

**PIONEERING RESEARCH
AND SKILLS**
Annual report and accounts 2008–2009



EPSRC

Pioneering research
and skills

EPSRC ANNUAL REPORT AND ACCOUNTS

2008–2009

Presented to Parliament pursuant
to s. 2 (2) of Schedule 1 of the Science
and Technology Act 1965 (c.4)

Ordered by the House of Commons
to be printed on 20th July 2009

HC 801
London: The Stationery Office
£19.15

EPSRC
Pioneering research
and skills



INVESTOR IN PEOPLE

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ISBN: 9780102961119

PIONEERING RESEARCH AND SKILLS

JOHN ARMITT CHAIRMAN

In accordance with Schedule 1 to the Science and Technology Act 1965, the Engineering and Physical Sciences Research Council submits the following report on its activities for the period 1 April 2008 to 31 March 2009.

This year we have chosen a new phrase 'Pioneering research and skills' as part of our logo. It encapsulates EPSRC's role as the UK Government agency for funding world-class research, innovation and skills development in engineering and the physical sciences. The global economic challenges facing the UK highlight the importance of our investment this year of over £700 million in contributing to our economic prosperity. This was given added emphasis by The Prime Minister, the Rt Hon Gordon Brown MP, in his Romanes Lecture in early 2009 when he referred to science as 'a key element of our path to recovery'.

It is therefore vitally important that EPSRC continues to invest in a broad science and engineering research base which will provide a major stimulus for rejuvenating the economy. As this report demonstrates, our investment supports the provision of a strong, healthy research base delivering both excellence and high potential for economic and social impact. Our major programmes working with companies and other partners to encourage fast take-up of research breakthroughs by industry and commerce are ever more important in the current climate. The breadth and depth of this programme – set out in the EPSRC Delivery Plan for 2008-11 – spans research and skills development to tackle global challenges such as the need for secure and sustainable energy and the medical advances required for the healthcare of an ageing population.

The health of the EPSRC research portfolio is vital to maximising its impact, and an important indicator – the Research Assessment Exercise (RAE) – reported its findings in 2008. Its

conclusions were positive in identifying excellence in all EPSRC-related areas, adding further evidence of the success of our measures to enhance the health of the research base.

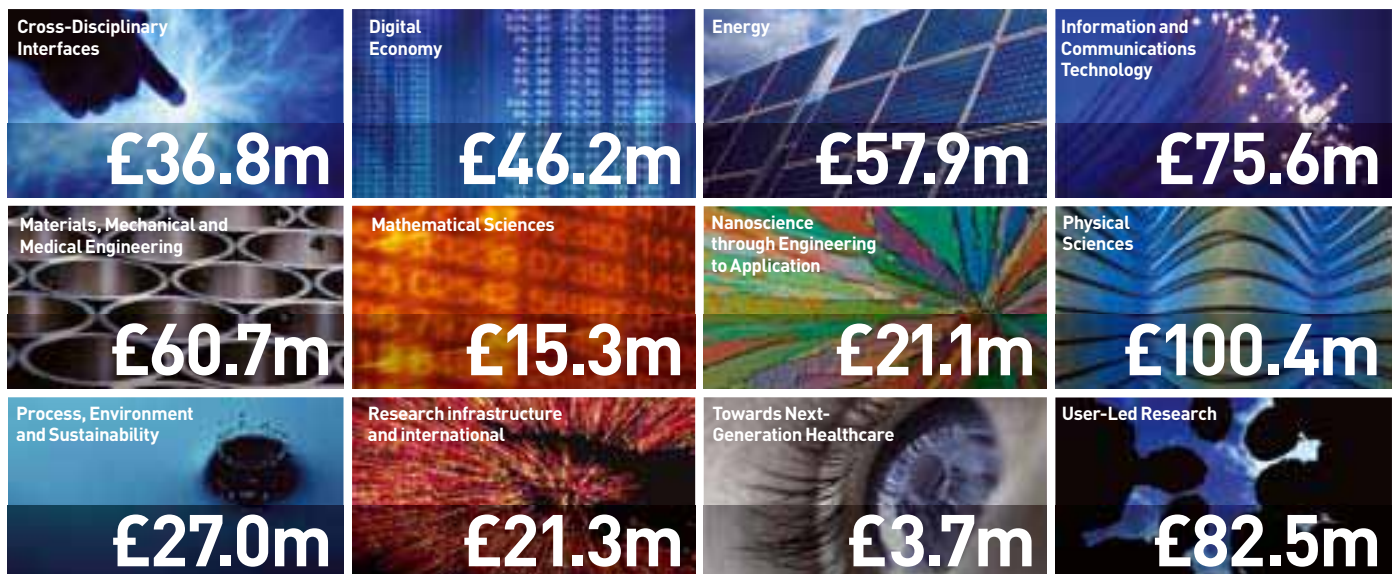
As the Chairman in the next three years of both EPSRC and the Olympic Delivery Authority – between them spending about £10 billion of public money – I am very conscious of the need to ensure that our investments are made efficiently and effectively. This year we are investing a higher proportion of our budget on research and skills programmes through continuing to reduce the already low proportion of our spend on administration. Our focus on increasing the co-funding of our programmes will ensure that we make the most of our investment in delivering the impact so vitally important to the UK.



John Armit Chairman

EPSRC portfolio 2008-2009

Financial values quoted are for funds committed in 2008-2009.



INVESTING FOR PROSPERITY

DAVID DELPY CHIEF EXECUTIVE

The tough economic conditions being experienced across the world this year emphasise the vital role science and engineering has to play in contributing to the UK's long-term prosperity and the wellbeing of society. Our major event this year 'Pioneers09' showcased highlights from our programme demonstrating clearly the richness of innovative research and talent in the UK and its economic and social impact. In my presentation to over 700 delegates from businesses and academia I emphasised how our support for research and skills can have a significant impact on the country's economic recovery. Key factors are our investment in 6000 cutting edge research projects worth £3.3 billion, the high-value skills we develop every year through our 8000 PhD students and the collaboration of over 2000 companies in our programmes.

Our achievements this year represent a major step forward to meeting the ambitious goals of our Delivery Plan 2008-11 which I presented to research communities across the UK during the year. They cover our progress in delivering an impressive body of high quality research involving the 23,400 researchers and students that we support. This ensures a strong research base for the UK providing the resources to face major challenges such as our future energy supply, the needs of next generation healthcare and the developing digital economy.

Big impact for skills

The research breakthroughs that emerge from our funding, allowing companies to improve their competitiveness, depend on highly talented people with a diverse range of skills. Our drive to meet the need for current and future skills requirements, launched in 2008 by Lord Drayson, Minister of State for Science and Innovation, features the bold new approach of investing £280 million in 45 new Centres for Doctoral Training. These Centres across the UK will boost doctoral skills to tackle

a wide variety of issues including climate change, energy, our ageing population and hi-tech crime. They will also improve UK strengths in core sectors of the economy such as automotive and aerospace manufacturing.

I was very impressed by the excellent response from the research community to the £45 million collaborative fund announced by EPSRC and the Wellcome Trust in 2008 to boost innovation in medical engineering in the UK. This invitation to set up world-class centres of excellence to develop innovative solutions to future healthcare needs attracted proposals worth £500 million. The best of these proposals will be funded in 2009 to establish medical engineering 'hubs' bringing together clinicians, biomedical researchers and engineers to solve today's big medical challenges. EPSRC has also developed fruitful partnerships with other organisations in this field such as that with Cancer Research UK, the Medical Research Council and the Department of Health for England in a £50 million bid to transform cancer imaging in the UK.

Thinking big

Positive encouragement for 'big thinking' that will have the impact needed to enhance the global competitiveness of UK research is an important feature of our Delivery Plan. Our response in 2009 included a first tranche of awards worth £20 million for new 'Programme Grants' focused on mould breaking research projects in areas with huge potential such as the harvesting and production of hydrogen from water, and step changes in the performance of semi conductor devices.

Our Delivery Plan target of driving the commercialisation of research by building on the strong science base established by our investments depends on effective links with influential partners. By 2009 we had made major progress in realising the huge potential of our partnership with the Technology Strategy Board set up by Government



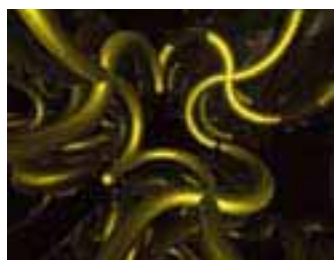
Key highlights of the year

Lord Drayson launches new EPSRC-supported centres for doctoral training across the UK.

First tranche of new EPSRC Programme Grants for 'mould-breaking' projects.

EPSRC invests £10 million in Technology Strategy Board project, the flagship 'low carbon' vehicles initiative.

£500 million worth of proposals for EPSRC support to boost innovation in medical engineering.



to stimulate innovation in areas with the greatest scope for boosting UK growth and productivity. EPSRC funding of over £90 million is being contributed to collaborative projects with the Board including their 'flagship' programme to boost the proportion of low carbon vehicles on our roads. Big thinking also characterises our work with other 'Strategic Partner' organisations in the private and public sectors, ranging from aerospace to pharmaceuticals. These research intensive bodies work with us to provide platforms for our programmes which tackle major challenges facing society and the economy identified by the Government. The funding for research and skills development with our 28 Strategic Partners – £81 million from EPSRC and £56 million from the partners – indicates the significance of the activity.

To support our aim of boosting areas of research of major strategic importance to the UK economy and society that are 'at risk' of shortage of expertise we made four new Science and Innovation Awards in 2008. Worth a total of £20 million, these will bolster the UK's research capacity including realising the huge potential from exploiting the new 'super carbon' graphene, and developing innovative software that takes advantage of rapid advances in high performance computers.

Ambitious outreach

Our goal of maximising engagement of UK research teams with their counterparts around the world is important if global challenges are to be tackled effectively. We are already making a big impact from over £400 million of our funds invested in research with international links. Our collaborations with key developing countries such as China and India are developing fast, and this has been enhanced by the launch of Research Councils UK offices in both countries. The RCUK office opened in India this year will build on the current

EPSRC-supported research worth £6.7 million linked to this fast developing economy.

An iconic outreach project called Bloodhound seeks to inspire the next generation of engineers through a bid to push the land speed record up to 1000mph by 2011 – 30% faster than any car has gone before. Led by Richard Noble, the project involves an education programme which has already attracted over 1000 schools and related organisations, and cutting-edge, EPSRC-supported research in aerodynamics. As a founder sponsor, it complements our Science in Society programme to inspire the young to pursue a science or engineering education.

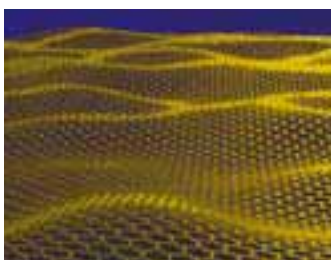
Peer review pressure

After extensive consultation with our communities and stakeholders, we have introduced measures to improve the effectiveness of our peer review of grant proposals. These include a requirement for applicants to outline potential impacts of research, and measures to reduce the pressure on all those involved in peer review caused by the steadily growing number of applications in recent years. This is a significant change for the research community, and we will carefully monitor the effect of the new measures to help us maintain and further develop a world-class research base.



David Delpy Chief Executive

New Science and Innovation awards for 'at risk' areas.



New RCUK India office to build on EPSRC's £400 million international research links.



EPSRC is founder sponsor of the 'Bloodhound' project to inspire the next generation of engineers.



EPSRC 'Pioneers09' showcase event attracts over 700 and reaches out to millions.



Healthy Research Base

The future of the UK depends on a vibrant, healthy and well resourced research base in engineering and the physical sciences. While the innovations and discoveries from research are exciting and challenging in their own right, they also have a major impact by fuelling the economy with knowledge and trained people and providing an essential platform for the full range of the sciences.

08 Delivering high-quality research

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Breaking the engineering barrier

Shown here is an artist's impression of 'Bloodhound' the car that will attempt to break the world land speed record in 2011 and inspire the next generation of engineers.

'We will have failed if we get to 1000mph and don't get the national surge in the popularity of science and engineering', says project leader Richard Noble.





Basic goes solar

'This project is a fine example of basic research as part of an EPSRC Portfolio Partnership, moving to the next stage of exploitation,' concludes Professor Ben Murdin of the University of Surrey commenting on new work to develop cheaper solar cells.

Some 90% of standard solar cell modules are now made from silicon which offer relatively high power efficiencies but at a cost. The emergence of organic materials based solar cell technologies promise great potential for lowering costs using their solution-based simple fabrication techniques to offset the inherently lower efficiencies of the cells. The group propose to improve existing technologies further and develop organic-

inorganic hybrid types that could be produced at reduced cost and bring them closer to commercialisation. 'Carbon nanotubes can be incorporated into organic cells enhancing their performance greatly' according to Professor Silva.

New funding from one of our Strategic Partners, E.ON, is enabling a research team led by Professor Ravi Silva to build on this earlier EPSRC-funded work by exploring the prospects for alternatives to standard silicon-based solar cells.



DELIVERING HIGH-QUALITY RESEARCH

23,400

Approximately 23,400 researchers and students funded in 2008-09.

YEAR IN CONTEXT

The backdrop of the most rapid change in the global economy in decades has highlighted the growing significance of EPSRC's mission. The Government's Science and Innovation Investment Framework challenges EPSRC to deliver two key components of the knowledge economy to support the UK in retaining international prominence and economic stability. These are the provision of new knowledge from research that inspires both scientific innovation and economic benefit; and a flow of highly skilled people to drive forward a modern economy.

Continuing to sustain and stimulate a healthy core research base through funding support has become an ever more important role for EPSRC. Over £500 million was invested by EPSRC during the year to fund top quality research spanning a wide range of disciplines from pure physics to the life sciences. We awarded over 1,100 research grants, selected for the high quality of the proposals through our range of support modes. This investment contributes to sustaining an essential platform for a strong research base through a significant portfolio of investigator-led research, with approximately 23,400 researchers and students funded by EPSRC in 2008-09 (rising from approximately 19,500 in 2004-05).

To ensure that the peer review system continues to deliver world-class research transparently and efficiently, a wide ranging and very comprehensive consultation was carried out by the Research Councils UK. The views in the resulting report published in 2007, together with more recent feedback to EPSRC, have helped shape proposals for improvements in how our peer review system

operates, to be implemented in 2009. The main changes are measures to reduce overall research proposal numbers, a requirement for applicants to outline potential impacts of research, and a revised review panel structure. One of the major drives for change has been the doubling of research proposals received by the Research Councils in the last two decades, resulting in increased pressure on all involved in peer review.

The EPSRC Delivery Plan for 2008 to 2011, launched in 2008 at public meetings across the UK, focuses our portfolio on tackling the current challenges faced by government, society and the economy. These include pressing public policy issues such as:

- The rapidly shifting economic activity;
- The acceleration of innovation and technology developments;
- Provision of a secure supply of affordable and sustainable energy;
- Living with environmental change;
- Demographic change including an ageing population; and
- Global uncertainty and the threat of terrorism.

For EPSRC, there are five key drivers that have shaped the Delivery Plan:

- The need to encourage innovation through transformative research;
- Increased emphasis on the economic impact of supported research;
- Greater need for an interdisciplinary approach across traditional boundaries;
- New arrangements for publicly-funded health research; and

Synthetic copycat of a living cell

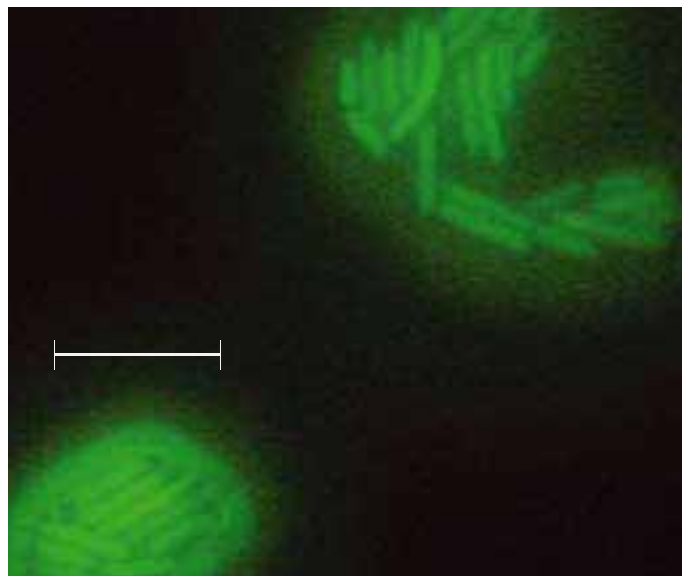
First steps towards creating a synthetic 'cell', using long-chain molecules to mimic the surfaces of the real thing, have been made by a team led by Professor Cameron Alexander at the University of Nottingham. The breakthrough has been to demonstrate in the laboratory that the synthetic capsule-like structures can interact to natural bacteria cells and transfer molecular information.

Although at an early stage, the research results open up exciting potential healthcare applications. Among them could be the development of new targeted drug delivery systems where the capsules would carry the drug molecules to attack specific disease cells in the body

while leaving healthy cells intact. This would reduce the side effects sometimes associated with treatments for life-threatening illnesses such as cancer. The technology could also offer a new way to treat bacterial infections by sequestering harmful bacteria selectively without requiring antibiotics.

The work has been funded through the EPSRC-run 'IDEAS Factory' programme which aims to promote blue sky, curiosity led research.

Fluorescence micrograph of glycopolymer capsules with attached E. Coli cells at the capsule surfaces.
Scale bar = 1µm



DELIVERING HIGH-QUALITY RESEARCH CONTINUED

- The dynamics of research globally, including the rapidly changing economies of India and China.

We have responded to these influences within a broader portfolio providing increased focus on delivering vibrant research programmes on priority themes – energy, the digital economy, nanoscience through engineering to application, and towards next-generation healthcare.

ENSURING EXCELLENCE

The health of the research base in the UK depends on substantial and well-managed support for core engineering and physical sciences. The output provides a foundation for the benefit of the full range of sciences and it also transfers into the knowledge-driven economy and ultimately applications. The key to sustaining the long-term health of research is our policy of enabling researchers to be creative and to take the lead on proposals for support – 68% of research grants funded in 2008-09 were investigator-led. For example this is facilitating response to fast-moving developments in plastic electronics, spintronics, quantum coherence, and complexity. It also facilitates the new multi-disciplinary approaches increasingly required to deliver high-quality research outcomes for such topics where there is considerable crossover between traditional areas of expertise.

Health check

A potentially important indicator of the health of the EPSRC research portfolio is the outcome of the Research Assessment Exercise (RAE) which reported its findings in 2008. The RAE analysis of

research excellence, linked to the Government's allocation of funds to support university departments through the Funding Councils, has therefore been reviewed by EPSRC. A key RAE finding was that, across the UK university research sector, 17% of research was world-leading and 87% of all research activity was of international quality. The RAE assessment panels' conclusions on individual disciplines were also positive for the Research Council, identifying excellence in all EPSRC – related research areas.

Rigorous review

The UK research community is recognised worldwide as being highly successful – robust bibliometric analysis places UK research outputs second only to the USA in most areas of engineering and physical science research. EPSRC has sustained its strategy of rigorous evaluation of the areas within its mission. The latest in a series of international reviews focussed on the health of materials. While the panel of leading international experts concluded that the health of UK materials research was good, EPSRC has taken forward an action plan to address some gaps and opportunities and is consulting the research community on solutions. For example, action has already been taken to strengthen the sector with the creation of three new Centres for Doctoral Training in advanced metallic systems, advanced composites, and molecular modelling and materials science.

Chemistry is the theme for the next discipline-based international review in April 2009, and a mathematics review will follow. EPSRC is also leading RCUK reviews of e-Science (December

87%

87% of university research activity is of international quality (RAE 2008).

New sensors detect poisons and explosives



New nanosensors based on a fundamental science discovery could be used in novel security devices to detect poisons and explosives or for highly sensitive medical sensors. The research, led by physicists at Imperial College London, opens up the potential for the sensors being tailor-made to instantly detect the presence of particular molecules such as poisons or explosives in transport security screening. Another possibility is their use in healthcare to pinpoint proteins in patients' blood samples.

The team showed that by putting together two nanostructures made of gold and silver, each 500 times smaller than the width of a human hair, they can make an early prototype device which, once

optimised, should demonstrate the high sensitivity required. Professor Stefan Maier of Imperial College London concludes: 'This study is a beautiful example of how concepts from different areas of physics fertilise each other - in essence our nanosensor system is a classical analogue of electromagnetically induced transparency, a famous phenomenon from quantum mechanics.'

DELIVERING HIGH-QUALITY RESEARCH CONTINUED

2009) and energy research (April 2010) – the first ever undertaken.

During the year, a review of physics by Professor Bill Wakeham Vice Chancellor of the University of Southampton, commissioned by the Research Councils UK, reported on the health of the subject. In his conclusions he considered that 'UK physics enjoys excellent international standing and the role of physics and physicists is vital for other disciplines. A significant proportion of physics research takes place in non-physics departments. This provides evidence of both the pervasiveness of the discipline and the flexibility of physicists, but physics departments need to make sure that they maintain intellectual ownership of some parts of the discipline.'



UK physics enjoys excellent international standing...
Professor Bill Wakeham



ACHIEVING TRANSFORMATION

Signposts to potential

In 2008 EPSRC has ramped up its 'signposting' technique as part of its drive to open up opportunities for the research that promises to transform areas of science. We have identified new signposted areas in engineering, ICT, physics, nanoscience and mathematical science based on the findings of international reviews and dialogue with the research communities. Each of the areas chosen remains in place for at least 18 months and up to 10% of a programme's responsive mode budget is available to fund signpost topics.

Topics which have been signposted during the year include:

- Synthetic biology
- Water engineering
- Grand challenges in microelectric design
- Grand challenges in silicon technology
- Plasmonics
- Quantum coherence
- Physics/life sciences interface
- Nanometrology
- Nanotoxicology

This approach focuses on priority subjects and avoids the need for specific subject 'calls' by EPSRC for grant proposals. For example funding of £8 million has been allocated to the first theme with high potential – the 'physics/life sciences interface'. This year a higher proportion of these grants are for a longer period than the typical three years, enabling a sustained approach to tackling major strategic research.

Bullet tagging to combat gun crime

Bullet tagging technology developed in the UK could be in use soon to help fight gun crime, and also has potential to combat knife crime.

The breakthrough is the development of 'nanotags', made from pollen with a unique chemical signature added, which would allow investigators to trace who has handled bullets used in a crime. Invisible to the naked eye, the tiny tags could be coated onto gun cartridges and would then attach themselves to the hands or gloves of anyone who handled them. Until now it has been very hard to establish a link because of the difficulty in retrieving finger prints or significant amounts of DNA from the shiny, smooth cartridge surfaces. The tags could

therefore lead to a higher rate of successful gun crime convictions.

The advance has been achieved by a team of chemists, engineers, management scientists, sociologists and nanotechnologists from Brighton, Cranfield, Surrey and York universities with EPSRC funding. Project partners are the Forensic Science Service, BAE Systems and coatings manufacturer Andura.

Tagged and bound: nanotags applied to cartridge cases and detectable, after firing, on the user's gloves.



£20m

£20m for first Programme Grants to tackle 'mould-breaking' research.

DELIVERING HIGH-QUALITY RESEARCH CONTINUED

One of the topics chosen for signposting is the emerging field of synthetic biology which could bring about the creation of novel artificial biological organisms and devices. The potential applications range from medicine to energy. Synthetic biology provides an example of our cross-discipline, cross-council approach. In this case EPSRC has come together with three other research councils to ensure support for new projects designed to rapidly build the UK's expertise and capacity. EPSRC and BBSRC have jointly awarded funds to seven new networks in synthetic biology allowing researchers to build links across the boundaries of disciplines and institutions. The networks, which link eight universities, have the necessary strong social and ethical dimensions, and where appropriate funding will be made available from ESRC and AHRC. Together with BBSRC, we are planning to engage in public dialogue activity in 2009 to help understand the public's perceptions, aspirations and concerns regarding synthetic biology.

Boost for big thinking

EPSRC is responding to the challenge of enhancing the global competitiveness of UK research by positive action to inspire 'thinking big'. We are therefore encouraging and supporting more ambitious, 'mould-breaking' research projects through larger and longer grants. Our new 'Programme Grants' initiative, for example, tackles major issues that take longer than three to four years to achieve outcomes, and often involve larger than normal multidisciplinary groupings of researchers. The first tranche of five major grants worth £20 million were awarded in 2009,

encompassing areas with huge potential such as step-changes in the performance of semiconductor devices, and the harvesting and production of hydrogen from water. EPSRC's Director of Research Base, Dr Lesley Thompson, emphasises that, 'We believe longer more ambitious grants have the potential to deliver research that will be truly internationally leading. Increasing the number of these grants is a priority.'

