project which aims to enhance the educational use of the ISIS Facility for school pupils. The highly successful event was not, however, a one-way process as ISIS's staff also learned a great deal.

Presentations demonstrated the scientific breadth of the research carried out at ISIS as well as the technology and physics of the machine. There were also laboratory sessions, opportunities for the teachers to participate in brainstorming groups exploring the role of school visits to ISIS, as well as wider discussion on the communication of science to the wider public.

Teachers learned how neutrons have studied a plethora of materials, from weird low dimensional quantum ones through industrially useful materials like catalysts and surfactants to Bronze Age pots and broken bones. On a tour of the facility itself, the group explored the initial creation of the hydrogen ions to the final detection of a neutron, following the whole fascinating technological life cycle of a single ISIS pulse.

One teacher was delighted by the usefulness of the course. "Staff and other visitors commented upon how 'clued up' our students were and I can put this down to the amount of information they were given in the classroom. I had shown them pictures and explained a bit about particle physics using information based on the Materials World conference and Cambridge masterclasses. They said it was really easy to translate the knowledge to real life, if particle physics is real life.

"What you're doing (on the education front) has the potential to significantly impact a large number of students. If your intention was to 'put something back' then you've succeeded with at least 20 kids."

www.isis.rl.ac.uk

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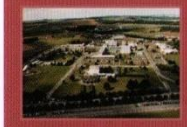

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sci-art club

sci-art club is aimed at young people interested in science but is also suitable for those who are young at heart. Members have access to quizzes, projects, easy and fun experiments, as well as competitions and teaching resources.

To join, register on-line now at:
www.sci-art.cclrc.ac.uk

Articles, ideas and comments are welcome! *Please submit articles to the Editor by Friday 7 February for inclusion in the next issue.*