EPSRC has continued to provide support through its Platform Grant Scheme to help maintain and develop the strong engineering and science research base that is so important to the future of the UK. This helps to sustain established UK research groups whose reputations are already respected worldwide in their fields, and have strong track records in winning support from EPSRC and other sources. It can be used to underpin such high-profile areas by retaining key staff, and undertaking feasibility studies, longer term research and international networking. The support enables groups to take a strategic view of their research that can be enhanced by submission of responsive mode proposals during the lifetime of a Platform Grant. Some improvements were made to the operation of the scheme in 2008 following recommendations from an independent review which concluded that it was meeting the majority of its aims. This includes extending the scheme to cover the whole of EPSRC's remit.

Building future healthcare

Next generation healthcare, one of the priority themes in our portfolio, received an enthusiastic

MOULD-BREAKING GRANTS

Two of the first tranche of EPSRC Programme Grants to inspire 'big thinking' research that tackles major issues are featured here.

Below: Artistic impressions of meta-material structures. Images: Eric Plum

Photonics- the next revolution

Over the last twenty years photonics, the study and application of photons – elementary particles responsible for electromagnetic phenomena – has literally changed our world. By making possible developments such as optical fibre networks, optical disc data storage, modern image display technologies and laser-assisted manufacturing, photonics has had an enormous impact on everyday life. Mobile phones and broadband internet are just two examples.

And this, says Professor Nikolay Zheludev, of the Optoelectronics Research Centre at the University of Southampton, is just the beginning. "The next photonic revolution", he says, "will be fuelled by the development of photonic metamaterials – artificial electromagnetic materials with unusual and useful functionalities that are achieved by structuring on the sub-wavelength scale."

Thanks to the award of a new £5.2 million EPSRC Programme Grant, Professor Zheludev and his colleagues along with UK and international collaborators, will be drawing on a wide range of resources to develop a new generation of switchable and active nanostructured photonic materials. These, they anticipate, will provide groundbreaking solutions for applications ranging from telecoms, energy, light generation, imaging, lithography, data storage and sensing, to security and defence applications. And in the process the group intend to establish the University of Southampton as a world-leading centre for research into nanostructured photonic metamaterials.



'Cat's whisker' energy

Ensuring a sustainable supply of energy is a critical problem facing us all. Using a combination of basic and applied science Professor Neil Alford of the Department of Materials at Imperial College London and his colleagues, Professor Lesley Cohen of the Department of Physics and Professor Nicholas Harrison of the Department of Chemistry, are applying their joint expertise in nanomaterials and nanotechnology in a new EPSRC Programme Grant of £3.2 million to develop innovative ways to reduce energy consumption, generate cheap energy, and store energy.

On the energy saving front, the group are examining the use of different materials which change temperature in response to changes in magnetic or electric fields as a means to reduce energy consumption for cooling. To generate energy they are exploring a new twist on the technology used to power old-fashioned cat's whisker crystal radio sets. But instead of relying on radio waves, the group are hoping to convert solar radiation to generate energy. For energy storage they are looking at better ways to combine catalysts with energy from sunlight to split water molecules to generate hydrogen which can be stored to power devices ranging from cars to fuel cells.

'It's an exciting opportunity to bring together new developments in chemistry, physics and materials,' says Professor Alford. 'And it's a rewarding chance to work to develop new sustainable energy technologies that will benefit everyone.'

Carbon-neutral power for the home



A super efficient system that has the potential to power, heat and cool homes across the UK is being developed at Newcastle University as part of a joint UK-China programme funded by EPSRC.

The process works by burning vegetable oil such as a type derived from the seeds of a plant which can grow successfully on otherwise unproductive land. This powers a generator to provide electricity for the home, and waste heat from the process heats water and converts to cool a fridge. The overall result, taking into account that the fuel crop absorbs carbon while growing, is near zero carbon emissions. Drawing on the modelling expertise of scientists at the University of Ulster, the team will build a full-scale prototype

system incorporating a unique energy storage system being developed with the University of Leeds. This overcomes one of the barriers to take-up domestic scale generation systems by helping to ensure that the correct form of energy is available at the right time.

DELIVERING HIGH-QUALITY RESEARCH CONTINUED

£50m

£50m to establish world lead for the UK in cancer imaging.

response from the research community to the £45 million fund announced by EPSRC and the Wellcome Trust in 2008. The joint invitation to set up world-class centres of excellence focussed on developing innovative solutions for the needs of future healthcare, attracted preliminary proposals worth £500 million. Each of the awards to be made in 2009 will establish a medical engineering hub that will drive innovation, putting clinicians, biomedical research scientists and engineers together to solve the big challenges in medicine today.

'We are delighted with the huge response which has seen interdisciplinary groups of researchers come together in ways that EPSRC and the Wellcome Trust have not seen before', said Dr John Wand, head of EPSRC's healthcare programme. 'Working with the Technology Transfer arm of the Trust also means that we have a good route to effective translation of the research we support into applications.'

Cancer imaging in the UK is to be transformed by a £50 million funding boost over the next five years. The initiative will support the development and introduction of the latest cancer imaging technologies. Collaborative funding from Cancer Research UK (£30 million), EPSRC (£15 million), the Medical Research Council (£3 million), and a contribution from the Department of Health for England will deliver this exciting strategic initiative that will establish the UK as world leader in cancer imaging research. The investment will enable four large cancer imaging centres to be established to serve as focal points of world-class research using imaging techniques such as Magnetic Resonance Imaging (MRI) and Positron Emission Tomography

(PET). Five cancer imaging research programmes will also be set up on specific imaging areas. It will also contribute to a new cyclotron – a particle accelerator used to produce radioactive tracers for cancer studies.

New blood for key areas

EPSRC contributes strongly to maintaining and enhancing UK research in areas of strategic importance. Examples of research areas in the UK that can confidently claim to be global leaders in their field include plastic electronics, aerospace engineering and pharmaceuticals. But the UK cannot afford to jeopardise its vital role as an innovative, knowledge-based economy by some aspects of strategic research being at risk of inadequate capacity or shortage of the necessary highly skilled people.

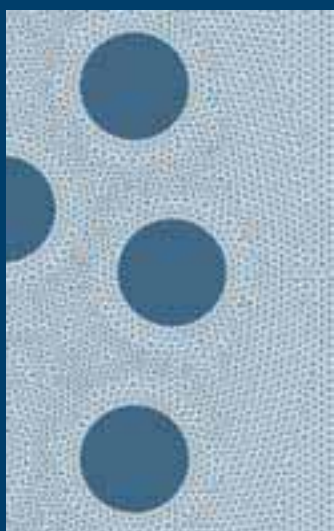
Major progress has been made to develop our drive to support and nurture outstanding engineering researchers at an early stage of their careers who demonstrate the talents for independent research leadership and the ability to explore 'high-risk' projects. The 'Challenging Engineering' initiative was first piloted in 2004, and after 4 rounds of funding over £21 million has been awarded to 25 researchers chosen for their potential. The wide-ranging engineering topics to be taken forward by the award winners include carbon capture and storage, engineering nanomaterials, fibre-optic sensors for geotechnology, sensors in extreme environments, and sustainable technologies for using brownfield sites. The scheme has evolved since the pilot and each researcher now receives up to £1 million to develop their

THE 2008 SCIENCE AND INNOVATION AWARDS

The 2008 Science and Innovation awards aim to boost support for challenging research areas of strategic importance to the economy and society that are particularly at risk. The four awards made this year totalling £20 million went to projects that will create new centres of research activity and support innovative approaches in existing research environments. A total of 29 projects have been awarded totalling £119 million since the scheme began. The new awards are funded by EPSRC, with supporting finance from the Higher Education Funding Council for England and the Scottish Funding Council.

Below: Finite element 'grid' forming the foundation for a numerical method for modelling a coral. The complexity of such grids create massive computing requiring the use of high performance computers.

Bottom: Artist's impression of graphene membrane.



Exploiting the new 'super carbon'

The hunt for new applications of the new 'super carbon', graphene, discovered in Manchester in 2004 is the mission for a centre involving Manchester and Lancaster universities. Graphene, an isolated atomic plane made from carbon atoms, exhibits unique electronic properties that have inspired world-wide efforts to exploit their use in new sensors, transistors and other electronic devices. But researchers increasingly foresee wider uses for the substance. The new award will enable the centre to explore the range of exciting new applications in materials science, chemistry and engineering.

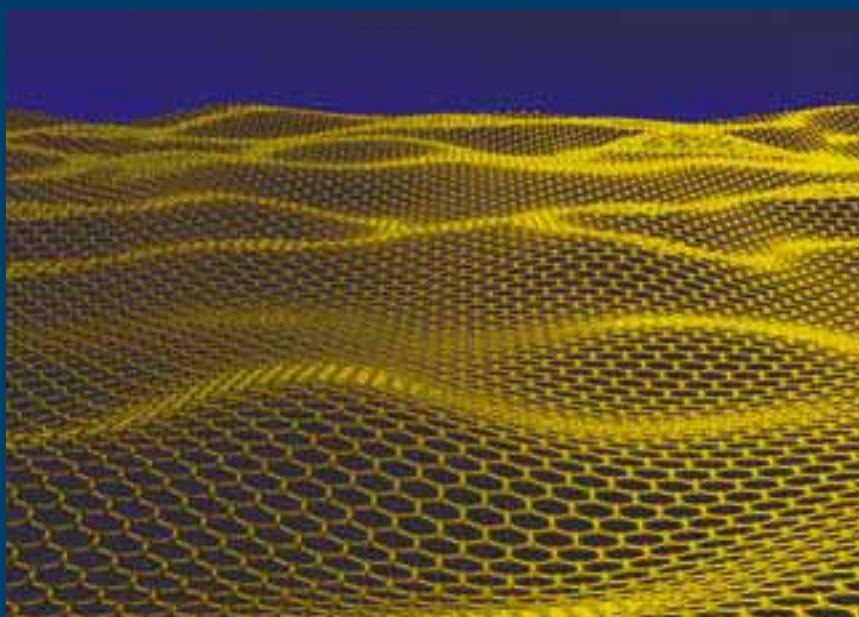
A second award to strengthen research capacity for graphene went to Exeter University and Bath University. The new centre will be an international focus for graphene science, supporting industrial as well as academic research activities. It will concentrate on fundamental research and applications in nano-electronics, photonics and bio-sciences. The award enables the creation of new academic posts and state-of-the-art equipment rivaling that found in any laboratory worldwide, to attract leading researchers from around the globe.

Spin-out from synthetic biology

A rapidly developing industrial sector based on synthetic biology is forecast for the next decade. Its breathtaking potential could encompass sectors like healthcare, renewable energy, materials, industrial processes and food technology. Winners of the award, Imperial College London and the London School of Economics, aim to generate intellectual property for licensing, spin-out companies and collaborative research, and place them and the UK in the vanguard of this emerging area. Synthetic biology concerns the design and manufacture of biologically based devices that do not already exist in nature. It differs from conventional genetic engineering because of its emphasis on foundation technologies – based on the principles of standardisation, modularity and abstraction. This potentially makes the engineering of biology easier and more reliable because the approach is to use standard parts to produce standard devices.

Software to scale the peak

Narrowing the gap between the peak performance that can be reached by high performance computers and that achieved by current software is the mission for the award won by a consortium involving Edinburgh, Heriot Watt, and Strathclyde universities. Improvements in software must keep pace with advances in computing technology if new investment in hardware is to be fully exploited for the UK's benefit. By bringing together mathematicians with specialists in computer science and high-performance computing, the initiative will focus on speeding the path 'from algorithm to implementation' for challenging applications relevant for energy, health sciences, nanoscience and the digital economy. The centre will foster knowledge exchange with major computing companies as well as industrial users of computer algorithms.



War on superbugs

Superbugs such as MRSA and vancomycin resistant Enterococci are causing suffering for thousands of patients. One of the few antibiotics that can be used to combat such increasingly resistant infections as MRSA is being researched by a team led by the University College London. A nanomechanical approach to see how this antibiotic 'vancomycin' works will they hope pave the way for the development of more effective drugs.

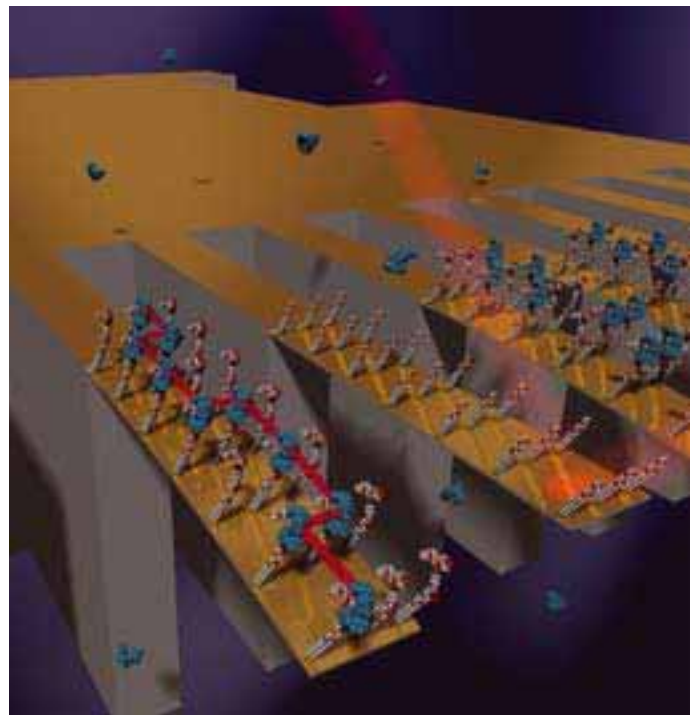
Dr Rachel McKendry explains the science: 'The cell wall of these bugs is weakened by the antibiotic, ultimately killing the bacteria. Our research on cantilever sensors suggests that the cell wall is disrupted by a combination of local antibiotic-mucopeptide binding

and the spatial connectivity of these events. Investigating both of these binding and mechanical influences on the cells' structure could lead to the development of more powerful and effective antibiotics in future.'

The research was funded by EPSRC, the IRC in Nanotechnology (the universities of Cambridge, Bristol and UCL), the Royal Society and BBSRC.

[Schematic representation showing the nanomechanical detection of antibiotic-peptide interactions on multiple cantilever arrays.](#)

(Image: University College London)



DELIVERING HIGH-QUALITY RESEARCH CONTINUED

research groups over a period of 5 years.

This year EPSRC, in partnership with the UK Funding Councils, maintained its successful Science and Innovation Awards programme focussed on revitalising a new tranche of potential 'at risk' areas. The 2008 awards will boost the exploitation of the new 'super carbon' graphene, develop the huge potential of synthetic biology, and improve software for advanced computing (see page 14).

GLOBAL DIMENSION

This year's economic climate has re-emphasised that the evolving challenges of the 21st century are global. To meet the challenges for research, EPSRC has continued to work to ensure that top UK research teams can collaborate with their equivalents partners around the world. Over £400 million of EPSRC funds are invested in supporting research with international links. These include developing energy partnerships with China, working on rural infrastructure in India and ground -breaking materials science with research teams in the USA.

Our strategy for maximising international engagement has three key elements:

- stimulating and supporting interactions between the best researchers in the UK and their best counterparts overseas – 'best with best';
- seeking to promote and build the influence of UK research performers globally; and
- enhancing relationships with the key strategic countries China, USA and India through the new Research Council UK offices in these countries to forge relationships with counterpart organisations.

The launch of the Research Councils UK office in India in October 2008 was a highlight for EPSRC international engagement with this fast developing economy. Hosted by the British High Commission in New Delhi it will promote collaboration between UK and Indian funding bodies and build on the current EPSRC-supported research linked to India worth £6.7 million. This research support includes backing for a consortium of British and Indian universities, institutes and companies that plan to establish the first India-UK Advanced Technology Centre of Excellence.

The new India office complements the earlier opening of Research Councils UK offices in the USA and China. An example of progress in China during 2008 includes a partnership between EPSRC and the Natural Science Foundation of China to jointly fund research in spintronics. Funding of £4 million has also been allocated for UK researchers to build collaborations with China on cleaner fossil fuels. The existing EPSRC/China research collaborations are worth £8.8 million.

EPSRC-supported researchers' links with the USA are estimated to be worth over £112 million. In 2008 we participated with the US National Science Foundation in two new calls for researchers in the US and UK to collaborate in chemistry and materials research. Also, EPSRC is holding a joint five-day workshop this year with the US National Science Foundation to stimulate promising new or underdeveloped areas of synthetic biology. Up to £5.5 million joint funding is allocated for supporting genuinely novel and potentially transformative research ideas arising from the event.

India

India is the location for the new RCUK office for international engagement.

Lift for life sciences training

Advances in medicine and biology depend on a range of skills including mathematicians, physicists, chemists and engineers. A review of EPSRC's Life Sciences Interface (LSI) Doctoral Training Centres, designed to deliver the high-level skills needed, has led to a £49 million boost to ensure that the quality and impact of training is maximised. The result was the setting up this year of three new centres, and 'refresh' funding for seven existing centres with proven performance and exciting research plans that support our mission of developing next generation healthcare skills.

One of the new centres, based at Nottingham, Loughborough and Keele universities, will train graduates in growing heart muscle

and regenerating cartilage and bones. Another based at the University of Birmingham will train students in imaging technology to help advance the treatment of a wide range of illnesses, from finding new ways to detect tumours to diagnosing diseases of the blood.

Topics covered by centres with 'refresh' funding for training include molecular organisation and assembly in cells (University of Warwick), medical devices research (University of Strathclyde), and chemical biology (Imperial College London).



8,000

8,000 students sponsored during 2008-09.

A new agreement was signed in 2008 to foster closer science and engineering links between the UK and Japan. EPSRC's Chief Executive Professor David Delpy and the Executive Director of the Japan Science and Technology Agency, Fumiaki Takahashi, signed a Memorandum of Understanding on the 150th anniversary of the start of diplomatic relations between the two countries. A joint programme of cooperative research in oxide electronics, organic electronics and spintronics was launched in 2008.

NEXT GENERATION SKILLS

YEAR IN CONTEXT

The role of EPSRC in training the next generation of world-class researchers is central to meeting the Government aim of boosting the flow of skilled people into the economy who are educated in science, engineering and technology subjects. As the largest sponsor of postgraduate research training in engineering and the physical sciences in the UK, EPSRC supported a population of over 8000 students during the year.

A major advance in 2008 was the investment of £280 million by the Research Council in new training centres across the country which will tackle some of the biggest problems facing the UK, underpinning the objectives highlighted in the EPSRC Delivery Plan. Significant progress has also been made to realise part of our vision to nurture the next generation of world-leading researchers. This includes major funding to support young researchers at an early stage of their careers, and a new emphasis on research leadership for our fellowship support.

Our aim of inspiring youngsters to pursue careers in science, mathematics or engineering continues to be realised through a 'Science in Society' programme with funding of £7 million in 2008-09. This involves hundreds of researchers and postgraduate students in engaging with the public, and we offer opportunities to develop the communications skills required.

The key aims for securing the future supply of people, set out in the EPSRC Delivery Plan for 2008-2011, are to:

BREAKING THE ENGINEERING BARRIER



In 2011 Richard Noble and the 'Bloodhound' team hope to complete an epic and iconic journey. They plan not only to build a car capable of breaking the World Land Speed Record but also to break through the barrier that often deters the young from becoming innovative engineers.

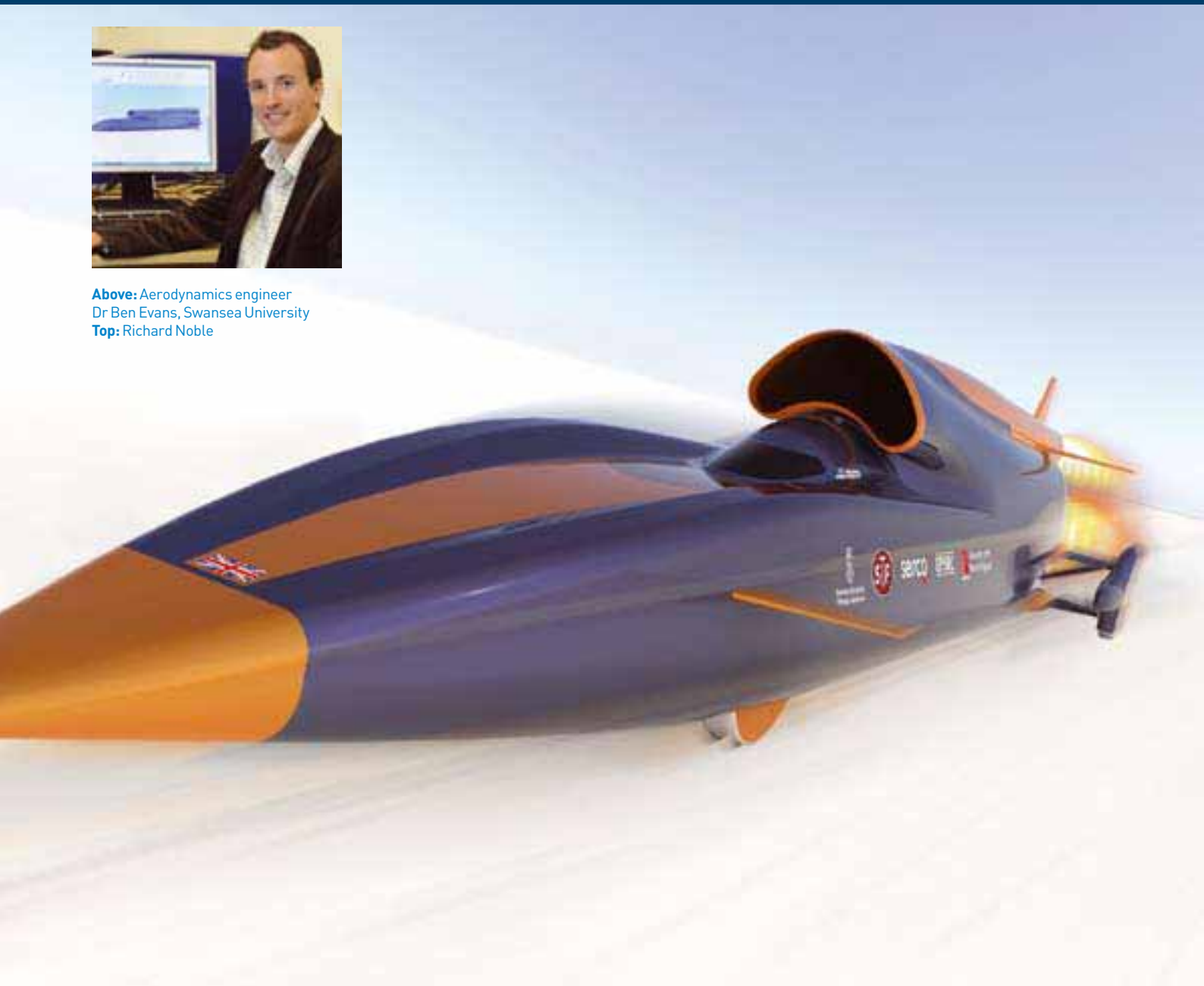
The four-year project aims to push the record past the 1,000 mph barrier. It was born after the present Science Minister Lord Drayson, then at the Ministry of Defence, decided that an iconic engineering feat was needed to inspire future generations. EPSRC, a founder sponsor of the project, is funding the vital aerodynamic research being carried out at Swansea University. Dr Ben Evans of Swansea has spent the last year creating the predictive airflow data that has shaped the car, using computational fluid dynamics. This has already influenced the aerodynamic design of

innovative titanium wheels, and options for the car's dramatic nose shape to minimise the effect of a 'spray drag' phenomenon caused by sand particles. The work will in time have spin-off into better vehicle or aircraft design, improved fuel efficiencies and even new medical techniques.

The Bloodhound education programme will be available to all pupils from primary and secondary schools and students in further and higher education. Over 1,000 organisations including 750 schools have already registered for the education programme's materials. As Richard Noble emphasises, 'We will have failed if we get to 1,000mph and don't get the national surge in the popularity of science and engineering'. His team was a highlight of the Big Bang Fair of 2009 which attracted around 5,000 school students.



Above: Aerodynamics engineer
Dr Ben Evans, Swansea University
Top: Richard Noble



FROM HI-TECH CRIME TO GREEN POWER

Featured here are four of the 45 new EPSRC supported training centres across the UK, created in 2008. With funding of £280 million the centres together will tackle some of the biggest problems facing the UK from hi-tech crime to sustainable energy.

Right: Preparing for forging.
(Image: Somers Forge)

Hi-tech crime and global security

Crime and terrorism are constantly evolving threats to UK businesses and citizens. The UK's infrastructure such as transport, power and communications need to remain protected while identity theft and credit card fraud continue to have a devastating effect on everyday life. The new centre at University College London (UCL) will prepare the next generation of security scientists to face up to these challenges.

Centre Director, Professor Gloria Laycock who is also Director of the UCL Jill Dando Institute of Crime Science, explains that, 'The security science centre will train and shape a generation of thought leaders in integrated and socially sensitive security. This will encompass not only the future academics but also the policy makers and industrialists with whom they interact during and after their training'.

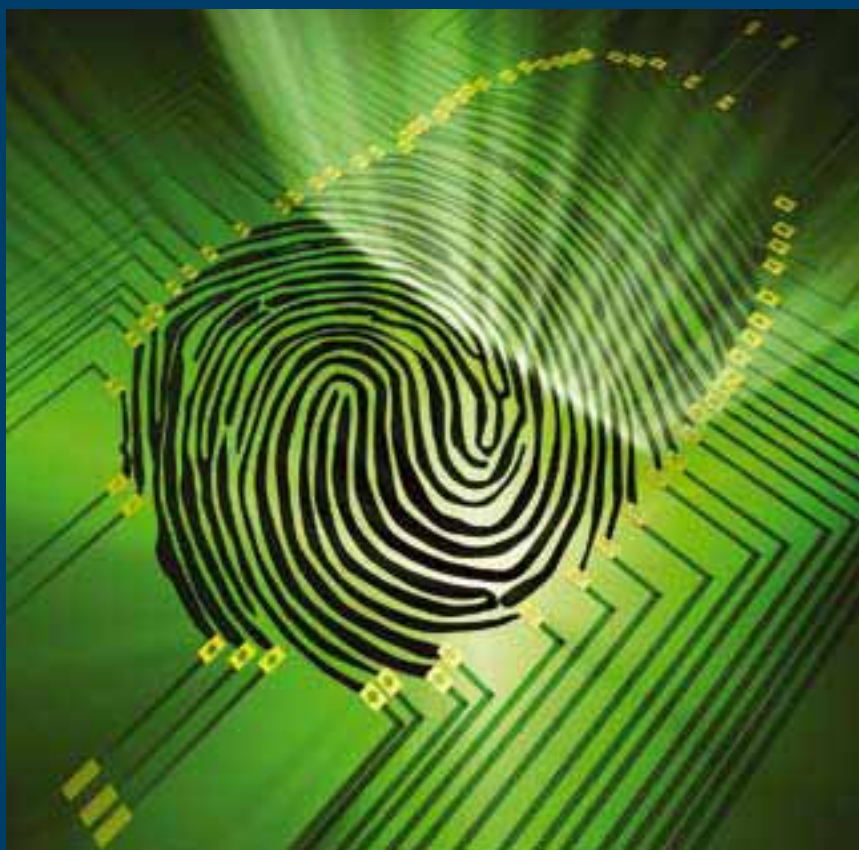
Training will include developing new security technologies, and understanding human behaviour, vulnerable organisations and infrastructure.



Centre of steel

The 'steel city' Sheffield will host the 'Advanced metallic systems centre' to deliver new research and training to help the UK's aerospace, automotive and power generation industries lead the world. The centre led by the University of Sheffield in partnership with the University of Manchester, will supply competitive metals specialists to high-value manufacturing sectors.

Research projects will focus on developing new materials and radically improving industrial processes spanning the complete product lifecycle, from raw materials through forming, coating, performance and recyclability. Centre Director, Professor Panos Tsakirooulos, says that the centre will, 'directly address the potentially serious consequences of a shortage of personnel with doctorate level training in metallic materials and associated technologies on the global competitiveness of the UK's manufacturing and defence capability'.





Above left:
The Cambi Plant at Cotton Valley.
(Images: Thames Water)

Above right:
Thames Blue Sky Egg digester.

Water pressure

A new multi university centre will deliver the next generation of water sector research engineers who can meet the growing challenges to the water industry caused by more urbanisation, demographic shifts and climate change. Research will focus on chemical-free treatment, reducing the carbon footprint of water and wastewater services, improving water efficiency and service resilience and reducing sewer flooding. Centre Director Professor Simon Parsons says: 'This is an exciting opportunity for us to work closely with the UK water sector in delivering sustainable water services into the next decade.' He leads the centre based across five universities – Cranfield, Sheffield, Imperial College London, Newcastle and Exeter.

Green power shortage

Wind power has a pivotal role to play in the fight to tackle climate change and CO₂ emissions. It will also need to be a substantial contributor if the UK is to meet its energy target of 20% of electricity generation from renewable sources by 2020.

This rapid expansion of on and offshore wind farms requires highly skilled engineers and scientists to deliver low-cost wind power and increase its deployment. Director of the new centre at the University of Strathclyde, Professor Bill Leithead emphasises that: 'Over the next 15 years a very rapid worldwide expansion in wind power generation of electricity is expected. There is currently a severe shortage of wind power engineers that could hamper future growth. This centre will provide a much needed pool of engineers'. It will bring together the full range of skills needed – in aerodynamics and power conversion systems to energy yield calculations and condition monitoring.

Driving fuel cell performance

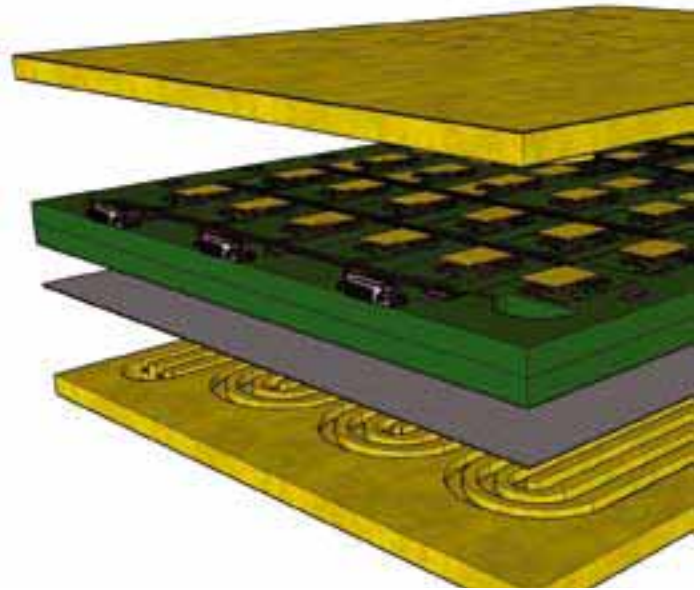
The use of fuel cells as a widely used, environmentally friendly power source for vehicles could revolutionise transport in the future. But what happens inside a fuel cell under the variable conditions when driving a car, from 'cold' to 'hard use', can have a big impact on cell performance. A physical chemist, Dr Anthony Kucernak at Imperial College London is leading a team to develop a detailed 'map' of the inside of a fuel cell to help make future devices more efficient and longer lasting.

Sensors will be developed to help build a model to show why some parts of a fuel cell might not perform as well as others, depending on their position within the cell. This could be caused

by factors such as depleted reactants or the presence of water. 'The ideal situation would be to achieve uniform rates of reaction throughout the cell since unequal rates mean that overall efficiency is not as good as it should be', explains Dr Kucernak. The ultimate goal of the project is to produce an instrument that could be used to help manufacturers test their components with a view to better fuel cell performance.

The work, funded by EPSRC and the National Physical Laboratory, has collaborating partners University College London, Johnson Matthey and Intelligent Energy Ltd.

Exploded view of the fuel cell system which will be created as part of the research.



NEXT GENERATION SKILLS CONTINUED

Support the next generation of world-class researchers and research leaders so that the UK can increase its global research impact and economic competitiveness;

Strengthen strategic research areas by targeting funding to create new research teams;

Attract the most talented people to research by enhancing the Doctoral experience, working with Funding Councils;

Help the flow of people through their research career pathways and enhance skills to meet user needs;

Continue to support and monitor the success of the Academic Fellowship scheme on behalf of all research councils;

Enhance the attractiveness of research careers and share best practice to address diversity issues, working with the RCUK Research Careers and Diversity Unity; and

Inspire the young to pursue research careers in science, maths, and engineering, in collaboration with the RCUK Science in Society Unit, through our public engagement programme.

£280m

£280m for 45 new training centres across the UK.

NEW WAVE OF SCIENTISTS AND ENGINEERS

The biggest ever EPSRC investment in training the scientists and engineers Britain needs for its future was announced in December 2008 by Lord Drayson, Minister of State for Science and Innovation. This £280 million initiative will create 45 training centres across the UK and train 2000 students to form a new generation of world-class scientists and engineers.

Introducing the initiative, Lord Drayson said, 'Britain faces many challenges in the 21st Century and needs scientists and engineers with the right skills to find answers to these challenges, build a strong economy and keep us globally competitive. EPSRC's doctoral training centres will provide a new wave of engineers and scientists to do the job'. He went on to point out that the centres would provide the skills to help develop clean renewable energy, fight hi-tech crime, assist in reducing carbon emissions and discover new healthcare solutions for an ageing population.

The Centres for Doctoral training are a bold new approach to training PhD students, creating communities of researchers to work on current and future challenges. Seventeen of the new centres will be industrial training centres that will equip students with the business skills they need to turn pioneering ideas into products and services, boosting their impact on the UK's economy.

Professor David Delpy, Chief Executive of EPSRC, explained why the centres were so vital: 'People are at the heart of our future strategy. We want to drive a modern economy and meet the challenges of tomorrow by investing in talented

Ganging up on bacteria

By 'ganging up' and 'talking' to each other bacteria are better able to survive and therefore more likely to infect a host and avoid the immune system.

Dr David Spring, an EPSRC Advanced Research Fellow at the University of Cambridge, explains: 'If a single cell were to release its toxin it becomes vulnerable to attack by the host's defences. If the bacteria wait until there are enough of them they can launch their toxins en masse and stand a better chance of overwhelming the immune system.' If the research team could interfere with the 'signalling' method bacteria use to establish whether they have reached the 'quorum' needed to become dangerous they could stop them producing toxins. One

of several approaches being developed is to produce an enzyme that could destroy the signalling mechanism.

Dr Spring is optimistic about the work's potential for treating such conditions as cystic fibrosis in due course. There are also possibilities for non-medical applications such as antibacterial toothpaste and antifouling paints for ships hulls.

Dr David Spring, EPSRC Advanced Research Fellow, Department of Chemistry, University of Cambridge. Bacteria *serratia marrescens* [red].



NEXT GENERATION SKILLS CONTINUED

50%

50% of students go on to work outside the academic sector.

people and inspiring the next generation of scientists and engineers. The centres expand our existing training portfolio, focusing on priority themes for the UK, often involving emerging and multidisciplinary research, and enabling greater collaboration with business'.

This new investment builds on the success of centres in complexity science, systems biology and the life sciences interface. It has also attracted much support from business and industry.

Examples of new EPSRC centres are:

- Tackling hi-tech crime and global security (University College London)
- Steel city to strengthen high-value UK manufacturing (University of Sheffield)
- Building a low carbon future (University of Reading)
- Water pressure: managing a precious resource (Cranfield University)
- Improving healthcare through innovation (University of Oxford)
- Advancing carbon capture and clean coal technologies (University of Nottingham)
- Advancing skills for the future of transport and the environment (University of Southampton)

INVESTING IN TALENT

EPSRC has underlined its commitment to supporting excellence in the UK's postgraduate research skills by announcing £82 million in grants to train 1200 future scientists and engineers starting in 2009. These Doctoral Training Grants (DTGs) were announced six months earlier than in previous years to facilitate

the recruitment of the best students by universities, providing a better fit with the student recruitment cycle. The grants, awarded to 45 UK universities, mark a significant investment in the talented future PhD students who will help drive forward the UK's economy. Around 50% of students we support go on to work outside the academic sector and play a vital role in industry and the wider UK economy.

Each year we allocate DTGs to a wide range of universities based on EPSRC research grant income. They allow institutions to be flexible in staff recruitment and retention as well as enabling them to tailor the duration of support – from three to four years – to the demands of research projects.

GOOD COMMUNICATORS

EPSRC has remained in the forefront of support for activities which engage the research community and the public. Our programme provides researchers with opportunities to develop outreach projects and to gain the communications skills needed to engage with the public.

During the year, EPSRC in partnership with the British Association, arranged a series of workshops around the UK for researchers keen to be involved in public engagement. These share best practice, exchange ideas and provide information on funding.

SPOTTING WORLD-CLASS TALENT

Featured here are a trio of talented researchers who won our new-style Fellowships awards this year. The first 46 awards made in 2008 identified those with the highest potential to become the next generation of worldwide leaders in their research fields.



Vision for X-rays

'As a one-time hospital physicist, I've had far too many chances to see how early diagnosis of cancer tumours can make the main difference between a cancer that can be cured, and one that kills,' says EPSRC Career Acceleration Fellow, Dr Alessandro Olivo, of the Medical Physics and Bioengineering Department at University College London. By adapting a more powerful form of X-ray imaging, known as X-ray phase contrast imaging (XPCi), for use in hospitals, Dr Olivo and his colleagues hope to change all that.

The X-ray imaging available in hospitals works by measuring the way X-rays are absorbed by tissues. However, it does not always produce images with enough contrast to make it possible to see small-scale or faint structures clearly. By measuring how the X-rays are bent, or refracted, as they pass through a material XPCi is able to enhance visibility by producing images that have higher contrast. The catch is that XPCi relies on the use of synchrotron X-ray sources. By adapting the technique to allow it to be used with the conventional X-ray sources available in hospitals, Dr Olivo and his team will not only be aiding earlier and improved detection of a number of diseases. They will also be introducing a very powerful new research tool that will bring benefits in many fields of science and technology, leading to – among other things – better security at airports and more reliable testing techniques in industry.



Top: Career Acceleration Fellow Alessandro Olivo, University College London.

Middle: Leadership Fellow Julian Allwood, University of Cambridge.

Bottom: Career Acceleration Fellow Rachel O'Reilly, University of Warwick.

Tailoring tiny reactors for big applications

Dr Rachel O'Reilly, an EPSRC Career Acceleration Fellow based at the Department of Chemistry at the University of Warwick, is a chemist concentrating on the very small with the aim of making potentially big breakthroughs to improve a wide range of chemical processes. By designing polymers that will undergo a predictable and well ordered assembly into nanometre-scale spheres, rods and hollow structures that have a particular function in a particular area, her team is working to create nano-scale vessels that can be used as mini chemical labs to carry out specific chemical reactions.

It is very early days yet, she admits, but this research could ultimately lead to range of

developments. These include nanosensors that respond to properties such as temperature or pH to make it easier to switch catalysis on and off and to control the speed of reactions. Easier ways to recover and recycle catalysts are also feasible. Other possibilities include new ways to control the release of substances, and improved methods for sorting out the left- from the right-handed forms of molecules in drug purification. The nano-vessels could also make it possible to carry out reactions that normally would require organic solvents – which are expensive and polluting – in water. "It's really exciting research" says Dr O'Reilly, "and it draws strongly on my interest in exploring ways to make chemistry more efficient and environmentally benign."

Rising demand, reducing emissions

International policy is to aim for a cut of at least 50% in carbon emissions by 2050. Yet the demand for the steel and aluminium – whose production currently accounts for 8% of global carbon emissions – continues to grow. By 2050, it is likely to have doubled. Can this growing demand for metals be met while still achieving ambitious emissions reduction targets? The answer, says Leadership Fellow Dr Julian Allwood, of the Department of Engineering at the University of Cambridge, is 'yes – but it won't be easy'.

"Achieving the carbon emission targets for steel and aluminium requires an industry-wide transformation," he explains. "This, in turn, will require new business models along with new manufacturing processes designed to increase production efficiency and recycling." In a five year Leadership Fellowship project which began in January 2009, Dr Allwood and his colleagues are taking a two-pronged approach to developing a low-carbon metals industry that draws on both policy and practice. Together with a large consortium of major industrial partners and academics, the group is working to identify and find ways to overcome the business, economic and political barriers metals producers and users will face in meeting the carbon-reduction targets. And at the same time they are working to develop the technologies the metals industries will need to achieve the carbon-reduction goals.

Conserving our heritage

Our priceless heritage of centuries old buildings and artefacts is important to our culture and provides a valuable economic asset for the UK through the tourism sector. But it is under threat from climate change and other factors causing degradation. To focus the latest research and skills on these problems, two of the UK Research Councils, EPSRC and the Arts and Humanities Research Council, initiated a joint £8 million programme. The first 10 projects, launched in 2008, are bringing together a diverse range of skills to build expertise and develop new techniques.

One of the projects is investigating the ageing 15th century fabric of the magnificent York Minster. For the first time in

its long history, advanced X-ray techniques will be used to analyse restoration work already carried out during its lifetime. The new research at the University of York plans to use such innovative science to inform the Minster's multi-million pound restoration programme. 'We will look at previous building materials used in restoration and the different compositions to understand why they have decayed or survived, and then try to advise teams on the best materials to use', explained Dr Karen Wilson of the research group.

York Minster
(Reproduced by kind permission of York Minster)



NEXT GENERATION SKILLS CONTINUED

46

46 new-style Fellowships awarded.

A FELLOWSHIP OF LEADERS

The EPSRC vision of identifying and nurturing the next generation of world-leading researchers has led to the refocusing of our fellowship schemes to create Leadership Fellowships and Career Acceleration Fellowships. A total of 46 of these new-style awards have now been made.

Leadership Fellowships are for academics prepared and qualified for a major challenge. They are expected to have established themselves as leading researchers of international standing in their area by the end of their five-year award. It is also anticipated that they will demonstrate leadership within their institution and research community, and contribute to the uptake of research outputs for economic and social impact.

These fellowships offer talented mid career researchers the opportunity to focus on research for the term of the award, as well as supporting all the costs of the associated research for the full duration of the award. The first call in 2008 attracted 303 outline proposals and 23 awards were made as a result. The Leadership Fellowships are intended for academics at a slightly earlier stage of their career than the now discontinued EPSRC Senior Research Fellowship scheme, and in part they replace the Advanced Research Fellowship.

Career Acceleration Fellowships are for researchers at an early stage of their career enabling them to focus on research for the five-year period of the award. They are expected to have established an independent career of international standing by the end of the award. The first call in 2008 attracted 450 outline proposals

and 23 awards were made. Career Acceleration Fellowships partly replace the Advanced Research Fellowship.

Further awards for up to 50 more Career Acceleration and Leadership fellowships are intended during the coming year.

We continue to offer up to 30 three-year Postdoctoral fellowships to enable the most talented new researchers to establish an independent research career, shortly or immediately after completing a PhD. From the 195 proposals received 26 awards were made during the year. They are targeted at four specified areas of our remit – theoretical physics, theoretical computer science, mathematical sciences and the life sciences interface. Ten awards were also made in engineering, jointly with the Royal Academy.

Beam in on the brain

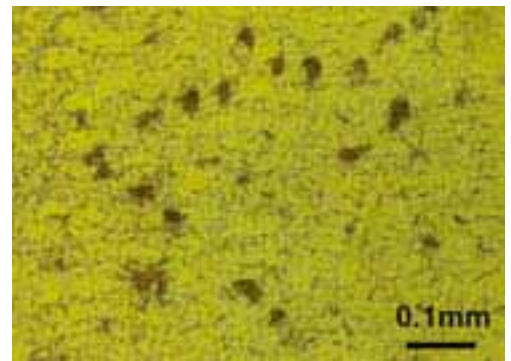
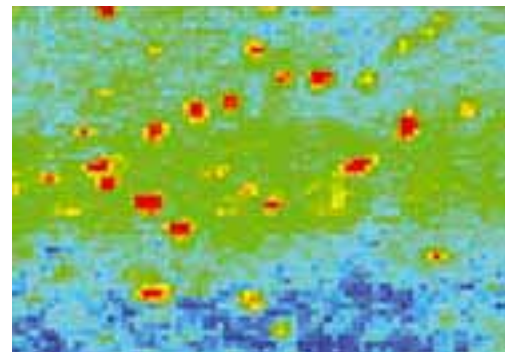
A new 'super microscope' study of iron deposits in brain tissue cells could lead to a more effective early test for Parkinson's disease. EPSRC-funded work has used the UK's powerful synchrotron 'Diamond' to map and compare the distribution of iron in the brain in Parkinson's cases and normal healthy brains. Altered levels of iron may help with early diagnosis of the degenerative disease suffered by around four million people worldwide.

Lead researcher Dr Joanna Collingwood of Keele University explains the significance. 'Improving our understanding of the biochemical aspects of the disease should in the long term provide potential openings for early MRI detection and diagnosis.'

This is key because we know that by the time a typical individual presents with symptoms, chemical changes have already caused significant cell death.'

Diamond is a new facility the size of five football pitches which operates at just below the speed of light, delivering an X-ray beam less than a single cell in diameter.

Iron map of brain tissue with vulnerable cells relating to Parkinson's disease. (Image: Diamond Light Source)



ACCESS TO THE BEST

£113m

£113m UK RC money invested in supercomputer 'HECToR'

THE YEAR IN CONTEXT

Access to the best research facilities is crucial to the strength of UK research, and EPSRC supports a range of facilities and services with funding of over £14.3 million this year. These include the most advanced high-end computing facility in the UK, 'HECToR', launched by the Research Councils UK in 2008. This £113 million supercomputer is now bringing its breathtaking calculating power to bear on projects like those featured below.

The computer simulations and calculations complement theory and experiment in scientific research. The faster and more powerful the computer the larger and more complex the simulations or calculations can be. HECToR, at four times faster than its predecessor and the equivalent of 12,000 desktop systems, has already proved up to its task.

Another new giant machine called 'Diamond', based at Harwell in Oxfordshire, is a synchrotron that can be described as a series of 'super microscopes'. It is supporting challenging research projects like that to help early diagnosis of brain disease and to better understand a group of materials that can help target the delivery of drugs to the right place in the body. Other centrally provided UK facilities such as ISIS, the pulsed neutron source, and the Central Laser Facility, supported by the Science and Technology Facilities Council (STFC), are available to advance EPSRC-supported research projects. In collaboration with STFC, EPSRC is investing to maximise the value from these including the ISIS

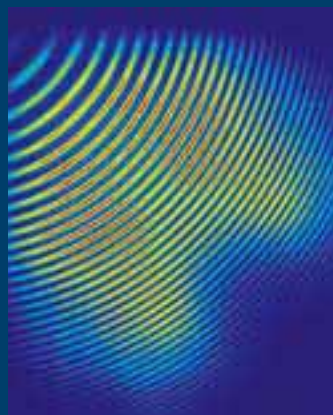
Target Station 2. Part of this mission is to ensure that a new generation of researchers are skilled in using the facilities. We are therefore providing funding to support a balanced portfolio of research with an element of doctoral training.

HECTOR PROVES ITS POWER

Capable of 63 million, million calculations a second, HECToR is the largest and most advanced supercomputing facility in the UK. Launched in 2008 at the University of Edinburgh, the procurement was funded and managed by EPSRC on behalf of the Research Councils UK. Some of the projects where HECToR has helped researchers this year to stay at the forefront of their fields are highlighted here.

Closer look at lasers

Ultra-intense, ultra-fast lasers are under development for many uses, including cancer treatment, because they can cut through precision targets, such as cancer cells, causing no heat or collateral damage. Professor Ken Taylor and his team at Queen's University, Belfast have used HECToR to shed more light on precisely how they do it by going back to fundamental physics to stimulate the interaction of light at various wavelengths and intensities with one of the smallest multi-electron atoms, helium. 'We have been able to characterise the basic physics of these interactions in terms of entangled two-electron states, which are among the strangest entities in the quantum mechanical universe,' he says. Future simulations will look at light of even shorter wavelengths, including the X-ray range. 'Before HECToR we couldn't go to these extreme limits,' says Professor Taylor.



Entangled two-electron ionizing states of helium after interaction with an intense, short pulse of blue laser light as modelled on HECToR.

Cracking eggshell secret to new materials

'If we could understand the mechanisms by which chickens and other organic systems produce unusual crystals, we could use these mechanisms to design new materials with useful properties,' says Professor John Harding who leads a research team from the universities of Sheffield and Warwick. Their work on eggshells is part of the science of 'biomimetics' which uses biological ideas to guide the search for potential applications. They have used HECToR to simulate the action of protein and water molecules in marshalling nano-sized particles of calcium carbonate to build up the structure of eggshell. Many simulations, each involving 100,000 atoms, are needed to work out how the molecules and particles interact. 'What we have got is how proteins control the structure of calcium carbonate which is a big step towards understanding how a chicken makes the shell. We could not have done a project of this size before HECToR,' says Professor Harding. The work will provide valuable information for experimental groups seeking to design new molecules to produce particular crystal types and shapes.



Protein molecule (Ovocleidin-17) interacting with a calcium carbonate nanoparticle.

Burning question

Improving the performance of engines such as gas turbines used in power stations and jet aircraft, and reducing exhaust emissions, is a burning question for researchers. Sophisticated three-dimensional computer models of combustion are key to making these improvements. 'In combustion fuel typically burns in a stream of turbulent air' explains Dr Stewart Cant of the University of Cambridge, 'We need to know how the flame behaves in very fine detail and only advanced computer modelling can provide the answers. With EPSRC support, HECToR allows us to do many of the complex simulations we need. The results are passed to industry to help develop new designs of combustion systems.'

Single molecule computers?

Transistors, the essential electronic units of a computer etched into silicon are likely to reach the limits of their miniaturisation in a few years. So researchers supported by EPSRC are looking for the next generation of ever tinier transistors-based on a single molecule – by exploiting the supercomputer power of HECToR. Lead researcher Professor Colin Lambert of Lancaster University emphasises the potential of the research. 'If we are successful we will deliver transistors that are 100 times smaller than those we have now, so computers could be 100 times more powerful and have 100 times the memory.'

But the work is at a very early stage and the huge theoretical and experimental challenges to predict how a single molecule will interact with its electrodes requires a powerful machine like HECToR to cope with highly complex computations.

Capturing wind power

Professor Bill Leithead of the University of Strathclyde, pictured here, leads a new centre that will train the next generation of highly-skilled engineers to deliver low-cost wind power.

'Over the next 15 years a very rapid worldwide expansion in wind power generation of electricity is expected. Our centre will provide a pool of engineers with the full range of skills needed', says Professor Leithead.



Economic and social impact

The need to maximise the potential for innovative research to benefit the UK economy and society as a whole is embedded in all EPSRC's research and skills development activities. To achieve economic impact, a significant proportion of the research and training we fund involves direct collaboration with industry, including strong links between our research base and over 2000 companies.

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Collaborative cut for carbon



An award winning new car engine, developed with EPSRC support, has achieved a major reduction in carbon emissions. In the context of over 34 million vehicles on UK roads, the breakthrough could lead to substantial environmental benefits.

Called HOTFIRE, the project's success is testament to the power of collaboration, bringing together the expertise of Lotus Engineering, University College London, Loughborough University and Continental Powertrain, as well as the Research Council. The result was a concept car that sprays fuel directly into the cylinders of a petrol engine rather than using a fuel/air mix. The work paid off with fuel consumption slashed by 15%. The project won the automotive

category at The Engineer Technology and Innovation Awards 2008, and has attracted keen interest from several major car manufacturers.

[Concept car that cuts fuel consumption.](#)



At least 40% of the UK service sector is based on science, technology, engineering and maths.
David Delpy, CEO EPSRC



IMPACT FROM EXCELLENCE

THE YEAR IN CONTEXT

'The UK is one of the largest manufacturing economies in the world, and at least 40% of the UK service sector is based on science, technology, engineering and mathematics.' David Delpy, EPSRC Chief Executive, highlighted this in his introduction to the EPSRC's research and industry showcase event 'Pioneers09' to underline the importance of the impact of the researchers we support in converting the outcomes of their work into genuine advances in products and processes. It has been estimated that around 40%* of all investment and 75% of industrial research and development in the UK are based on engineering and the physical sciences. Improvements to our peer review of grant submissions introduced in 2009 include a requirement on applicants to outline the potential impacts of research.

The transfer of cutting-edge knowledge is already embedded in all our current portfolio of research and training activities. Nearly 40% of the research and training we fund involves direct collaboration with industry, demonstrated by the strong links between our research base and over 2000 companies. This year our drive to maximise opportunities for impact from innovative research has benefited from major partnerships with bodies such as the Technology Strategy Board, the Energy Technologies Institute and new additions to our Strategic Partnerships covering a range of companies and other organisations. Our development of a greater shared understanding with our 12 Framework universities has also played a valuable role. This approach has continued to make a vital contribution to achieving

the Government's goal of a step-change in the impact on the UK economy and society.

Our aim of accelerating the transition from fundamental discoveries to their applications, such as new technologies, products and processes, is a key theme of our 2008-2011 Delivery Plan published during the year. The five-point plan is to:

- Accelerate the exploitation of research outputs for economic benefit through major strategic partnerships with the Energy Technologies Institute and the Technology Strategy Board.
- Work with key stakeholders to forge links that pull research through to exploitation more rapidly and efficiently focused on the EPSRC priority themes – energy, digital economy, nanoscience and towards next generation healthcare.
- Align the skills base more closely to the needs of business innovation through more targeted, demand-led doctoral training.
- Enhance the flow of knowledge and people between academia and industry by facilitating partnerships and through focussed routes to collaboration including knowledge transfer centres of excellence, and post-doctoral follow-on opportunities based in industry.
- Publicise the opportunities for – and successes of – knowledge transfer so that it becomes normal business for the research communities.

To achieve these goals, a new EPSRC Business Innovation Directorate was created in April 2008 to improve our awareness and connectivity with user organisations and other key stakeholders so that links between academic researchers and

*Engineering and Physical Sciences in the UK, SPRU, 2003 – report commissioned by EPSRC.

PIONEERING EVENT

A major EPSRC showcase event was held in 2009 to connect businesses with research. Called 'Pioneers09' it was attended by over 700 people and involved keynote talks, seminars, debates and a 'dragon's den' style presentation. A high-profile exhibition presented interactive exhibits in four 'zones' – energy, rapid response, interactive home, and the great outdoors. It featured nuclear fusion, renewable energy, virtual reality, assisted living, thrill technology and low-carbon buildings. Two of the highlights on display are described here.

Outreach to millions
Extensive media coverage resulted in outreach of the research highlighted at Pioneers09 to millions in the UK and beyond. Stories were featured in the Daily Telegraph, Daily Mail, Sun, Spain's La Republica, BBC Radio and USA's Fox News.

Virtually real

A helmet that recreates the sights, smells, sounds and even tastes of far-flung destinations has been devised by EPSRC-supported researchers at York and Warwick universities. Called the Virtual Cocoon the research team believe that it stimulates the senses so convincingly that they have called the experience 'Real Virtuality'.

The prototype helmet experienced by visitors at Pioneers09, connects wirelessly to a computer which feeds it information about a virtual world. It features a much higher definition screen than conventional television. A tube connected to a box of chemicals releases smells under the wearer's nose, while a similar device can spray flavours into the mouth and provide a texture sensation. Heat and humidity can be altered using a fan and heater while surround-sound speakers recreate ambient noise.

Professor Alan Chalmers of the University of Warwick predicts that the headset could be in use in five years for a range of uses like long-distance business meetings, school students 'visiting' history, families wanting to get a taste of exotic destinations, and computer games. Other potential applications are in training soldiers, police officers, medical staff or firemen.

'We are not aware of any other research group anywhere else in the world doing what we plan to do', said Professor David Howard of the University of York.



Smart sensing for dementia sufferers

A smart sensing system developed with EPSRC support by the University of Bath could be available commercially within five years to help 700,000 dementia sufferers live independently at home.

Once installed in the home, the new sensing system is designed to monitor people's movements and actions. As well as providing voice prompts – like reminders to turn off the tap or cooker – they can also switch lights or appliances on and off to eliminate potential dangers.

Two trial systems installed in care homes in London and the West Country have been operating successfully for over a year. They are providing clear evidence that, if installed in domestic properties, such systems could help people with dementia live safely and with more control over their lives. As well as boosting quality of life for those with dementia, the technology could help ease the burden on the families with the condition and reduce healthcare budgets.

Above right: Culham Science Centre – explaining nuclear fusion.

Below: Dr Marina Bloj from the University of Bradford demonstrates the 'virtual cocoon'.





Harnessing the power of the sea promises to make a significant contribution to the UK target for delivering renewable energy supplies. A new device that can capture the power of waves, based on EPSRC-funded research at Queen's University Belfast, is being commercialised by the Edinburgh-based company Aquamarine Power. Full-scale testing has now started on the innovative design, called 'Oyster', which is scheduled to generate power for the National Grid by 2013.

In contrast to many other wave-power devices, 'Oyster' uses hydropower technology to transfer wave power to shore – where it is then converted into electricity. 'This has simplified the system, cut costs and reduced environmental

risks', says Dr Sian McGrath of Aquamarine. There are fewer moving parts immersed in sea water, no need for underwater electrical or electronic components, and no gearbox, generator or power electronics. 'This means it is easier to maintain and is reliable' – adds Dr McGrath – 'an array of just ten Oysters could provide enough energy for 7000 people'. She is confident that the company is set to become the first in the world to deploy both wave and tidal devices on a commercial scale.

[Full-scale 'Oyster' prototype device that can capture renewable energy from the power of waves.](#)

IMPACT FROM EXCELLENCE CONTINUED

industry are strengthened. Director Catherine Coates emphasises that, 'Our main aim is to focus on user-driven research and user-driven postgraduate training. EPSRC's roles are to work with users to identify long-term underpinning issues that will affect entire sectors in the future, and to accelerate the impact from investment already made in research and skills.'

DELIVERING OUTCOMES

There are many examples of new businesses arising from EPSRC-supported research innovations – over 130 'spin-out' companies have emerged over the past three years. Some highlights of such ventures are featured on these pages. Our aim is to see our investments benefiting society and the economy through ground-breaking results, particularly in our identified priority themes. For example, EPSRC-supported scientists are playing a key role in exploiting the vast potential of gallium nitride with huge potential for energy, the digital economy, nanoscience and next-generation healthcare (see page 34).

A breakthrough in 'smart sensing' which hit the headlines in 2009 also promises to contribute to the EPSRC goal of delivering research which responds to the challenges of an ageing population. An innovative system incorporating cutting-edge sensors, electronics and IT capabilities is currently on trial successfully in care homes (see page 29).

An example of world-leading technology opens up a new dimension in virtual reality, helping realise our priority theme of support for innovation that will benefit the UK's digital economy. A new virtual

reality helmet could within a few years have commercial potential for applications from long distance business meetings to enhanced role-play computer games (see page 29).

This and other EPSRC-supported research may follow the lead of two beacons of economic success arising from research we have funded: Plastic Logic, a spin-out from the University of Cambridge now regarded as the outstanding leader in plastic electronics manufacturing, and SPI Lasers, a spin-out from the University of Southampton which is now renowned for its global sales of optical fibre-based lasers.

130

130 'spin out' companies emerging from EPSRC-supported research in the past three years.



Research opens up third-generation markets

An academic-industry partnership building on EPSRC-funded research has opened up the prospect of expanded market share for the UK manufacturer of the world's most advanced antennas for mobile, wireless and hand-held devices.

The Knowledge Transfer Partnership (KTP) between Dr Oliver Leisten of Sarantel Group and Professor Ian Reaney of the University of Sheffield led to the development of a potentially cheaper component that uses glass forming techniques for the antenna core. As a result, Sarantel will be able to reach a much broader section of the antenna market and boost profitability.

The KTP associate Dr Mehdi Mirsaneh has acquired considerable research and problem solving

experience within a commercial setting and from on-the-job training which has led to employment as a Research Fellow at the University of Southampton.

Following this success, a second KTP to improve the antenna metallisation process used in manufacturing has been awarded to the company and university. KTP is funded by the Technology Strategy Board along with other government funding organisations.

SKILLS FOR THE ECONOMY

25%

25% of investment in collaborative training comes from employers.

THE YEAR IN CONTEXT

Many key sectors of the UK economy are heavily dependent on the flow of PhD researchers supported by EPSRC. Around 30% of the research studentship training we sponsor involves industry participation, with over 800 industrial companies and user organisations engaged during the year. The proportion of EPSRC-supported PhDs going on to enter business or the public services reached around 50% in 2008-09. Increasing demand for such skilled people has been seen in areas such as pharmaceuticals, aerospace, energy, computing, and telecommunications.

The development of the skills needed to equip research students with the business skills they need to turn pioneering ideas into products and services received a major boost in 2008. The 45 new EPSRC-supported Centres for Doctoral Training with £280 million funding (see page 18) included 18 Industrial Doctoral Centres (IDCs) specifically geared to industrially-related skills development. The IDCs will provide world leading training for 900 researchers in topics vital to the economy ranging from biomedical science to clean power generation.

This year we introduced a further initiative to boost the element of industry experience in the Doctoral Training Grants we fund (see also page 21). EPSRC has set universities a target of converting 10% of their allocation of Doctoral Training Grants to Cooperative Awards in Science and Engineering (CASE) which broaden student experience through skills development that includes a proportion of collaboration with industry.

CENTRES MEAN BUSINESS

To ensure that EPSRC-supported training programmes have maximum economic impact, there is a high level of involvement of organisations using research outcomes. Around 25% of the investment in collaborative training comes from employers – around £18 million in 2008-09.

The 45 new Centres for Doctoral Training (CDTs) announced this year represents an approach to the training of PhD students that is widely supported by business and industry. For example Professor Jeremy Watson, global director of research at Arup exemplifies their role, 'Businesses like Arup need a good supply of highly-qualified scientists with the right skills to further innovation in the design of sustainable towns, cities and the wider environment. They need to understand how business works and also be able to turn their best ideas into a successful business proposition'.

Arup is a partner on one of the new EPSRC centres which aims to create zero carbon buildings. Based at the University of Reading, it will integrate zero carbon energy sources, such as solar cells and combined heat and power systems, with demand reduction tools including smart meters and consumption feedback devices.

Industrial Doctorate Centres

The 18 Industrial Doctorate Centres within the new training package, starting in 2009, build on the success of earlier centres. These will award Industrial Doctorates aimed at ambitious and able graduates enabling them to reach senior positions in industry early in their career. Supported by EPSRC and industry, the four-year course

Award-winning chemist

A prestigious chemistry award has been won by an EPSRC-supported PhD student at the University of Strathclyde for his collaborative work with industry. Allan McPherson's Pfizer Prize was awarded for his impressive ideas on new methods of preparing inaccessible compounds in the laboratory with potential use in treating cancer, infectious illnesses and harmful bacteria.

Allan's innovative approach centred on a range of molecules extracted from a fungus known as 'Agarius blazei'. Some molecules from this natural source are known to have properties with potential for medical applications but scientists have been unable to access specific samples in large enough amounts to test their potential. His

technique could overcome this obstacle and be the key to their preparation and use in medicine.

Allan beat off stiff competition from more than 120 other researchers to win the award. His PhD research is funded by an EPSRC Industrial CASE award in collaboration with AstraZeneca Pharmaceuticals.

Winner of prestigious chemistry award, Allan McPherson of the University of Strathclyde.



SKILLS FOR THE ECONOMY CONTINUED

75%

75% of Industrial Doctorate course spent with collaborating company.

provides an intensive, broadly-based research programme relevant to the needs of industry with students spending around 75% of their course working directly with their collaborating company. A recent independent review of the scheme found that it had provided a major and beneficial effect on a wide range of companies and sectors. Over 500 companies have been involved so far.

The tranche of new Industrial Doctorate Centres includes the following three examples:

- **The Efficient Power from Fossil Energy and Carbon Capture Technologies Centre** led by the University of Nottingham will train future research leaders to tackle the major challenge of delivering new power plants to generate electricity using fossil energy with near zero emissions.
- **The Systems Approach to Biomedical Science Centre** at the University of Oxford will ensure that the UK has a strong flow of future innovators and research leaders in areas such as pharmaceuticals and biotechnology.
- **The Optics and Photonics Technologies Centre**, a collaboration between Heriot-Watt, St Andrews and Strathclyde universities, will deliver world-leading training, research and knowledge transfer between the participating universities and UK industry across a wide range of related technologies.

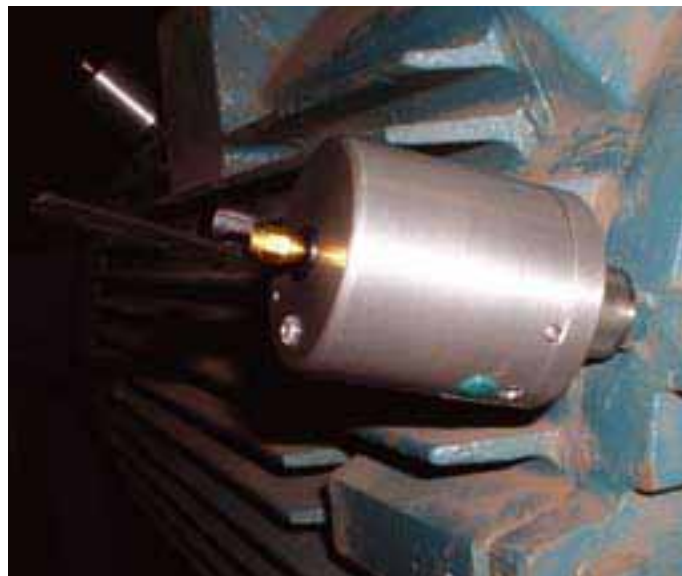
Good vibrations for industry

Turning vibrations into commercial potential for industrial plants has resulted from a concept originated at the University of Southampton from EPSRC-funded research. A spin-out company from the university, Perpetuum Ltd with £5 million private equity funding, has developed sensors which 'harvest' the energy generated by the vibrations of all kinds of machinery, and use it to monitor performance. The beauty of the innovative sensing technique is that it can be used in dirty, dangerous or inaccessible locations where more conventional battery operated or wired sensors are impractical.

Perpetuum CEO Roy Freeland sees a wide range of applications that could benefit from vibration harvesting: 'Wherever there is a

motor, whether it's a waste water treatment plant or a chemical plant, a micro generator can be used to power a wireless battery-free sensor to transmit large amounts of critical data which can be used to optimise operation, improve cost efficiency of maintenance, prevent accidents and make significant savings in energy costs'. A device on test at Yorkshire Water's waste incineration plant is reported as giving exceptionally pleasing results so far.

Microgenerator installed at Yorkshire Water's waste incinerator plant.



EXPLOITATION OF RESEARCH

£44m

£44m for new knowledge transfer awards.

YEAR IN CONTEXT

For EPSRC to achieve its goal of quickening the pace of research being exploited successfully by users, it needs the right partners. Major progress was made this year in developing a series of partnerships that will accelerate the exploitation and commercialisation of the research we support. These include our substantial collaboration with the Technology Strategy Board (TSB), a non-departmental public body sponsored by the Department for Innovation, Universities and Skills* (DIUS). The government regards interactions between the Research Councils and the TSB as a key element of its strategy to boost the percentage of R&D spend in the UK and ensure closer links between investment in the science base and business. EPSRC's current funding commitment for a series of collaborations with the TSB over the Delivery Plan Period (2008-09 to 2010-11) has doubled the government's stated target figure.

Another key partner is the private sector Energy Technologies Institute (ETI) which has a £1 billion target over 10 years to accelerate the deployment of new energy technologies for the UK. EPSRC and the TSB provide the public funding contribution to the ETI. The first projects, announced in January 2009, are in redesign of wind turbines for offshore use and developing and demonstrating a tidal turbine. The projects aim to help the UK meet its challenging energy and climate change targets.

Our collaboration with research intensive organisations from Airbus to the Wellcome Trust has continued to develop through our Strategic Partnerships programme, growing to 28 in 2008-09. We are also working closely with the National

Institute for Health Research and the Medical Research Council to help ensure that our research portfolio aligns with clinical needs.

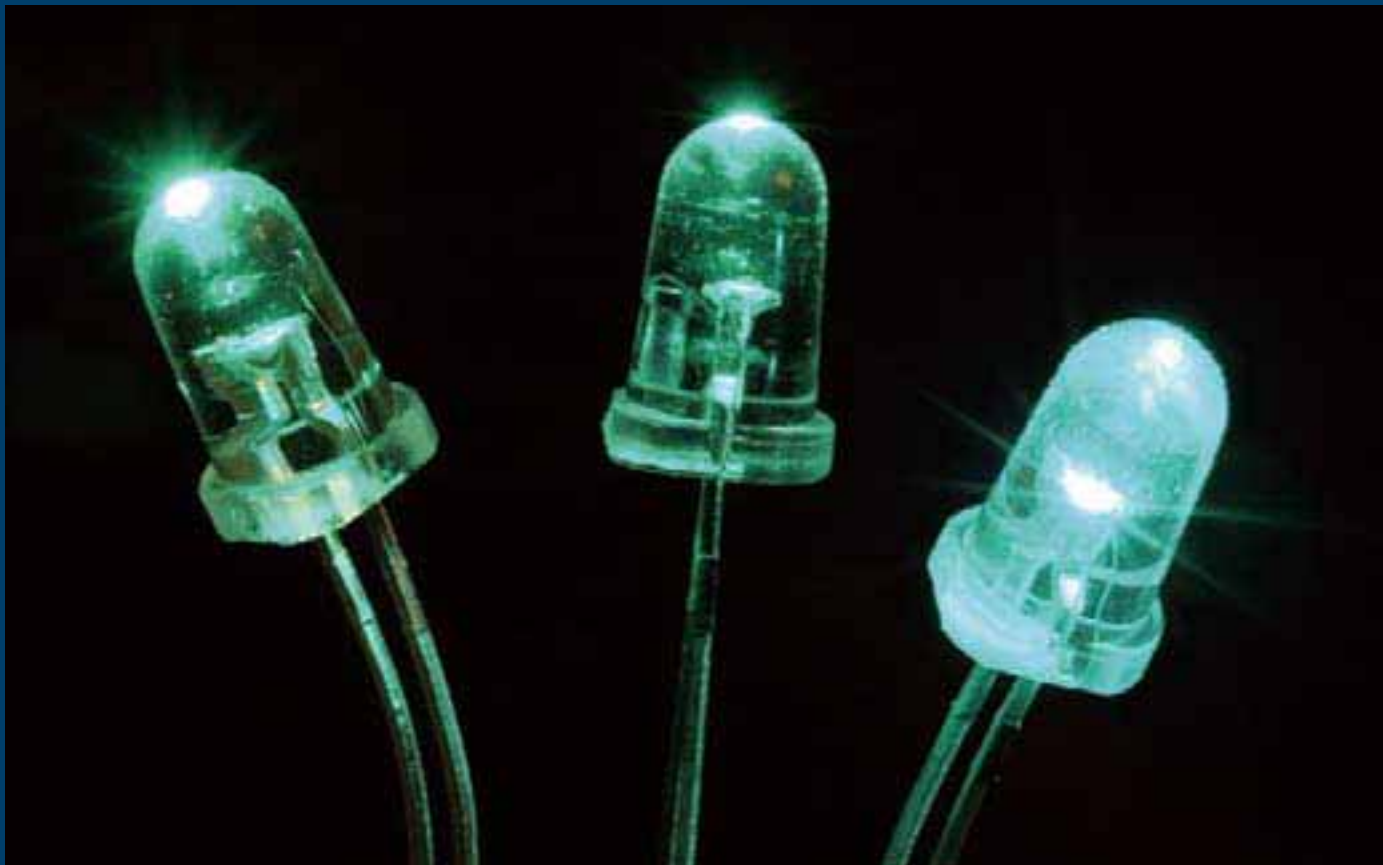
During the year we introduced Knowledge Transfer Accounts (KTAs), which will enable universities to develop a flexible portfolio of knowledge transfer activities and overcome existing barriers to exploitation of research results. This will contribute to a culture where knowledge transfer is valued as much as research and ensure that discoveries from research we support are turned into tangible benefit to the economy and society. We have awarded £44 million for the establishment of 12 accounts.

Knowledge Transfer Secondments (KTS) are three-year awards, starting in 2009, for 13 universities with the highest levels of collaborative grants from EPSRC and without a KTA. The total funding of £11 million will provide the resources and flexibility for secondments of EPSRC-funded staff to organisations which can exploit their research results. The KTS support can also be used to host researchers from industry.

ACCELERATING COMMERCIALISATION

The Research Councils are collectively playing a key role in supporting emerging technologies to be taken forward by the Technology Strategy Board. This drive to accelerate the commercialisation of research builds on the strong science base established by research council investments. EPSRC is involved in all three 'strands' of the TSB's allocation of its £700 million budget over three years – the innovation climate, challenge-led innovation, and technology-inspired innovation,

* Department for Innovation, Universities and Skills (DIUS) reformed as Department for Business, Innovation and Skills from June 2009.



Above: Packaged green LEDs based on InGaN multiple quantum well devices grown in the Thomas Swan MOCVD reactor at the Cambridge Centre for Gallium Nitride.

A 60 year light bulb?

Low-energy, light-emitting diodes (LEDs) using gallium nitride (GaN) have begun to appear in applications such as camera flashes, bicycle lights, mobile phones and interior lights for transport. Even the façade of Buckingham Palace is now lit up by GaN LEDs.

To turn GaN LEDs in to a market blockbuster the technology needs to be widely available to light up homes and offices, the lighting for which currently accounts for around 20% of UK electricity consumption. Using GaN this could be reduced to only 5%, delivering an environmental bonus from massive cuts in carbon dioxide emissions from power generation. The obstacle is price – GaN LEDs are currently too expensive to manufacture for wide scale use in our buildings. But, with EPSRC support, researchers at the Cambridge University Centre for Gallium Nitride have developed a way to cut the cost by 90%. This could mean cheap, mass produced LEDs becoming available for lighting within five years.

‘They are incredibly long lasting’, explains Professor Colin Humphreys, head of the Centre, ‘A GaN device can burn for 100,000 hours and last for 60 years of normal household use’. Other possible applications include using GaN light to distinguish tumours during surgery or to kill off viruses and bacteria. Devices for the optical computers of tomorrow, which will operate 10,000 times faster than today’s electronic computers, are another exciting possibility.

Spin-out for most common cancer

Breast cancer is now the most common form of the disease in the UK and, worldwide, over a million women are diagnosed with the cancer every year. A potentially important contribution to diagnosis is a new breast imaging system with considerable commercial promise, now being developed in the UK. It uses technology similar to that used in land mine detection – a radar system which could make screening quicker, safer and more successful than mammograms. Developed at the University of Bristol with EPSRC support, it has been commercialised by the spin-out company Micrima and is being trialled by the North Bristol NHS Trust (NBT).

The Bristol team has been working on the breakthrough for some years to develop a breast imaging device which uses radio waves and therefore has no radiation risks unlike conventional mammograms. The new technique works by transmitting radio waves of a very low energy and detecting reflected signals which are then used to make a 3D image of the breast. Specialist breast clinician Mike Shere of NBT said: 'It takes much less time to operate than a mammogram. Women love it as they compare it to a mammogram and find the whole experience much more comfortable.'

'Land-mine' technology in use for quicker, safer, more patient-friendly breast cancer screening.



EXPLOITATION OF RESEARCH CONTINUED

£10m

£10m contribution to 'low-carbon' vehicles flagship project.

and has sponsored over 100 research projects with a value of some £90 million since the establishment of the Technology Strategy Board in 2004.

An example of EPSRC support in the 'innovation climate' is through the allocation of Industrial CASE (ICASE) studentships to the TSB's Knowledge Transfer Networks (KTNs). These networks build on groups with a shared interest in an emerging strategically important technology and facilitate shaping its future in the UK. Three new KTNs, established by the TSB this year, focussed on developing innovations in the creative industries, the financial services, and energy generation and supply.

In 2008 one of the TSB's flagship 'challenge-led' programmes, a £200 million initiative to transform the introduction of low carbon vehicles, was launched. EPSRC intends to contribute £10 million to this jointly funded project to achieve a significant environmental benefit by increasing the proportion of low carbon emitting vehicles on the UK's roads.

Also announced this year were two new Innovation and Knowledge Centres (IKCs) in line with the TSB's 'technology-inspired innovation' mission. EPSRC and the BBSRC are partnering the Board with total public funding of £20 million to establish the IKCs at Leeds and Belfast universities.

The development of emerging technologies to treat the common ailments of an ageing population will be the focus at Leeds. Researchers are working on novel technologies such as biological scaffolds, nano-materials and self-assembly peptides to enhance and accelerate regeneration of tissues

by harnessing the power of stem cells. The Belfast Centre focuses on safeguarding the UK's information architecture and the security of electronically stored information. This includes research to tackle the serious potential threat to the UK of financial and economic 'cyber attack'. These centres are expected to be self financing within five years with the Leeds IKC alone offering places for 50 innovation fellows and 50 innovation PhDs to develop their research.

FUNDS FOR 'MISSING LINK'

A 'Follow-on Fund' run by EPSRC bridges the gap between basic research grants and potential support from commercial sources. In 2008 academics in UK research organisations were invited to bid for new funds to assist them in taking forward ideas generated by EPSRC research grant funding. The key aim is to provide support at the very early stages of turning discoveries into commercial propositions.

The scheme which has funded 92 projects worth £7 million over 4 years was independently reviewed this year. The report found that the scheme was successful in meeting its stated aims of allowing researchers to explore the commercial potential of ideas produced from EPSRC research funding, improving their readiness level and attracting further support.

We increased our funding to £3 million in 2008-09 and will raise this to £4 million a year in the two following years. We have also opened up the scheme to all research institutions with EPSRC grants. During 2008, we concluded an agreement with H20 Venture Partners Ltd to run a pilot to

A beautiful partnership



In recent years one of EPSRC's Strategic Partners with 300 brands and global sales of \$83 million has worked with us to develop an impressive joint research and skills programme now worth over £2.5 million. That partner is Procter and Gamble whose product range, from leading detergents to batteries, demands a broad range of R&D and the skilled people to support it. European Director of Open Innovation, Michael Duncan, emphasises the importance of the company's new strategy of using more external partners like EPSRC. 'We have a very strong UK research base through our three technical centres in this country employing around 1000 people. To realise our drive for 'open innovation' we needed to collaborate with EPSRC

to expand our research and training to link with some of the best universities in the world based in the UK. We have increased our spend in this area considerably in the last few years.' These research programmes include the search for alternative materials for detergents, screening materials for potential use in health and beauty care products, and investigating the potential of nanoscience.

'One of the beautiful things about EPSRC is their flexibility in doing the right thing to facilitate programmes that are relevant to UK industry. In 2009, we are involved with EPSRC in a 'sandpit' to focus on blue skies ideas for reducing laundry temperatures that could bring enormous environmental benefits.'

EXPLOITATION OF RESEARCH CONTINUED

enable Follow-on Fund projects to benefit from additional finance and the supporting expertise of H2O's team of experienced technology entrepreneurs. This will enable selected projects to work with H2O on maximising the prospect of commercial success.

Another partnership between EPSRC and the ERA Foundation offers co-funding for promising follow-on projects in IT systems and telecommunications.

During the year we also agreed a partnership with The Royal Society to jointly fund their 'Mercer Feasibility Awards' taking forward research ideas for possible exploitation. An arrangement with Finance South East (FSE) to operate a collaborative industry-academic proof of concept scheme to enable potential commercialisation using the management expertise of FSE was also concluded.

POWER OF PARTNERSHIPS

We have continued to build on our partnerships with research intensive organisations in the private and public sectors. The 28 current Strategic Partnerships, representing areas from aerospace to pharmaceuticals, bring additional focus and relevance to our research portfolio, and deliver substantial extra funding to support research and skills development in universities. During the year five new partnerships were formed bringing the total of research funding to £81 million from EPSRC and £56 million from the partners. These are:

- GlaxoSmithKline (GSK)
- National Physical Laboratory (NPL)
- Pfizer
- Cancer Research UK (CRUK)

- Centre for the Protection of National Infrastructure (CPNI)

In 2008, EPSRC and GlaxoSmithKline (GSK) entered into an alliance which will boost research into drug discovery and development. Total investment of £10 million will be deployed over the next five years bringing together academic and industry expertise and resources on projects of mutual interest. The memorandum of understanding between the partners includes the joint goal of seeking better 'leverage' for chemistry in the UK to realise commercial exploitation. Another joint initiative between the Research Council, GSK and Pfizer focuses on flow chemistry.

Head of academic liaison at GSK, Malcolm Skingle, said: 'Our business is based on innovative and creative medicinal chemistry. We want to help EPSRC keep pushing ahead with new initiatives which ensure that knowledge and capability continue to expand at research and postgraduate level.'

Research that will benefit technologies with economic impact through measurement applications was given a boost this year through our Strategic Partnership with the National Physical Laboratory. Up to £13 million will fund research and post-doctorate skills development at the Laboratory aimed at economic benefit to the UK.

Mrs Catherine Coates, EPSRC's Director, Business Innovation says: 'Strong strategic partnerships with companies and in the public sector allow us to highlight centres of world leading excellence in the UK to users, including global companies looking for research excellence around the world. Together we also identify and support key areas of pre-competitive research, and vital postgraduate skills needs.'

£56m

£56m from EPSRC Strategic Partners.

Designing out medical errors

Healthcare research has shown that better design has huge potential to reduce common medical errors and the resulting suffering for patients and cost of resources. With millions of patient contacts with the NHS every day, designing for greater safety in the NHS is being given high priority and, to tackle the problem, a scoping study has been completed by the Cambridge University Engineering Design Centre for the Department of Health and the Design Council, with EPSRC support.

The study focuses on a range of medical hazards. Pill boxes for example look identical and busy ward nurses administering several drugs for each patient may understandably make mistakes. Operating theatres and wards

are equipped with devices with similar bleep signals with different meanings that may not be clear to medical staff. The design of patient devices such as blood pressure monitors can confuse some users. The study's impact is in shaping Government policy and a programme based on the strategy in the EDC report is being put in place.



CHALLENGES FOR SOCIETY AND THE ECONOMY

YEAR IN CONTEXT

Our three-year Delivery Plan challenges EPSRC, and the research communities it supports, to tackle very real issues for the UK economy and society, and to accelerate exploitation of research by users. These EPSRC-led 'mission' programmes which aim for rapid development of new technologies in their fields are:

- Energy*
- The digital economy*
- Nanoscience through engineering to application*
- Towards next generation healthcare

Our approach to developing these programmes is to engage users in Government, business, Non-Governmental Organisations, the public or other researchers. This maximises the potential for exploitation by business, input into policy, and improvements in quality of life. The major 'Towards next-generation healthcare' programme faces up to the growing challenge of an ageing population in the UK and the potential benefits to society from research that leads to improved health and lower medical costs. Our major partnership with the Wellcome Trust, funded jointly with £45 million, will provide increased support for applied research in healthcare leading to breakthroughs such as the new biological cement for the repair of 'burst fractures' of the spine, a development from EPSRC funded research. The potential impact of this joint initiative for society was emphasised by Dr Mark Walport, Director of the Wellcome Trust: 'Major advances in medical diagnosis and treatment, such as CT scanning, MRI, and fibre optic surgical

techniques have come from interdisciplinary collaborations between engineering, physical and medical sciences'.

The Digital Economy programme aims to enable the early adoption of information technologies to encourage the transformation of how business operates, government delivers, and society interacts. An example of our progress towards maximising impact through greater user involvement is that the 100 companies involved in the new centres to develop leadership skills in digital economy include many which are new to the programme. This year EPSRC has worked with the Government team[†] developing a 'Digital Britain' action plan to secure the UK's place at the forefront of innovation, investment and quality in the digital and communications industries. Led by Stephen Carter, Minister for Communications, Technology and Broadcasting, it aims to accelerate the rate of growth and cement the UK's position as a world leader in the knowledge and learning economy.

Cross research council nanotechnology research investment has been focused via a series of Grand Challenges addressing areas of societal importance. The first two nanotechnology Grand Challenges were in energy and healthcare and the third is looking at nanotechnology solutions for the environment.

The aim of the Research Councils' major energy programme is to position the UK to meet its energy targets and policy goals by the support of world-class research and skills development across a wide range of engineering and science areas.

Such challenges imply a pace of change in

£45m

£45m partnership with the Wellcome Trust for healthcare research.

* Major cross-Research Council programmes.

[†] 'Digital Britain' is a joint initiative by the Department of Culture, Media and Sport and the Department for Business, Enterprise and Regulatory Reform.

'Self-healing' aircraft?

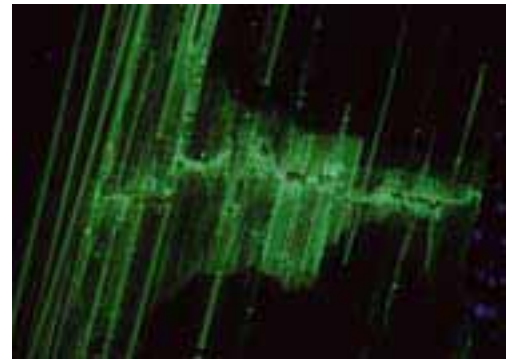
A new technique that mimics healing processes found in nature could enable damaged aircraft to mend themselves automatically, even during flight. Developed by the University of Bristol with EPSRC support, the breakthrough offers obvious safety benefits and the potential for lighter aircraft leading to fuel savings in the aircraft industry and environmental benefit from reduced carbon emissions.

The simple but ingenious technique is like the bruising and bleeding/healing process in the human body. If a tiny hole or crack appears in an aircraft, epoxy resin would 'bleed' from embedded vessels near the damage and quickly seal it restoring the structural integrity. By mixing dye in the resin, any 'self mends' could

be made to show as coloured patches that could easily be pinpointed during subsequent ground inspections, and a full repair carried out. Lead researcher Ian Bond of the University of Bristol says: 'This approach can deal with damage not obvious to the naked eye but which can lead to serious structural failures'.

His team are collaborating with industrial partner Hexcel Composites Ltd to develop the technique to make it available for commercialisation.

Flying colours: fractured fibre-reinforced polymer under UV illumination showing how the 'healing agent' bleeds into the damage.



CHALLENGES FOR SOCIETY AND THE ECONOMY CONTINUED

£120m

£120m for cross-council 'Digital Economy' research programme.

science and technology that highlights the importance of the RCUK Science in Society programme which engages the wider public in the potential impact on society of EPSRC-supported research. For example the importance of the public's views on the future of nanotechnology emerged from a public dialogue exercise prompted by the EPSRC Societal Issues Panel, and are helping shape research funding in the area. Also in 2008 the outcome of public dialogue research on energy by Ipsos MORI, commissioned for the joint Research Councils' Energy Programme, was published.

DIGITAL ECONOMY

The 'Digital Economy' encapsulates research and development that delivers novel design or use of technologies to help transform the lives of individuals, society as a whole, the business sector and government. This cross-council research programme led by EPSRC has a joint funding commitment of £120 million. Such research may lead to many life-changing breakthroughs from projects such as:

- Improving the treatment of patients with heart disease by using personalised computer models which can accept real time data, like electrical patterns and blood pressure;
- An integrated transport system, connecting traveller's vehicles and services to provide personalised information that will help influence travel behaviour; and
- A computer tool incorporating GPS and barcode scanners to help children who cannot speak create a story about their day at school.

A major new investment of £38 million was announced by the Research Council this year to create 'Research Hubs' in Digital Economy. These are large, multidisciplinary research centres that will build capacity and expertise in priority areas and drive a cultural change in the way to deliver digital technology. Proposals were invited from institutions to form new multidisciplinary centres encompassing the arts and humanities, medical sciences and economic and social sciences, as well as engineering and physical sciences. Interaction with industry partners and a range of other stakeholders will ensure that the new Hubs

Digital boost for African farmers

A device to help some of the most impoverished farmers in Africa maximise crop yields has been tested in the laboratory and at London's Kew Gardens and a trial is now being carried out in Kenya. Developed by the University of Leeds as part of EPSRC's Village E-Science for Life project, the sensor device gathers data on air temperature, humidity, air pressure, light, soil moisture and temperature. This information is crucial to making key agricultural decisions about planting, fertilisation, irrigation, pest and disease control and harvesting.

The Leeds team has been working with two Kenyan villages to apply the advanced digital technology through its use in education and to improve

agricultural practices. Professor Jaafar Elmighani of the research team says: 'Our part of the project is about providing the right information at the right time to farmers. This means they can use available water more efficiently minimising wastage and helping optimising their harvests to feed their families'. Once device tests are completed they will be trialled initially in the two Kenyan villages, with the prospect of the technology being rolled out to other communities in the future.



CHALLENGES FOR SOCIETY AND THE ECONOMY CONTINUED

will maximise economic and social impact.

Part of our major investment in Centres for Doctoral Training are seven centres which will train the next generation of industrial and academic research leaders in the Digital Economy. Together these interact with over 100 companies, many of them new to the orbit of EPSRC research support. Examples are:

- A centre at the universities of Bath and Bournemouth focussing on a vibrant economic area for the UK – the digital media, special effects and animation area. Its partners range from special effects houses to film and TV research centres;
- A centre with over 30 industry partners at the University of Nottingham which will train over 50 PhD students in the Ubiquitous Computing revolution; and
- A digital economy innovation centre at Lancaster University supported by 40 companies including 20 SMEs in the Northwest.

In 2008 the programme initiated a workshop to explore the effects that digital economy might have on the business world. The 'sandpit' style workshop, which brought together a spectrum of expertise, resulted in a key issue being identified – the importance of user involvement in design in the digital world. Seven new research projects emerging from the event are to be funded by EPSRC with £5 million.

Head of Digital Economy, John Hand, flags up an intriguing new approach called 'Research in the Wild' – 'This aims to get new technologies out

on the street at an early stage and to allow researchers to see how devices are used and abused. We can see how they are used in new or unusual ways and then feed that back into the long term research agenda.'

SECURE AND SUSTAINABLE ENERGY

The goal of secure and sustainable energy is central to the EPSRC-led joint Research Councils' Energy Programme which delivered £102 million worth of research and skills support in 2008-09. The programme brings together the full range of science and engineering disciplines to bear on sustainable energy supply, energy demand reduction, and understanding the uncertainties of markets, regulation and policy.

To expand the UK research capacity in energy related areas, Centres for Doctoral Training in targeted areas including nuclear energy, sustainable power generation and supply, and low carbon technologies have been set up. The UK Energy Research Centre (UKERC), based at Imperial College London, has won support for a second phase. As well as being a world-class, whole systems research centre, UKERC also acts as a bridge between the UK energy research community and the wider world of business, policy and international energy research. During a successful first five-year term, UKERC has built the Research Atlas, the first tool to show the live status of energy research and development in the UK. This has contributed to the G8 talks through workshops to improve collaboration on clean energy and low-carbon society issues. Computer modelling to quantify a range of low-carbon

100

100 companies involved in centres for training in 'digital economy'.

New rust probe could cut costs of road closures



A new spin-out company 'SciSite' has been set up to exploit technology developed at Keele University which can test stretches of motorway for corrosion in steel reinforcement without the need to rip off the surface. The equipment includes a probe which uses electromagnetic signals to energise the rust and steel in a concrete structure. If the probe detects an anomaly such as corrosion or break in the steel structure, a rise in signal amplitude is displayed on screen. The scanning process is fast and can be done through thick layers of tarmac, concrete or any non ferrous material.

The process addresses one of the main causes of structural failure in large concrete

structures such as tower blocks and motorway bridges. Current survey techniques often lead to the stripping of concrete deemed to be at risk even though it is sometimes found to be sound. This may require sections of motorway to be closed off unnecessarily with a cost in traffic management of around £10,000 a week.

[The non-destructive technology is being used to detect structural damage in stretches of the Hammersmith Flyover in West London.](#)

CHALLENGES FOR SOCIETY AND THE ECONOMY CONTINUED

13

13 UK universities and 12 industrial partners in consortium for low-cost, sustainable hydrogen energy technologies.

scenarios has contributed to the Government's Energy White Paper. This centre is jointly supported by EPSRC, NERC and ESRC.

The programme has continued to invest in sustainable power generation and supply and has also been looking to increase its portfolio in demand reduction and low carbon transport. An 'IDEAS' Factory organised by EPSRC and funded by Department for Transport on airport operations attended by representatives from a range of sectors was held in 2008 and as a result £3.1m of projects were supported. Fresh insights and approaches are needed to meet the challenges posed by the requirement to increase capacity at airports while reducing their environmental impacts, using knowledge and methodologies available from non-traditional areas.

The EPSRC-led SUPERGEN programme is continuing to run very successfully and three of the consortia have been renewed this year. A further consortium has also been set up to deliver innovative technologies for the production of low-cost sustainable hydrogen energy. It brings together 13 UK universities with a world-class interdisciplinary research team which spans the physical sciences, engineering and social sciences. Twelve industrial partners have joined the consortium with more expected to follow. The initial award is £5 million over 4 years.

Other activity focused on contributing to the programme's objectives includes funding for research into the efficient use of thermal energy in existing process industry plants and in the design of new plants. Consortia projects which develop and apply the tools and techniques of complexity

science to energy research challenges have also been supported. Interdisciplinary research clusters in energy and equity and security of supply have been established, and consortia in carbon capture and storage have been supported under the EPSRC/E.ON Strategic Partnership.

The protection of ecosystems vital to the planet motivated a new ten-year programme led by EPSRC launched in 2008. The £6 million initiative funded a range of research projects focused on making the infrastructure, built environment and transport systems more resilient to environmental change. It will also develop more sustainable, less energy-intensive systems and approaches that are beneficial to society and the environment, and with advantages for economic impact.

IMPACT OF SCIENCE ON SOCIETY

EPSRC has remained in the forefront of support for activities which engage the research community and society, with funding of £7 million in 2008-09. Working with many partners, we have played a leading role in shaping the agenda for emerging issues for society including dialogue with the public on the implications of future research. We have also pioneered this year training on the societal and ethical implications of our research portfolio to raise awareness amongst EPSRC staff. Our activities to inspire the young to pursue a science education included support for the education programme associated with the high-profile Bloodhound world land-speed record attempt featured on page 17.

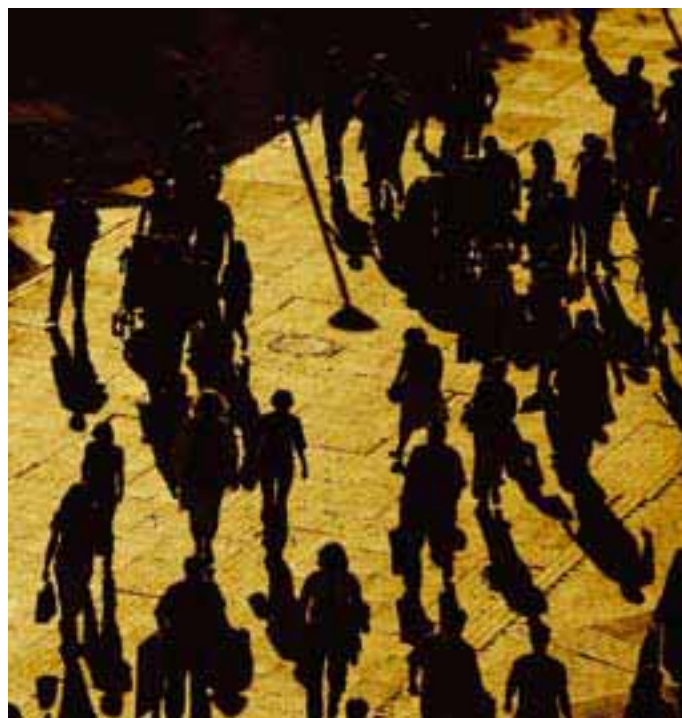
Big views on the very small

The potential for rapid advances in exploiting nanotechnology to treat and diagnose patients, prompted EPSRC to recognise the need to consult the public on the medical use of new, very small scale technology. The result was a ground-breaking public consultation exercise commissioned by EPSRC in 2008 which brought together 80 representatives of the public and specialists in the field. The resulting views are helping inform the direction of research we fund in this field.

It was revealing about what the public wanted to see from nanotechnology and their fears. One revelation was the strong support for targeted delivery of therapeutic agents, particularly highly toxic drugs. This was driven by perceived

benefits in reduced drug side effects and an appreciation of potential cost savings for the NHS. For example, the use of nanotechnologies to screen candidates for drug treatment was seen as having major cost benefits as well as increasing the speed of making treatments available. Public concerns included worries about whether the technologies could always target tissues precisely or that devices within the body might prove toxic or irretrievable.

There was strong support for diagnostics where the technology could help prevent disease or enable patients to undertake lifestyle changes and manage a disease before it had advanced. One of the concerns however was that diagnostic devices might exacerbate concerns of the 'worried well'.



CHALLENGES FOR SOCIETY AND THE ECONOMY CONTINUED



The heart of robotics

A lovable robot which appears to react in an emotional way with people has been created by robotics experts and others at the University of the West of England. Heart Robot's variety of reactions include responding to loud noises by appearing anxious and tense, with its 'heart' beating faster. Project coordinator David McGoran said: 'We hope that people will feel an emotion in response to the robot and that this will inspire them to find out more about robotics'. The project was funded by an EPSRC Partnership for Public Engagement award.

Public thinking

While the research we support has much to offer society, we recognise that the rapid advances in technology raise concerns amongst the public and that our research communities need to be alert to them. A ground-breaking public dialogue took place in 2008 on the strategic theme of nanotechnology for healthcare. It revealed a clear indication of people's aspirations and fears, and the types of technology they wanted to see progress. These views, along with a wide range of inputs from scientists and clinicians, have helped inform the direction of research funding in this field. This was the first time that EPSRC had conducted such public dialogue and used the outcome in this way. It clearly demonstrated that, under the right circumstances, public dialogue provides a very useful tool and source of intelligence in developing strategy for specific research areas which have a direct impact on society. Plans for 2009 include public dialogue activities jointly with BBSRC to help understand the public's views on the fast developing science of synthetic biology.

Engaging the public

This year's activities to encourage and enable the research community we support to engage with the public have resulted in a vibrant package, engaging millions of people in the UK. Our well established Partnerships for Public Engagement awards have continued to support a wide range of activities with 24 awards worth £2.7 million made to researchers supported by EPSRC this year. The latest awards include:

- 'Molecules out and about' aims to reach a broad cross section of society by giving people the opportunity to make model molecules and interact with massive molecular structures (Keele University);
- 'Bigger Bang' shows to tour theatres across South East England entertaining and informing schools and families about chemistry (University of Brighton);
- A series of 15 minute digital programmes for students and teachers of Key stage 3 science to be broadcast on Teachers TV (University of Salford); and
- Interactive demonstration to tour Scottish schools to help young people, parents and teachers understand the concept and environmental implications of carbon capture and storage (University of Edinburgh).

We have also continued to help EPSRC-supported researchers overcome obstacles to engaging with the public through the 'Beacons' project which brings together the Research Councils, through the RCUK Science in Society Unit, the UK Higher Education Funding Councils and the Wellcome Trust. The project's six regional centres across the UK support researchers in overcoming the major barriers to engagement such as pressure to publish and attract research funding.

To enthuse the young about science and engineering, the 'Researchers in Residence' scheme places early stage researchers in secondary schools throughout the UK in order to engage school children with contemporary research, simulating their interest and increasing the likelihood of them

Maths on the TV horizon

An unlikely combination of comedian Alan Davies and Marcus du Sautoy, maths Professor and EPSRC Senior Media Fellow, featured in a BBC TV Horizon programme broadcast in 2009. The challenge was for Professor du Sautoy to explain the power and wonder of maths to non mathematician Alan, by taking the much loved comedian on a mathematical road trip. Could the Professor make Alan, who remembered little of his maths education, fall in love with the subject in two weeks? Together they explored some of the fundamental principles of maths and tried to understand the greatest maths problems of the 21st Century, successfully impressing Alan with the awe inspiring aspects of the subject.

Professor Marcus du Sautoy (left) and Alan Davies.



CHALLENGES FOR SOCIETY AND THE ECONOMY CONTINUED

2m+

Over 2 million viewers for Marcus du Sautoy's TV show on Maths.

considering further study or research careers. We also continue to support a team of early career researchers through our NOISE campaign with the emphasis changing this year to provide them with more media opportunities and a greater appreciation of why public engagement can be a vital part of a research career.

REACHING MILLIONS

High-profile champions of science and engineering are needed to help redress the shortage of 'explainers' with the gift of being able to communicate research topics to millions of the wider public through the media and at major events. Getting innovative research into the limelight helps provide valuable impact through developing greater awareness within society. Our Public Engagement Programme therefore includes eight Senior Media Fellows this year, all leading researchers in engineering, mathematics or the physical sciences with a keen interest in actively developing public engagement. The fellowships free up their time to concentrate on initiatives with big impact like the recent major BBC TV programmes on mathematics with Senior Media Fellow, Professor Marcus du Sautoy and the 'Atom' and 'Science and Islam' presented by EPSRC Senior Media Fellow, Professor Jim Al-Khalili.

The two new Senior Media Fellows appointed in 2008 are:

Dr Mark Miodownik of King's College London specialises in self-organising and self-healing materials. He has appeared in a BBC2

programme called 'Chain reaction', Channel 4's Grand Designs: Trade Secrets, and BBC Radio 4 'Who needs scientists'. He writes for the Guardian and Independent newspapers on engineering issues. His work on the senso-aesthetic properties of materials has led to collaboration on outreach activities with major museums including the Tate Modern, Hayward Gallery and the Wellcome Collection, and popular presentations around the UK.

Professor Chris Cooper, University of Essex, specialises in researching all aspects of oxygen in the body and has won a prestigious international award for outstanding achievements in this field. His communication skills were recognised by featuring in an Oxford University Press/Times Higher popular science writing competition. He has appeared in a variety of public presentations and engagement activities, notably in communicating the role of light in physics and medicine at the Royal Society Summer Exhibition.



'The Golden Bunsen Award' winners.

HOLMES HINES MEMORIAL FUND

This charitable fund, administered by EPSRC, was set up following a bequest which stated that it should provide annual prizes, scholarships, exhibitions or research grants, the incidental expenses of visiting scientists, the purchase of scientific apparatus and equipment, and funds for 'such other purposes for the advancement of scientific knowledge as the Council shall see fit'. The Holmes Hines Memorial Fund can be used to help individuals or organisations and offers awards for activities relating to science and engineering for which public funds are not available. Although the fund is administered by EPSRC, awards are not restricted to subjects falling within the EPSRC remit and applications can cover any area of science or engineering.

During 2008/09 Holmes Hines Memorial Fund allocated £10,962 towards a range of activities and projects. This compares with £9,289 allocated in 2007/08.

Examples of awards made during 2008/09:

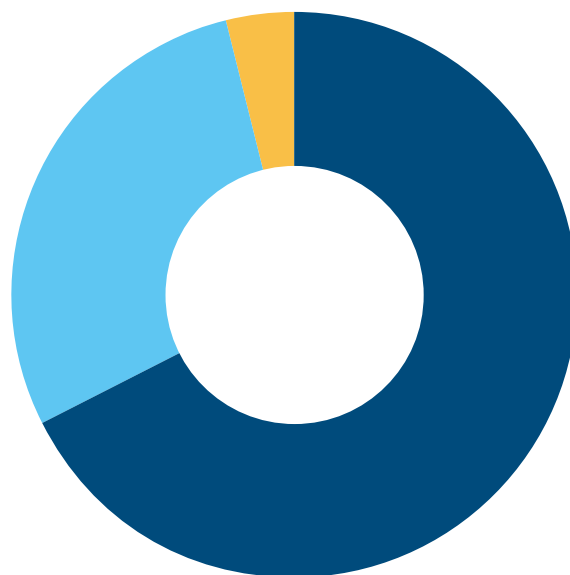
- Support for students to attend a summer STEM (Science, Engineering & Maths) Festival.
- Funding towards the running of school Science Weeks.
- Funding towards the 'Reach for the Stars' project, a space education programme including a trip to Kennedy Space Centre.
- Support to allow students to take part in a 'Top of the Bench' competition and visit a laboratory run by a Pharmaceutical Company.
- Funding towards the costs of a Science Taster Day.
- Support for Science and Engineering Lunchtime and After School Clubs.
- Funding towards the costs of an Annual Schools' Science Conference.
- Contribution for the purchase of tools and equipment to be used for an Electronics Club.
- Support for 'The Golden Bunsen' Award, a competition for students attending a lunchtime science club.

Facts and Figures

FACTS AND FIGURES

EPSRC expenditure by category (%)

	%
■ Research grants	67.6
■ Postgraduate training and fellowship awards	28.7
■ Administration and restructuring	3.7



Research grant investment by Programme Research grant proposals considered and funded

Financial year 2008/09	Proposals considered ¹		Proposals funded		% funded	
	Number	Value (£m)	Number	Value (£m)	Number	Value (£m)
Cross-Disciplinary Interfaces	109	102.2	29	36.8	27%	36%
Digital Economy	51	362.8	21	46.2	41%	13%
Energy Multidisciplinary Applications	67	63.7	38	24.5	56%	38%
Energy Research Capacity	83	62.8	40	33.4	48%	53%
Information and Communications Technology	958	341.5	212	75.6	22%	22%
Mathematical Sciences	269	55.7	89	15.3	33%	28%
Materials, Mechanical and Medical Engineering	744	281.7	157	60.7	21%	22%
Nanoscience through Engineering to Application	55	36.7	32	21.1	58%	57%
Physical Sciences	1,058	395.3	230	100.4	22%	25%
Process, Environment and Sustainability	447	150.0	83	27.0	19%	18%
Research Infrastructure and International	255	88.5	54	21.3	21%	24%
Towards Next-Generation Healthcare ²	3	3.7	3	3.7	100%	100%
User-Led Research	235	110.7	161	82.5	68%	75%
Grand Total	4,334	2,055.2	1148	548.4	26%	27%

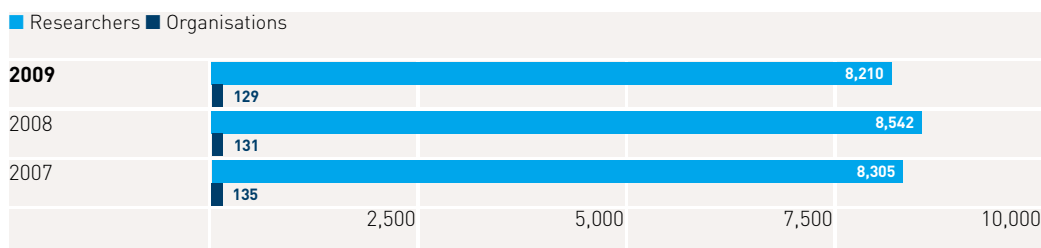
1 ie. on which a final decision was made between 1st April 2008 and 31st March 2009.

2 The vast majority of proposals under Towards Next-Generation Healthcare were considered and funded through partner organisations such as Wellcome Trust and Cancer Research UK.

Gross research grant expenditure by programme

Programme	2006/07 £m	2007/08 £m	2008/09 £m
Nanoscience	-	-	2.8
Next Generation Healthcare	-	-	3.7
Digital Economy	-	-	4.0
Energy Multidisciplinary Applications	-	-	1.0
Energy Research Capacity	30.6	42.2	63.9
Knowledge Transfer	4.0	4.3	13.5
Infrastructure and International	33.5	44.6	49.4
Mathematical Sciences and Public Engagement	11.7	14.2	15.7
Cross Disciplinary Research	52.8	63.9	49.3
Materials Mechanical and Medical Engineering	65.1	72.3	73.6
Information and Communication Technology	67.8	83.0	84.1
Physical Sciences	104.6	101.6	97.8
Process Environment and Sustainability	25.8	33.2	28.2
User Led Knowledge and Skills	22.3	26.5	20.3
Other Activities	4.3	-	-
Total	422.5	485.8	507.3

Total number of researchers (Principal and Co-investigators) and organisations with current funding on 1st April of each year



3,032

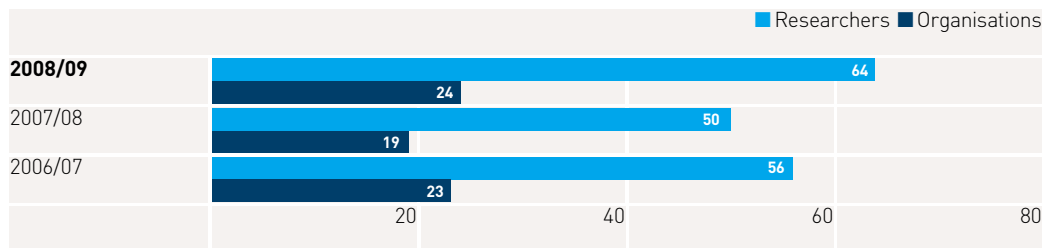
The research grants announced in 2008/09 funded 3,032 researchers in 103 organisations.

Science in Society Programme – Proposals considered and funded

	PROPOSALS CONSIDERED					
	2006/07		2007/08		2008/09	
	Number	Value (£m)	Number	Value (£m)	Number	Value (£m)
Partnerships for Public Engagement	47	5.9	69	9.1	119	12.6
Senior Media Fellowship	3	0.4	6	0.5	8	1.1

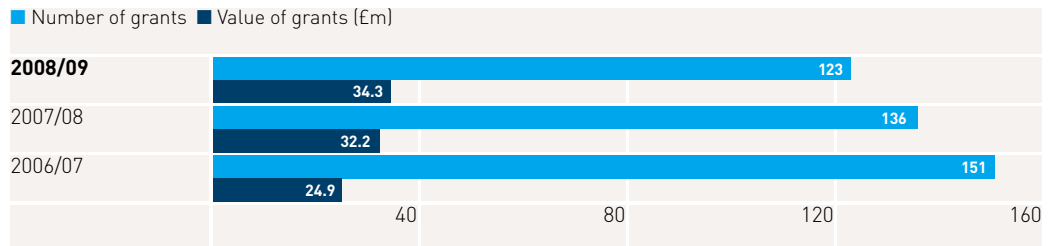
	PROPOSALS FUNDED					
	2006/07		2007/08		2008/09	
	Number	Value (£m)	Number	Value (£m)	Number	Value (£m)
Partnerships for Public Engagement	27	2.7	22	2.3	29	2.8
Senior Media Fellowship	3	0.4	1	0.1	3	0.5

Number of researchers and organisations funded by the Science in Society Programme



The variation in the number of researchers is due to the fluctuation of the numbers of coinvestigators on the grants.

Number and value of First Grant Scheme research grants announced



EPSRC Fellowships current at 31st March 2007, 2008 and 2009 by Scheme

Scheme	Calendar year		
	2007	2008	2009
Advanced	210	216	188
Career Acceleration	–	–	23
EURYI	5	5	4
Leadership	–	–	22
Postdoctoral	49	49	56
Overseas Postdoctoral	17	32	32
Senior	21	20	21
Senior Media	6	7	8
Springboard	5	6	1
Statistics Mobility	5	5	6
Grand total	318	340	361

- 1 Postdoctoral Fellowships are available in mathematical sciences, theoretical computer science, theoretical physics and at the life sciences interface.
- 2 Overseas Postdoctoral Fellowships support research in appropriate physical sciences and engineering disciplines outreaching to the Life Sciences. Fellows may spend up to half of their 3 year Fellowships working in overseas laboratories.
- 3 Springboard Fellowships provide short-term support (12 months in duration) to enable researchers in the mathematical sciences to work at the interface with another discipline, with business or industry or on an innovative project.
- 4 EPSRC awards Senior Media Fellowships through its Public Engagement Programme.
- 5 The European Young Investigator (EURYI) Awards Programme is a European scheme that EPSRC makes a financial contribution to (in 2004/05 EPSRC contributed 360k Euros and 2005/06 EPSRC contributed 720k Euros). Funds are awarded from a central resource comprising contributions from 20 participating organisations across Europe. From 2006/07 onwards EPSRC has not contributed to any new EURYI Awards but continues to fund the current Fellows until 2010/11.
- 6 In addition to the activities shown in the table, EPSRC is involved with the following fellowship schemes:
 - Administering the Academic Fellowships Scheme on behalf of RCUK
 - Jointly administrating the Engineering Postdoctoral Fellowships in collaboration with Royal Academy of Engineering
 - Contributing to Royal Society Industrial Fellowships (£400k in 2008/09)
 - Contributing to the Daphne Jackson Memorial Fellowship Trust (£58k for two fellowships in 2008/09).

EPSRC Fellowships current at 31st March 2009 by Scheme and Discipline

Discipline	Scheme										Grand total
	Advanced	Career Acceleration	EURYI	Leadership	Post-doctoral	Overseas Post-doctoral	Senior	Senior Media	Spring-board	Statistics Mobility	
Chemical Engineering	4	–	–	–	–	4	–	1	–	–	9
Chemistry	35	4	2	7	–	7	6	1	–	–	62
Civil Engineering	4	–	–	–	–	–	–	–	–	–	4
Computer Science	21	–	–	3	15	2	3	1	–	–	45
Electrical & Electronic Engineering	11	1	–	2	1	–	–	–	–	–	15
General Engineering	9	–	–	1	1	3	–	–	–	–	14
Life Sciences	1	1	–	–	–	3	–	1	–	–	6
Mathematics	37	1	–	7	26	–	5	1	1	5	83
Mechanical, Aeronautical & Manufacturing Engineering	13	–	–	–	–	–	–	1	–	–	14
Medicine	5	1	–	–	–	3	–	–	–	–	9
Metallurgy & Materials	5	1	–	–	–	–	–	–	–	–	6
Other	3	2	1	–	–	–	–	1	–	–	7
Physics	37	11	1	2	12	8	6	1	–	–	78
Unknown	3	1	–	–	1	2	1	–	–	1	9
Grand total	188	23	4	22	56	32	21	8	1	6	361

Net training expenditure (£m)

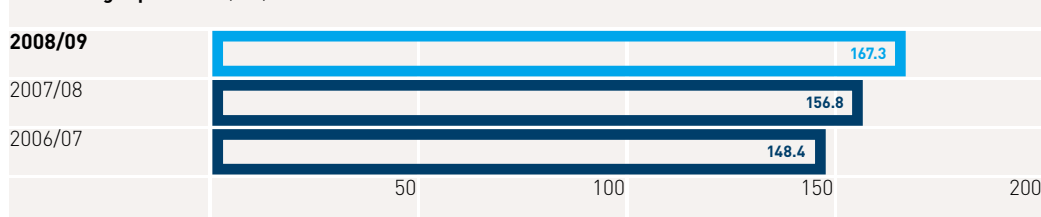
	2006/07	2007/08	2008/09
Doctoral Training Accounts	75.2	78.1	76.2
Centres for Doctoral Training	5.0	6.9	11.3
Collaborative Training Accounts	47.7	49.3	52.8
Graduate Schools	1.3	1.5	1.2
International Doctoral Scholarships	1.4	1.7	1.5
Dorothy Hodgkin Awards (EPSRC only)	0.7	2.1	2.2
Roberts Skills Payments	12.3	12.8	13.7
Other Training	4.8	4.4	8.4
Total	148.4	156.8	167.3

In the above table training expenditure is shown on a net basis (ie. after deducting receipts).
The Annual Accounts show training expenditure on a gross basis (ie. before deducting receipts).

£167.3m

Our total training expenditure in 2008/09 was £167.3m.

Net training expenditure (£m)



Training commitment (£m)

	2006/07	2007/08	2008/09
Doctoral Training Accounts ¹	78.4	86.0	167.0
Industrial Case Accounts ²	-	-	18.8
Collaborative Training Accounts ²	25.0	21.3	26.8
Centres for Doctoral Training ³	-	-	333.2
Knowledge Transfer Accounts	-	-	49.8
Dorothy Hodgkins Awards (EPSRC only)	2.7	2.7	2.8
Total	106.1	110.0	598.3

1 In 2008/09, 2 years worth of commitment was released for Doctoral Training Accounts.

2 In 2006/07, Collaborative Training Awards included £4.9m relating to CASE for New Academic Appointees and £16.0m relating to Industrial Case Accounts.

3 Includes Industrial Doctoral Centres, Life Sciences Interface Doctoral Training Centres, Mission Led Centres, Securing the Future Centres, and also the 45 new centres announced in 2008/09.

PhD students by discipline (not including collaborative students)

	Doctoral students ^{1,3}			Project students ²		
	2007	2008	2009	2007	2008	2009
Core e-Science	-	-	-	116	111	102
Basic Technology	-	-	-	20	-	-
Total	-	-	-	136	111	102
Chemical Engineering	141	133	147	99	141	198
Chemistry	1085	1082	1077	328	365	365
Civil Engineering	147	155	140	86	84	104
Computer Science	513	479	428	254	276	308
Electrical & Electronic Engineering	480	466	433	256	280	324
General Engineering	367	354	320	151	148	192
Life Sciences	168	159	138	37	38	49
Mathematics	671	713	710	89	105	119
Mechanical, Aeronautical & Manufacturing Engineering	213	188	169	164	167	191
Medicine	93	98	97	42	35	37
Metallurgy & Materials	275	267	213	121	142	158
Other	253	251	204	64	78	111
Physics	733	718	675	297	309	347
Unknown	269	296	282	21	67	104
Total	5,408	5,359	5,033	2,009	2,235	2,607
Grand Total	5,408	5,359	5,033	2,145	2,346	2,709

PhD Students by Scheme and Discipline 2009 (including collaborative students)

	Chemical Engrng	Chmstry	Civil Engrng	Comptr Science	Elctrcl & Elctronc Engrng	General Engrng	Life Sciences	Maths	Mechnct Engrng	Medicine & Materls	Other	Physics	Unknown	Total	
CASE for New Academics (CNA)	9	9	17	19	13	47	11	7	14	3	3	3	6	25	186
Collaborative Research Student (CTA)	1	49	4	8	24	26	2	12	4	4	4	12	4	20	174
Dorothy Hodgkin Overseas Scholar (DHPA grant) ⁵	17	21	9	3	29	16	13	12	6	23	8	28	14	33	232
Earmarked Awards:															
Analytical Science (DTG)	-	24	-	-	1	1	8	2	-	-	1	-	-	-	37
Mathematics CASE (DTG)	-	-	-	2	1	1	-	27	-	-	-	4	-	1	36
Engineering Doctorate - Research Engineer	31	16	57	18	66	100	37	1	42		43	50	10	49	520
EPSRC / ESRC Studentship	-	5	6	25	5	2	6	6	-	1	-	4	2	7	69
Industrial CASE Student	24	112	19	29	41	93	20	11	39	12	27	16	34	30	507
International Doctoral Scholars (IDS grant)	-	9	-	3	26	-	-	-	4	-	3	-	18	1	64
Life Sciences Interface Student (DTC grant)	10	73	-	44	-	10	31	33	-	18	-	-	45	72	336
Standard Research Student (DTG)	120	945	125	351	371	290	80	630	159	55	201	168	596	168	4,259
Totals	212	1263	237	502	577	586	208	741	268	116	290	285	729	406	6,420
											2007	2008		2009	
Number of organisations with funding from Collaborative Training Accounts											89	92		89	
Number of organisations with funding from Doctoral Training Accounts											78	74		71	
Number of institutions with Studentship support ⁴											95	96		93	

Project students are not included.

- 1 In October 2001 EPSRC introduced Doctoral Training Grants to Universities to replace individual studentships. Student data has been estimated for the previous 3 years while data was being collected from the Universities. Numbers of students are now actual figures but show a decline towards the present year due to the length of time needed to gather full datasets.
- 2 Project studentship posts are at doctoral level and supported through research grants.
- 3 Typically approx 5% of standard DTG studentships are associated with collaborative partners. This is in addition to the specific collaborative schemes shown below.
- 4 As institutions may receive funding for both Collaborative Training Accounts and Doctoral Training Accounts this figure reflects the total number of organisations that have received funding from either or both schemes.
- 5 EPSRC acts as a scheme sponsor and administers the Dorothy Hodgkin Postgraduate Award (DHPA) Scheme on behalf of DIUS (26 core plus an additional 61 in 2008/09). In addition during 2004 the International Doctoral Scholarship scheme was introduced to allow leading research teams to recruit students from anywhere in the world. Universities with EPSRC supported Portfolio Partnerships or Interdisciplinary Research Collaborations (IRCs) have been given the flexibility to transfer up to 10% of their Doctoral Training Grants into the new scheme.

PhD students supported by Collaborative Schemes at 31 March 2007, 2008, 2009

	2007	2008	2009
Collaborative Research Student (CTA)	164	208	174
CASE for New Academics (CNA)	228	246	186
Engineering Doctorate – Research Engineer	525	542	520
Industrial CASE Student	666	592	507
Total	1,583	1,588	1,387

First Destination of EPSRC PhD Students whose funding finished or who qualified in 2004/05, 2005/06 and 2006/07

RC Reporting Category	2004/05	%	2005/06	%	2006/07	%
Government and Public Sector	42	5.0%	52	6.0%	53	5.5%
Academia	253	29.8%	284	32.6%	307	32.0%
Industry	245	28.9%	315	36.2%	380	39.6%
School Teaching/Training	20	2.4%	53	6.1%	41	4.3%
Engaged in study	131	15.4%	35	4.0%	31	3.2%
Other	69	8.1%	66	7.6%	85	8.9%
Not employed	88	10.4%	66	7.6%	62	6.5%
Grand total	848		871		959	

1 Data source is the HESA Destinations of Leavers from Higher Education (DLHE) Survey.

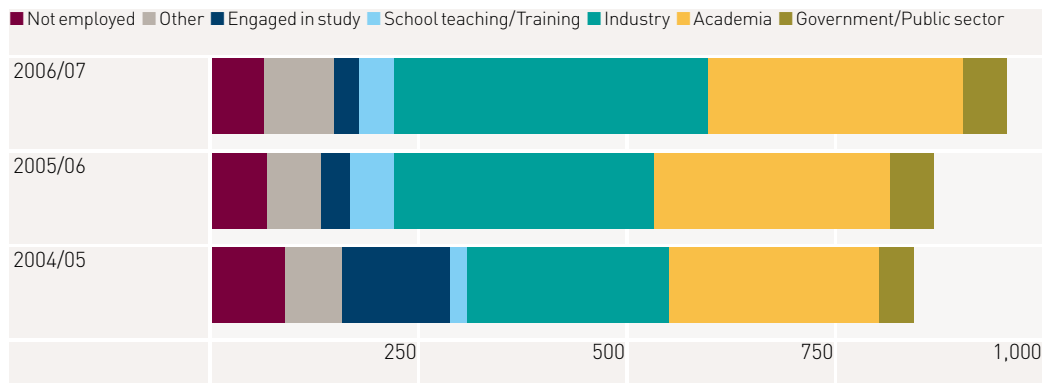
2 'Not knowns' have been removed from the tables above.

3 Other employment includes 'Self employed voluntary and unpaid work'.

First Destination of EPSRC PhD students whose funding finished or who qualified in 2004/05, 2005/06 and 2006/07

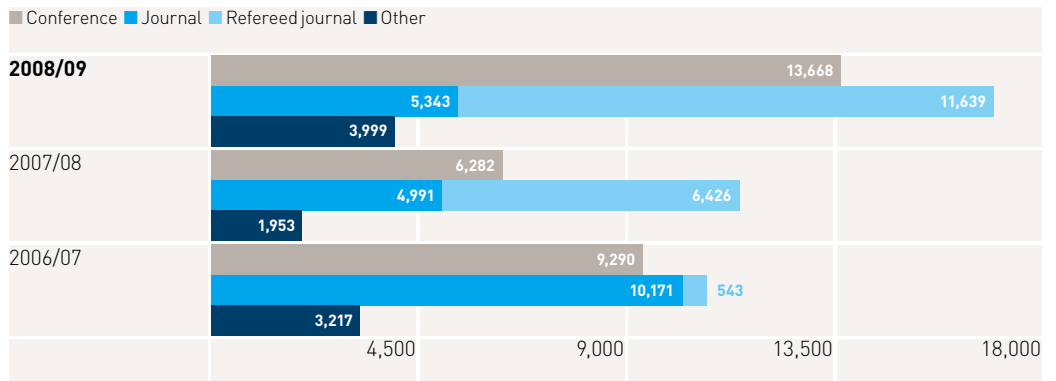
40%

40% of EPSRC PhD students who finished or qualified in 2006/07 were employed by industry.



Trends in publications

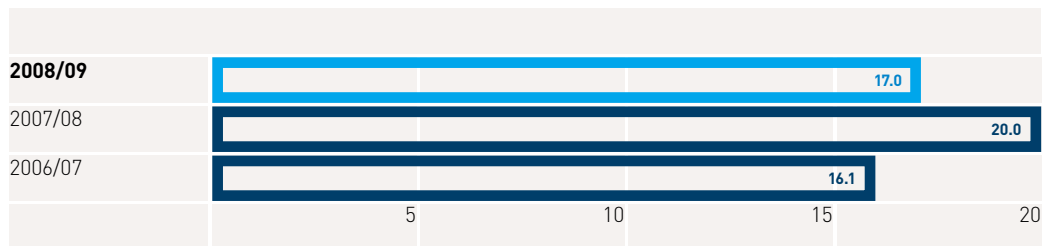
Numbers of publications reported on completed Final Reports



Other includes books and software. The publication types collected changed during 2006/07 and now include Conference Proceedings, Journals, Refereed Journals, Books and Other.

	2006/07	2007/08	2008/09
Final reports completed in year 2008/9	1,744	1,225	2,353
Percentage of final reports reporting publications	81%	81%	87%

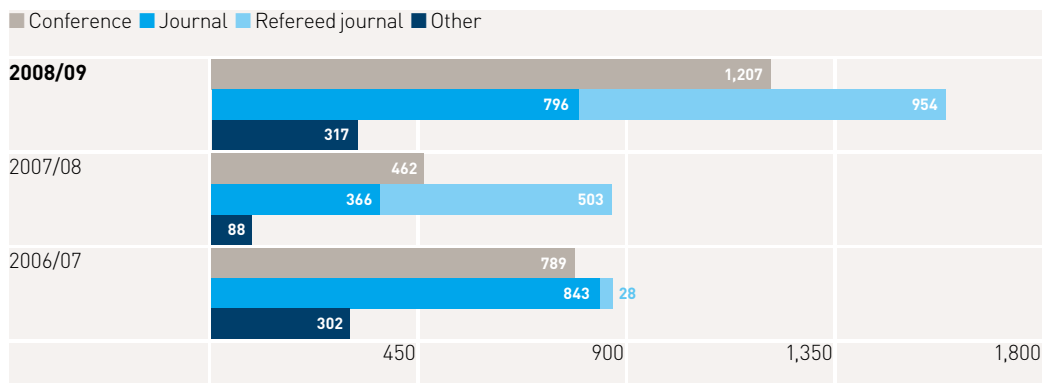
Average number of publications per completed Final Report



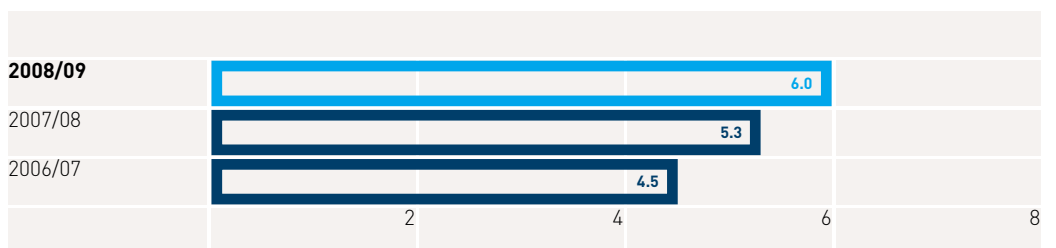
34,649

34,649 publications were reported on completed final reports in 2008/09.

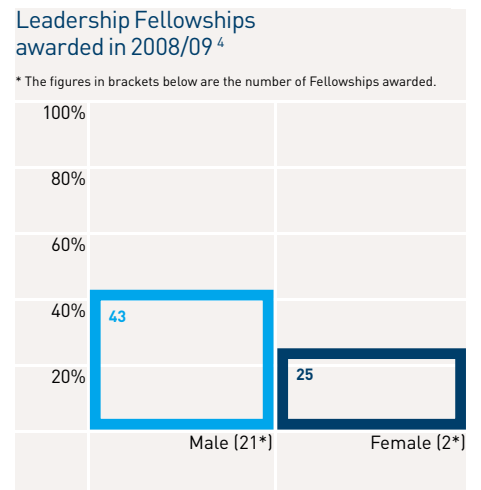
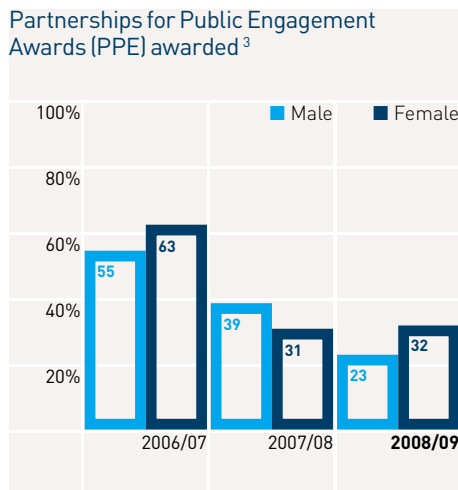
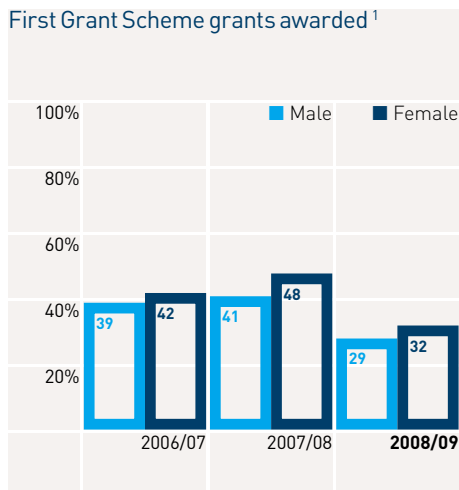
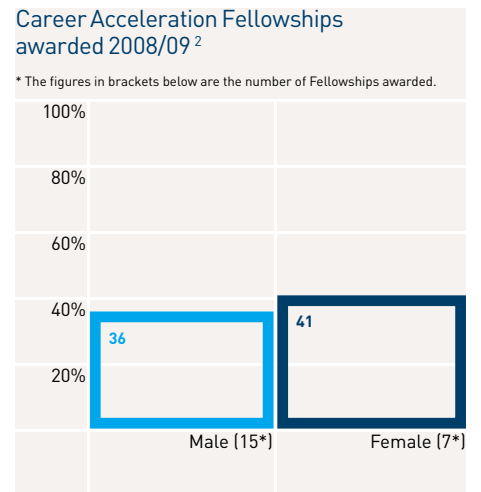
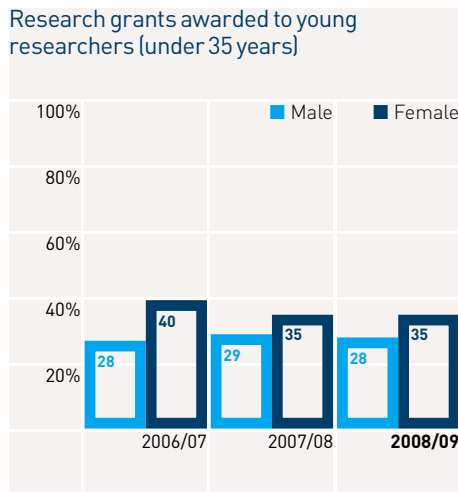
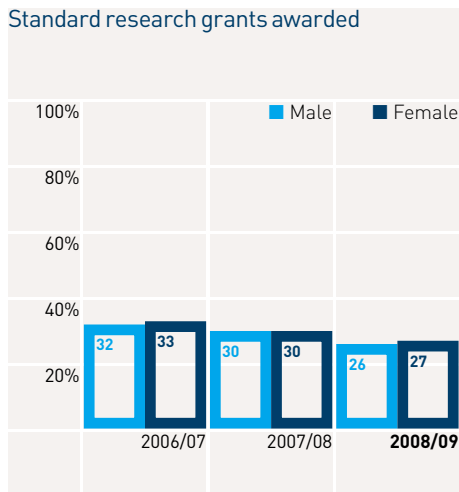
Number of publications with an industrial co-author reported on completed Final Reports



Average number of publications with an industrial co-author per completed Final Report



Funding rates (%) by gender



- The first grant scheme is to help new academics apply for research funding at the start of their careers. Proposals are considered in competition with other first grant proposals at responsive mode prioritisation panels.
- Career Acceleration Fellowships provide support for talented researchers at an early stage in their career. Application is through Calls for Proposals.
- PPE awards aim to communicate the excitement of fundamental and applied research in science and engineering to the public. Application is through Calls for Proposals.
- Leadership Fellowships provide support for talented researchers with the most potential to develop into the UK's international research leaders. Application is through Calls for Proposals.
- The funding rate percentages are calculated by dividing the number of grants/awards announced by the number of proposals considered.

Gender of current award holders as at 01/04/09 – where known (%)

	Male	Female
Students	78%	22%
Early Career	74%	26%
Grant Holders over 35 years old	90%	10%
Senior and Leadership Fellows	93%	7%

Ethnic origin of research grant Principal Investigators (%)

	2006	2007	2008
Asian & Asian British	2.5%	2.8%	4.2%
Black & Black British	0.2%	0.2%	0.4%
Chinese or Other	5.7%	5.3%	6.6%
Mixed	0.9%	0.5%	0.7%
Not Disclosed	5.4%	7.2%	6.1%
Unknown	2.4%	0.9%	0.2%
White	82.9%	83.1%	81.9%

The Engineering and Physical Sciences Research Council (EPSRC) was established by Royal Charter on 16 December 1993 and began operations on 1st April 1994. EPSRC inherited part of the programme previously funded by the Science and Engineering Research Council (SERC).

EPSRC receives its principal funding through the Grant in Aid from the Department for Innovation, Universities and Skills* (DIUS). The amount received in 2008/09 was £785m (2007/08 £739m). Income was also received from other Research Councils, Government Departments and other bodies.

The Accounts have been prepared in accordance with the Science and Technology Act 1965 and the Secretary of State for the Department for Innovation, Universities and Skills directions made thereunder.

Mission

The mission of EPSRC as set out in the 1993 Government White Paper on Science, Engineering and Technology 'Realising our Potential' is:

"to promote and support high quality basic, strategic and applied research and related postgraduate training in engineering and the physical sciences (Chemistry, Physics and Mathematics), placing special emphasis on meeting the needs of the users of its research and training outputs, thereby enhancing the United Kingdom's industrial competitiveness and quality of life."

EPSRC's objectives, as defined in its Charter, are:

- a) to promote and support high quality basic, strategic and applied research and related post-graduate training in engineering and the physical sciences;
- b) to advance knowledge and technology and provide trained scientists and engineers to meet the needs of users and beneficiaries (including the chemical, communications, construction, electrical, electronic engineering, information technology, pharmaceutical, process and other industries), thereby contributing to the economic competitiveness of the United Kingdom and the quality of life of its citizens; and
- c) to provide advice, disseminate knowledge and promote public understanding in the fields of engineering and the physical sciences.

Review of the year

The Statement of Net Expenditure records net expenditure after reversal of cost of capital for the year of £792.5m (2007/08 £751.9m). There was an increase in expenditure on research grants, with annual expenditure totalling £507.3m (2007/08 £485.8m) and an increase in expenditure on postgraduate and fellowship awards, with annual expenditure of £228.4m (2007/08 £210.4m).

During the year EPSRC paid a total of £12k to the Consolidated Fund (2007/08 £89k).

Transfers to and from reserves are shown in Note 23 to the Accounts.

Full details of the activities in the year and future plans are shown in the Management Commentary.

We report on the extent we are exposed to financial risks in Note 2 to the Financial Statements.

Research and development

As an organisation wholly engaged in research, EPSRC does not classify research and development separately in the Accounts.

Shared Services Centre

The seven research Councils have agreed to establish a Shared Services Centre (SSC), to be based in Swindon. The SSC will provide finance, grants, human resources, information systems, procurement and payroll operational services to each of the Councils and their institutes. The Councils are setting up the SSC with the aim of achieving procurement benefits through sharing and standardising processes. The SSC has been incorporated during the year as RCUK Shared Services Centre Limited and is in the process of establishing itself to be ready for the transfer of services. There is a phased implementation plan for transferring the Councils' services during 2009/10.

EPSRC is currently acting as 'host' for the shared services centre project on behalf of all Councils and has contracted for the development and establishment of the Shared Service Centre. The Councils have agreed to share all these costs and EPSRC's agreed share is 8.24%. The costs have been accounted for in EPSRC's books as £326k as provisions for redundancy and system termination costs and £3.1m as Assets in the course of construction. During 2008/09 EPSRC incurred costs totalling £1.7m in relation to the Shared Services Centre.

EPSRC has acquired B shares to the value of £650,960 as investment in the Shared Services Centre. B shares convey ownership rights to the holder, including any distribution or proceeds from sale of the Shared Services Centre.

The transition to a Shared Services Centre is regarded as a business critical project and is referred to in our Statement on Internal Control.

Payment policy

In accordance with Government guidelines, it was the policy of EPSRC in 2008/09 to seek to comply with the CBI Prompt Payers' Guide that states that commercial invoices should be paid within 30 days of the presentation of a valid demand for payment. EPSRC is now moving towards reducing the time taken to make payment to 10 days in line with revised Government policy.

During 2008/09 the majority of payments by EPSRC were made to predetermined scheduled dates. Payment of commercial invoices, as defined by the CBI, was monitored throughout the year and 99% of those invoices were paid within 30 days of receipt.

The remittance advice, which accompanies payable orders, gives a point of contact within Finance for queries or complaints from suppliers on payment performance. No complaints, under the terms of the CBI code, were received during the reporting year.

In November 1998, the Late Payment of Commercial Debts (Interest) Act came into force, providing small businesses with a statutory right to claim interest from large businesses (and all public sector bodies) on payments that are more than 30 days overdue. Amended legislation (the Late Payment of Commercial Debts Regulations 2002) came into force on 7th August 2002 providing all businesses, irrespective of size, with the right to

* Department for Innovation, Universities and Skills (DIUS) reformed as Department for Business, Innovation and Skills from June 2009.

claim statutory interest for the late payment of commercial debts. One such claim was received during the reporting year.

Details of the Prompt Payers' Guide can be found at www.payontime.co.uk.

Holding of Public Sector Information

EPSRC have complied with the cost allocation and charging requirements set out in HM Treasury and Office of Public Sector Information guidance, where they are appropriate. However, the information EPSRC holds is exempt from the requirements of *'The Re-use of Public Sector Information Regulations 2005'* as specified in para 5 (3) of the regulations.

Personal Data

There has been one personal data related incident in 2008/09. EPSRC will continue to monitor and assess its information risks in order to identify and address any weaknesses and ensure continuous improvement of its systems.

Resource Audit Committee

The Resource Audit Committee (RAC) includes three members of Council together with other members from the commercial and academic communities. RAC meets three times a year to review corporate governance, risk management, internal and external audit matters, efficiency and the Council's Accounts.

Financial Risk Management

Accounting policies in respect of financial risks and going concern are considered in notes 2 and 1b respectively.

Equality of opportunity

EPSRC has a policy of non-discrimination against people on the grounds of gender, age, religion, religious beliefs, disability, race or sexual orientation. This applies in recruitment, training, promotion and to all aspects of employment within EPSRC.

EPSRC has published its Race, Disability and Gender Equality Schemes. An Equality Group has been formed to monitor progress against its published Action Plan.

EPSRC gained accreditation as a Disability Symbol user in 2004 approved under the scheme operated by the Employment Service.

EPSRC continues to be a member of the Research Councils' Equality and Diversity Advisory Group.

Learning and Development (L&D)

EPSRC sought re-accreditation of Investors in People (IiP) in November 2008 and attained 'retained recognition' status. The review noted that EPSRC continues to show strong commitment to the Investors in People standard and is making excellent progress in meeting the requirements of their Retaining Recognition Action Plan. A further review will take place in November 2009. Highlights noted by the assessors included:

- Excellent commitment shown to progress the IIP Action Plan through a period of significant internal change.
- Communication processes to keep staff up to date with developments.
- Strong commitment to the clarity of organisational values shown through the 'Blueprint' development and document.
- New manager development including more experienced managers to pass on their skills and also learn.

- The plan for further use and development of the competency framework for managers.
- Work on the new staff development strategy and training plan incorporating strengthened evaluation.
- Work to improve and consult with staff on a possible new reward and recognition system.
- The appointment of an HR Business Partner bringing new experience to the organisation.
- Directors' drop-in sessions for all staff to attend.

Health and safety

EPSRC complies with all relevant legislation and regulations concerning health and safety at work. Comprehensive programmes of inspections, tests, risk assessments and training are carried out to ensure that safe and healthy working conditions are provided for all employees.

Staff Sick Absences

During 2008/09 a total of 1,842 days were lost due to staff sickness absences, representing 2.5% of total full time equivalent working days.

Employee involvement

Employee involvement in management and policy matters has continued through ongoing dialogue between management, staff and Trade Unions. The Embedding Change Group has played a major role in this dialogue, with conversations taking place in the form of focus groups as well as more traditional meetings. Change Champions have also contributed significantly to employee involvement through giving a voice to people who would not often find themselves in a meeting room. The Champions are currently re-grouping and reviewing their role within the organisation, with a view to engaging more as corporate citizens and championing worthwhile workplace causes. The HR Business Partner group has taken over the lead on much of the scope of activities carried out by the ECG, and will continue to engage with all staff on an ongoing basis.

Environmental policy

The Research Councils are committed, both individually and collectively, to adopting and promoting environmental good practice in all their operations. We have identified a number of operational areas where environmental good practice is important to us. To achieve those objectives, the Research Councils recognise that they must have a good understanding of the environmental impacts of their operations, and must develop realistic objectives and targets for the reduction of any adverse impacts.

Auditors

The Accounts of EPSRC are audited by the Comptroller and Auditor General under the terms of Paragraph 3(3) of Schedule 1 of the Science and Technology Act 1965. The cost of the statutory audit in 2008/09 was estimated to be £93k (2008/09 £43k). EPSRC's statutory audit fee has increased as a result of hosting the SSC project. There was additional auditor remuneration totalling £5k in respect of work undertaken on the introduction of International Financial Reporting Standards.

So far as the Accounting Officer is aware, there is no relevant audit information of which EPSRC's auditors are unaware. The Accounting Officer has taken all the steps that he ought to have taken to make himself aware of any relevant audit information and to establish that EPSRC's auditors are aware of that information.

CORPORATE ACTIVITIES

MEMBER OF COUNCIL AND ITS ADVISORY PANELS

Council Membership

The following were members of the EPSRC Council in 2008/09:

Mr J Armitt, CBE, FREng, Chair	Olympic Delivery Authority
Professor D Delpy, FRS, FREng	
Chief Executive	Engineering and Physical Sciences Research Council
Professor A Anderson, OBE	University of Dundee
Mr M Carr, FREng,	Independent
Professor L F Gladden, CBE, FRS, FREng	University of Cambridge
Mr D A Hendon, CBE, FREng	Department for Business Enterprise and Regulatory Reform
Dr A J Herbert, FREng	Microsoft Research Ltd
Dr S E Ion, OBE, FREng	Independent
Dr M Roberts	Guidance Ltd
Mr D Rutherford	Parsons Brinckerhoff
Professor J R Sambles, FRS	University of Exeter
Professor C M Snowden FRS, FREng	University of Surrey
Professor Sir Martin Taylor, FRS	University of Manchester
Professor Sir William Wakeham, FREng	University of Southampton
Professor M Welland, FRS, FREng (From May 2008)	Ministry of Defence
Professor Lord Robert Winston	Imperial College London

Representative from the Department for Innovation, Universities and Skills: Mr J Neilson

Technical Opportunites Panel
(TOP) Membership

Professor L F Gladden, CBE, FRS, FREng, Chair	University of Cambridge
Professor B Collins	Department for Transport
Professor J Fisher	University of Leeds
Professor N Halliwell, FREng	Loughborough University
Professor D Hand	Imperial College London
Professor S Price	University College London
Professor T Rodden	University of Nottingham
Professor R Silva	University of Surrey
Mrs A Starr	GE Aviation Systems
Professor R Wallace	University of Edinburgh
Professor I Walmsley	University of Oxford
Professor N Weatherill	University of Birmingham
Professor P Withers, FREng	University of Manchester

User Panel
(UP) Membership

Professor C M Snowden, FRS, FREng, Chair (from 1 June 2008)	University of Surrey
Eur Ing A M Hodge, MBE (Interim Chair until for 31 May 2008)	QinetiQ
Dr J Cooper	National Grid
Professor N Jackson	Ricardo plc
Ms J Milne	British Retail Consortium
Dr C Mottershead (until August 2008)	BP
Dr L O'Toole	UK Clinical Research Collaboration
Mr I Risk	Airbus
Dr D Watson	IBM
Mrs J Wilbraham	AstraZeneca
Dr S Wright	BT
Dr D York	Proctor and Gamble Ltd

Societal Issues Panel
(SIP) Membership

Professor Lord Robert Winston, Chair	Imperial College London
Dr D Bruce (until 30 September 2008)	Edinethics Ltd
Professor D Burke, CBE (until 30 September 2008)	Independent
Professor R Jones	University of Sheffield
Mr D Jordan, CBE	Independent
Professor G Laycock	University College London
Baroness Onora O'Neill, CBE	The British Academy
Professor J Petts	University of Birmingham
Mr N Ross	Independent
Professor K Sykes	University of Bristol
Professor Sir Martin Taylor, FRS	University of Manchester

Resource Audit Committee
(RAC) Membership

Professor Sir William Wakeham, FREng, Chair	University of Southampton
Mr P Douglas	Independent
Mr A Neal	Lancaster University
Mr D Rutherford	Parsons Brinckerhoff
Professor J R Sambles, FRS	University of Exeter

CORPORATE ACTIVITIES

EPSRC COUNCIL MEMBERS' REGISTER OF INTERESTS

Name	EPSRC Bodies	University interest	Industry interest	Other Government departments	Other
Professor Anne Anderson , University of Dundee	Council	Vice Principal	None	None	None
Mr John Armit Olympic Delivery Authority	Chair, Council	Professor J Petts Birmingham University (Sister) Professor G Petts Westminster University (Brother-in-Law)	Network Rail (CEO) until 31 March 07 Non-executive post with Berkeley Homes Chairman – Olympic Delivery Authority PriceWaterhouseCoopers	None	None
Mr Mike Carr Independent	Council	Various university investment activities as part of our strategic university research programme	None	None	None
Professor David Delpy EPSRC	CEO EPSRC	Vice Provost for Research at UCL until 1 November 2007	Shareholdings in Respironics Inc	Member of healthcare Innovation Council from 2007	Chair, Royal Society URF Panel (Aii) Board member Energy Technologies Institute from 2008
Professor Lynn Gladden University of Cambridge	Technical Opportunities Panel (Chair), Council	Department of Chemical Engineering	Unilever (Consultant) Johnson Matthey (major sponsor) Schlumberger (major sponsor) Holds Shell Chair of Chemical Engineering. (Dept has no links with Shell anymore)	None	National Physical Laboratory (member of NPL Royal Society/Royal Academy of Engineering Advisory Group to NPL)
Mr David Hendon BERR*	Council	None	None	Director Business Relations BERR* (full-time employee)	Trustee, Radio Communications Foundation Member, Institute of Engineering & Technology Communications Sector Panel Member of Membership Panel 5 of the Royal Academy of Engineering
*BERR re-formed as Department for Business, Innovation and Skills (BIS) from June 2009					
Dr Andrew Herbert Microsoft	Council	Member 2008 RAE Assessment Panel for Computer Science & Information Technology Industry advisor board member for University of Lancaster 'InfoLab 21' Fellow, Wolfson College Cambridge Life Member, Cambridge University Computer Laboratory 'Cambridge Ring' alumni network	Managing Director, Microsoft Research Ltd Non-executive board member, Greater Cambridgeshire Partnership Member CBI Eastern Regional Council Managing Director, Herbert Aviation Ltd	None	Member UK Computer Science Research Committee Independent expert UK Defence Scientific Advisory Committee
Dr Sue Ion Independent	Council Chair, Fusion Advisory Board	University of Manchester – Member of board of Governors UCLAN Honorary Professor Imperial College – Visiting Professor – possible recipient of EPSRC grants and other awards	Member of AWEML Science & Engineering Technical Ctte Non Exec Director on the Board of the Health and Safety Labs of HSE	Council for Science and Technology – Policy Issues HSE HSL Policy Advice	Vice President Royal Academy of Engineering (Until Sept 08) – Possible link with EPSRC awards and policy Member of Euratom Science & Technology Ctte Royal Academy of Engineering VP (until Sept 08)
Dr Malcolm Roberts Guidance Ltd	Council	CKTP awards with Oxford University & Liverpool University CASE Award with Cambridge University; Research sponsorship Oxford University. Nottingham University DTC partner.	Managing Director, Guidance Ltd, Guidance Navigation Ltd have a collaboration and consultation with University College, London	Guidance Navigation Ltd have RDA award (East Midlands). Guidance Microwave have awards from East of England RDA	Member of Loughborough University Industry Advisory Committee and de Montfort University advisory panel.
Mr David Rutherford Parsons Brinckerhoff	Council Resource Audit Committee (From 1 October 2006)	None	None	None	None

Name	EPSRC Bodies	University interest	Industry interest	Other Government departments	Other
Professor Roy Sambles University of Exeter	Council Resource Audit Committee (From 5 April 2008)	None	CASE PhD Student with Sharp UK CASE and GWR Phd Students with Hewlett-Packard PhD Student with BAE ICASE PhD Student with Qinetiq Fully funded studentship with Omni ID	Member DSAC Advisory Board Member CENTRE Consultant Dstl Winfrith 2 ICASE PhD Student with DSTL Porton Down CASE PhD Student with DSTL Porton Down	G C Sambles – SIRCO (Son)
Professor Christopher Snowden University of Surrey	Council User Panel – Chair	Vice-Chancellor	Intense Ltd – Non-Executive Director Filtronic Plc – Part-time Executive (Corporate Advisor) Board Member of UUK (Non Executive Director) Consultant for Diamond Microwave Devices Ltd	Member of DSAC of the MoD (Defence Scientific Advisory Council)	Chair of Hero Ltd (Until Sept 08) Member of the SE Science and Technology Council Vice-President of the Royal Academy of Engineering Senior Deputy President of the IET Board Member of the ETB (Engineering Technology Board) Chair Daphne Jackson Trust
Professor Sir Martin Taylor University of Manchester	Council	None	None	None	Vice-President and Physical Secretary of the Royal Society
Professor Sir William Wakeham University of Southampton	Council, Chair, Resource Audit Committee	Vice-Chancellor (£170,000) Universities & Colleges Employers Assoc – Board Member, Chair: September 2007- Southampton University Development Trust – Trustee Worldwide University Network Group – Board Member Worldwide University Network Trading – Board Member Worldwide University Network Foundation – Trustee Research collaboration (CASE award) Schlumberger Cambridge Research	COGENT – non-executive director Southampton Asset Management Ltd – director	South East England Development Agency – Director (£7,931)	Southampton and Fareham Chamber of Commerce – Board Member Higher Education South East – Board Member
Professor Mark Welland Ministry of Defence (From 19 May 2008)	EPSRC Council	University of Cambridge Professor	None	Ministry of Defence	None
Professor Lord Robert Winston Imperial College London	Societal Issues Panel (Chair) Council RCUK Advisory Group	Professor Science & Society, Imperial College London Principal Investigator Reproductive Medicine, Imperial College London Chairman, Royal College Music Chancellor, Sheffield Hallam	Director of Atazoa Ltd – company making large transgenic animals	Member, House of Lords Science & Technology Committee	Trustee of Stem Cell Foundation



Professor David Delpy Accounting Officer
30th June 2009

REMUNERATION REPORT

Unaudited information

Remuneration policy

The remuneration of the Chief Executive of EPSRC is decided by a Remuneration Panel chaired by the Director General of Science and Research and approved by the DIUS Permanent Secretary.

EPSRC's Council has established a Remuneration Committee to assess, annually, the individual performance of the EPSRC Directors, and decide, in the light of these assessments, the remuneration they shall receive. The Committee members are the Chair of EPSRC, Chair of the Resource Audit Committee and EPSRC's Chief Executive.

The remuneration of members of EPSRC's Council is reviewed annually by the Department for Innovation, Universities and Skills (DIUS).

Details of the service contracts of the Chief Executive and Directors are given in the table below.

Directors do not have any specific contractual rights for compensation on termination of their contract as a Director.

	Contract start date	Contract end date	Notice period
Professor D Delpy, Chief Executive	1 September 2007	31 August 2011	3 months
Mrs C Coates, Director	Permanent Contract	–	3 months
Mr A Emecz, Director	Permanent Contract	–	3 months
Dr L Thompson, Director	Permanent Contract	–	3 months
Mr S Ward, Director	Permanent Contract	–	3 months

Audited information

Salary and pension entitlements

The following section provides details of the remuneration and pension interests of the Chief Executive, Directors and EPSRC Council members.

Remuneration

	2008-09 Salary £k (a)	2008-09 Performance related bonus (b)	2007-08 Salary £k (a)	2007-08 Performance related bonus (b)
Chief Executive and Directors				
Professor D Delpy, Chief Executive	135-140	To be decided	120-125	–
Dr R Richards Interim Chief Executive to 31.08.07	–	–	100-105	0-5
Mrs C Coates, Director	75-80	To be decided	75-80	0-5
Mr A Emecz, Director	60-65	To be decided	60-65	0-5
Dr L Thompson, Director	60-65	To be decided	55-60	0-5
Mr S Ward, Director	80-85	To be decided	75-80	0-5

(a) 'Salary' is per full year equivalent, includes gross salary; overtime; recruitment and retention allowances and any other allowance to the extent that it is subject to UK taxation.

(b) The Chief Executive's salary includes a responsibility allowance.

(c) Performance Related bonuses and any changes in salary are determined by the EPSRC Remuneration Committee on an annual basis. The EPSRC Remuneration Committee comprises the Chair of Council, the Chair of the Resource Audit Committee and the Chief Executive. In the case of the Chief Executive, the bonus and any change in salary are decided by a Remuneration Panel chaired by the Director General of the Research Councils and approved by the DIUS Permanent Secretary.

(d) The average annual earnings increase (excluding bonuses) for these members of staff between 2007/08 and 2008/09 was 7.0%. The figure shown in the remuneration report for 2007/08 was incorrectly stated at 9.7%. The correct figure was 1.7%.

(e) There were no benefits in kind paid to these members of staff in 2008/09.

REMUNERATION REPORT CONTINUED

Pension benefits

A Cash Equivalent Transfer Value (CETV) is the actuarially assessed capitalised value of the pension scheme benefits accrued by a member at a particular point in time. The pension figures shown relate to the benefits that the individual has accrued as a consequence of their total membership of the pension scheme, not just their service in a senior capacity. The CETV includes any lump sum payments due on retirement.

The real increase in CETV reflects the increase in CETV effectively funded by the employer. It takes account of the increase in accrued pension due to inflation, contributions paid by the employee (including the value of any benefits transferred from another pension scheme or arrangement) and uses common market valuation factors for the start and end of the period.

Chief Executive and Directors	Prof. D Delpy Chief Executive £'000	Mrs C Coates Director £'000	Mr A Emecz Director £'000	Dr L Thompson Director £'000	Mr S Ward Director £'000
Accrued pension at age 60 as at 31.03.09 or at date of leaving	75-80 with no lump sum	25-30 plus 80-85 lump sum	15-20 plus 45-50 lump sum	20-25 with no lump sum	35-40 plus 115-120 lump sum
Real increase in pension at age 60	75-80 with no lump sum	0-5 plus 0-5 lump sum	5-10 plus 0-5 lump sum	0-5 with no lump sum	0-5 plus 0-5 lump sum
CETV at 31.03.09 or at date of leaving	1,245	577	218	356	947
CETV at 31.03.08	44	524	191	290	878
Real increase in CETV	231	10	9	39	14

Council Members' remuneration

The Chairperson and the Council Members are appointed by the Department for Innovation, Universities and Skills (DIUS) on behalf of the Secretary of State for Innovation, Universities and Skills. The contract terms vary between individual members, but the terms and conditions of appointment are standard. EPSRC provides each member of Council with a Code of Practice which sets out a framework in which they are expected to operate.

Council members receive an honorarium in recognition of their service to EPSRC, together with a refund of their reasonable expenses. Council members are not employees of EPSRC and the appointments are not pensionable. Members of Council who are civil servants are not entitled to receive an honorarium.

Remuneration	2008-09 £	2007-08 £
Mr Mr J Armit, CBE, FREng (Chairperson)	16,165	15,595
Professor A Anderson, OBE	6,655	-
Mr M Carr, FREng	6,655	-
Professor L F Gladden, CBE, FRS, FREng	8,860	8,645
Mr D Hendon, CBE, FREng	-	-
Dr A Herbert, FREng	6,655	6,490
Dr S Ion, OBE, FREng	6,655	6,490
Dr M Roberts	6,655	6,490
Mr D Rutherford	6,655	6,490
Professor J R Sambles, FRS	6,655	-
Professor C M Snowden, FRS, FREng	8,965	6,490
Professor Sir Martin Taylor, FRS	6,735	6,490
Professor Sir William Wakeham, FREng	8,860	8,645
Professor M Welland, FRS, FREng (from May 2008)	-	-
Professor Lord Robert Winston	8,860	8,645



Professor David Delpy Accounting Officer
30th June 2009

STATEMENT OF ACCOUNT FOR THE FINANCIAL YEAR 2008/09

Statement of the responsibilities of the Engineering and Physical Sciences Research Council and of its Chief Executive with respect to the Financial Statements

Under Paragraph 3 of Schedule 1 to the Science and Technology Act 1965, the Secretary of State for the Department for Innovation, Universities and Skills has directed EPSRC to prepare for each financial year a Statement of Accounts in the form and on the basis set out in the Accounts Direction. The Accounts are prepared on an accruals basis and must give a true and fair view of the state of affairs of EPSRC and of its income and expenditure, recognised gains and losses and cash flows for the financial year.

In preparing the Accounts the Accounting Officer is required to comply with the requirements of the *Government Financial Reporting Manual* and in particular to:

- observe the Accounts Direction issued by the Secretary of State for the Department for Innovation, Universities and Skills, including the relevant accounting and disclosure requirements, and apply suitable accounting policies on a consistent basis;
- make judgements and estimates on a reasonable basis;
- state whether applicable accounting standards as set out in the *Government Financial Reporting Manual* have been followed, and disclose and explain any material departures in the financial statements; and
- prepare the financial statements on a going concern basis.

The Secretary of State has appointed the Chief Executive as the Accounting Officer for EPSRC. The responsibilities of an Accounting Officer, including responsibility for the propriety and regularity of the public finances for which the Accounting Officer is answerable, for keeping proper records and for safeguarding EPSRC's assets, are set out in the Accounting Officers' Memorandum, issued by HM Treasury and published in *Managing Public Money*.

Accounting Officer's Statement on Internal Control

1. Scope of responsibility

As Accounting Officer, I have responsibility for maintaining a sound system of internal control that supports the achievement of EPSRC's policies, aims and objectives, whilst safeguarding the public funds and organisational assets for which I am personally responsible, in accordance with the responsibilities assigned to me and described in *'Managing Public Money'*.

2. The purpose of the system of internal control

The system of internal control is designed to manage risk to a reasonable level rather than to eliminate all risk of failure; it can therefore only provide reasonable and not absolute assurance of effectiveness. The system of internal control is based on an ongoing process designed to identify and prioritise the risks to the achievement of organisational policies, aims and objectives, to evaluate the likelihood of those risks being realised and the impact should they be realised, and to manage them efficiently, effectively and economically. The system of internal control has been in place in EPSRC for the year ended 31st March 2009 and up to the date of approval of the Annual Report and Accounts, and it accords with Treasury guidance.

3. Capacity to handle risk

Executive Management Group

The Executive Management Group (EMG), comprising the Chief Executive and the four directors, is the executive body for EPSRC and provides leadership and guidance on risk management issues. EMG has agreed a corporate risk management policy and regularly considers risk matters at its monthly formal meeting. In particular it reviews the corporate risk register which includes any risks which are of a corporate nature and are assigned to individual directors. This register also includes any directorate and project risks which have been given a red residual risk score. Such risks are escalated to EMG which will then consider the appropriate action to take.

Business Assurance

The Head of Finance is responsible for the Business Assurance function within EPSRC, including the coordination of risk management activities. These activities cover: provision of advice and guidance to directorates; organising training courses; reviewing quarterly reports from the directorates and business critical projects; providing commentaries to EMG; representing EPSRC at meetings of the RCUK Risk Management Network and liaising with internal audit on its audit activities.

Performance and Risk Management System

EPSRC implemented the Performance and Risk Management (PRM) System in 2006. PRM is based on the balanced scorecard model and brings together performance measures, actions and risk under EPSRC objectives. The Communications and Information directorate maintains the PRM system and provides reports on both Performance and Risk to EMG and directorate management.

Management of risk

EPSRC implemented the Management of Risk (MoR) framework in April 2007. MoR is a framework promulgated by the Office of Government Commerce (OGC) which creates a structured approach to risk management.

Staff training

All staff undergo an induction process that involves a risk awareness element, familiarising them with the need for risk management activities within the Council. Mandatory seminars on risk management are held for all new staff. Further training is provided for the owners of risks and of mitigation plans on how to identify, evaluate, monitor and control risks.

EPSRC risk register is accessible to all staff through the PRM intranet site. Other documents, such as EPSRC risk policy, are linked to PRM. The *'Research Councils' Internal Audit Service Good Practice Bulletin on Risk Management* is also available for guidance.

If it is decided by a line manager or director that an individual requires formal training in risk management (perhaps as a result of responsibility for one or more major risks) then this can be undertaken.

4. The risk and control framework

The Council of EPSRC

The Council of EPSRC has a responsibility to ensure that high standards of corporate governance are observed at all times. The Council periodically receives information about risk management. It also receives a report at each meeting and an annual report from the Resource Audit Committee which includes comment on risk management and business-critical projects. The Council has responsibility for decisions on major capital projects after having reviewed the business case and the risks involved in the venture.

Accounting Officer's Statement on Internal Control continued

The Resource Audit Committee

The Resource Audit Committee (RAC) is a committee of the Council tasked with monitoring standards of internal control and propriety, economy, efficiency and effectiveness, and for evaluating the extent to which systems and procedures are appropriate to allow EPSRC's objectives to be met. RAC's responsibilities include: examining the manner in which management ensures and monitors the adequacy of the nature, extent and effectiveness of internal control systems; paying particular attention to risks and contingency plans on all business-critical projects; and monitoring the nature and scope of the work of Internal Audit. RAC makes recommendations to EMG and reports to the Council following its meetings.

Directors and Directorates

EMG delegates responsibility for each of the corporate risks to one or more of the directors. Each director bears a responsibility for these and the risks associated with his/her directorate's activities. A director may choose to delegate responsibility for the day to day management of risk and associated mitigation or contingency plans to a member of the directorate staff.

The directors and their senior managers review the risk register for their own directorate on a regular basis: to consider new risks or new elements to an existing risk; for changes in status (changes in the likelihood of occurrence or in the impact that would be felt should the risk be realised) as a result of factors internal or external to the Council; for progress in mitigating risks; to determine whether or not the existing controls are adequate; and to determine whether further actions are required.

In addition proposed projects or initiatives are considered at an early stage to assess the potential risks and to determine the balance of benefits and risks. The relevant director or delegated staff member will then make a decision on whether or not to proceed, or will seek a decision from EMG.

Each directorate has an individual responsible for co-ordinating risk management activities.

Research Councils' Internal Audit Service

The Research Councils Internal Audit Service (RCIAS) and EMG work together to agree the range of audits to be carried out each year. RAC confirms the annual audit plan. The results of these audits are used by EMG in its decision-making on what actions are necessary to maintain high standards in EPSRC's corporate governance and risk management procedures.

The RCIAS carries out audits relevant to EPSRC's risk management activities on a regular basis. In 2008/09 audits included: Readiness for the SSC project (three separate reviews); Financial planning and budgeting; Management information.

In addition to the advice resulting from audits, Internal Audit guidance is welcomed as a source of updated best practice.

Controls

EPSRC has in place a system of controls which includes:

- annual Directors' Internal Control Statements;
- Programme Funding Assurance (FAP) visits by officials to Higher Education Institutions and office-based tests. The objective of these visits is to obtain assurance that research grant funds are used for the purpose for which they are given and that grants are managed in accordance with the terms and conditions under which they are awarded;
- ongoing review of risks and the necessary resulting actions;
- responsibility for managing risks delegated to the appropriate level within the organisation;
- regular management review of risks and business-critical projects;
- regular external review of risk management procedures.

At present EPSRC has one project designated as business-critical – the Shared Services Centre (SSC) project.

The SSC project will deliver a shared administrative support service for all UK Research Councils. Initially RCUK Shared Services Centre Ltd (SSC Ltd), the separate legal entity which will operate the shared service, will provide HR, Finance, Procurement and IS services but it is also planned to add Grants Processing. This project is business critical for EPSRC because it changes the way in which back-office services are provided by outsourcing them to the SSC Ltd.

The SSC project operates across all seven Councils and is directed by a Project Board comprised of representatives of each Council, SSC Ltd and a number of independent members. The Board is chaired by the Chair of the RCUK Executive Group. The principal risk for the project, and therefore for the seven Councils, is the potential for cost and time overruns and this is

**Accounting Officer's
Statement on Internal
Control continued**

a clear focus for the Project Board. Recently an exercise took place to review the timetable and costs for the whole project. The Project Board has now agreed a revised implementation plan which maintains the overall timetable and includes measures designed to control project costs.

As a stakeholder in this project EPSRC has its own group which manages its participation and associated risks in the project. The high level risks and mitigation strategies are scrutinised by EMG on a regular basis. Governance arrangements are also monitored by RAC.

5. Review of effectiveness

As Accounting Officer I have responsibility for reviewing the effectiveness of the system of internal control. My review of the effectiveness of the system of internal control is informed by the work of the internal auditors and the executive managers within EPSRC who have responsibility for the development and maintenance of the internal control framework, together with comments made by the external auditors in their Management Letter and other reports. I have been advised on the implications of the result of my review of the effectiveness of the system of internal control by the Council and RAC. A plan to address weaknesses and ensure continuous improvement of the system is in place.

The internal control system provides confidence that the risk is managed to a reasonable level and I can provide assurance that it supports the achievement of EPSRC's policies, aims and objectives.



Professor David Delpy Accounting Officer
30th June 2009

The Certificate and Report of the Comptroller and Auditor General to the Houses of Parliament

I certify that I have audited the financial statements of the Engineering and Physical Sciences Research Council for the year ended 31 March 2009 under the Science and Technology Act 1965. These comprise the Statement of Net Expenditure, the Balance Sheet, the Cashflow Statement, Statement of Recognised Gains and Losses, and the related notes. These financial statements have been prepared under the accounting policies set out within them. I have also audited the information in the Remuneration Report that is described in that report as having being audited.

Respective responsibilities of the Council, Chief Executive and Auditor

The Council, and Chief Executive as Accounting Officer, are responsible for preparing the Annual Report, which includes the Remuneration Report and the Financial Statements, in accordance with the Science and Technology Act 1965 and Secretary of State for Innovation, Universities and Skills directions made thereunder and for ensuring the regularity of financial transactions. These responsibilities are set out in the Statement of Council and Chief Executive's Responsibilities.

My responsibility is to audit the financial statements and the part of the Remuneration Report to be audited in accordance with relevant legal and regulatory requirements, and with International Standards on Auditing (UK and Ireland).

I report to you my opinion as to whether the financial statements give a true and fair view and whether the financial statements and the part of the Remuneration Report to be audited have been properly prepared in accordance with the Science and Technology Act 1965 and Secretary of State for the Department of Innovation, Universities and Skills directions made thereunder. I report to you whether, in my opinion, information given within the Corporate Activities section of the Management Commentary included within the Annual Report is consistent with the financial statements. I also report whether in all material respects the expenditure and income have been applied to the purposes intended by Parliament and the financial transactions conform to the authorities which govern them.

In addition, I report to you if the Engineering and Physical Sciences Research Council has not kept proper accounting records, if I have not received all the information and explanations I require for my audit, or if information specified by HM Treasury regarding remuneration and other transactions is not disclosed.

I review whether the Statement on Internal Control reflects the Engineering and Physical Sciences Research Council's compliance with HM Treasury's guidance, and I report if it does not. I am not required to consider whether this statement covers all risks and controls, or form an opinion on the effectiveness of the Engineering and Physical Sciences Research Council's corporate governance procedures or its risk and control procedures.

I read the other information contained in the Annual Report and consider whether it is consistent with the audited financial statements. This other information comprises the other sections of the Management Commentary, the unaudited part of the Remuneration Report, the Chief Executive's Introduction and the Chairman's Foreword. I consider the implications for my report if I become aware of any apparent misstatements or material inconsistencies with the financial statements. My responsibilities do not extend to any other information.

Basis of audit opinion

I conducted my audit in accordance with International Standards on Auditing (UK and Ireland) issued by the Auditing Practices Board. My audit includes examination, on a test basis, of evidence relevant to the amounts, disclosures and regularity of financial transactions included in the financial statements and the part of the Remuneration Report to be audited. It also includes an assessment of the significant estimates and judgments made by the Council and Accounting Officer in the preparation of the financial statements, and of whether the accounting policies are most appropriate to the Engineering and Physical Sciences Research Council's circumstances, consistently applied and adequately disclosed.

I planned and performed my audit so as to obtain all the information and explanations which I considered necessary in order to provide me with sufficient evidence to give reasonable assurance that the financial statements and the part of the Remuneration Report to be audited are free from material misstatement, whether caused by fraud or error and that in all material respects the expenditure and income have been applied to the purposes intended by Parliament and the financial transactions conform to the authorities which govern them. In forming my opinion I also evaluated the overall adequacy of the presentation of information in the financial statements and the part of the Remuneration Report to be audited.

Opinions

In my opinion:

- the financial statements give a true and fair view, in accordance with the Science and Technology Act 1965 and directions made thereunder by the Secretary of State for the Department for Innovation, Universities and Skills, of the state of the Engineering and Physical Sciences Research Council's affairs as at 31 March 2009 and of its net expenditure, recognised gains and losses and cash flows for the year then ended;
- the financial statements and the part of the Remuneration Report to be audited have been properly prepared in accordance with the Science and Technology Act 1965 and Secretary of State for the Department for Innovation, Universities and Skills directions made thereunder; and
- information which comprises the Corporate Activities section of the Management Commentary included within the Annual Report is consistent with the financial statements.

Opinion on Regularity

In my opinion, in all material respects the expenditure and income have been applied to the purposes intended by Parliament and the financial transactions conform to the authorities which govern them.

Report

I have no observations to make on these financial statements.

Amyas CE Morse

Comptroller and Auditor General
8th July 2009

National Audit Office
151 Buckingham Palace Road
Victoria, London SW1W 9SP

STATEMENT OF ACCOUNT CONTINUED

Statement of net
expenditure
for the year ended
31st March 2009

	Notes	2009 £'000	2008 £'000
EXPENDITURE			
Research	6	507,343	485,803
Energy Technologies Institute LLP	7	3,295	481
Public Engagement Programme	8	7,467	4,167
UK research facilities	9	14,426	26,903
International subscriptions	10	540	339
Postgraduate awards	11	175,907	165,368
Research Fellowships	12	52,514	45,047
Staff costs	13	14,710	13,319
Other operating expenditure	14	19,822	15,185
Total operating expenditure		796,024	756,612
INCOME			
Other operating income	4	3,523	4,708
Total operating income		3,523	4,708
NET OPERATING EXPENDITURE		792,501	751,904
Non-operating income	5	(11)	(89)
Amounts payable to the Consolidated Fund	5	12	89
Notional cost of capital (credit)	21	(239)	(857)
NET EXPENDITURE FOR THE YEAR		792,263	751,047
Reversal of notional cost of capital	21	239	857
NET EXPENDITURE FOR THE YEAR AFTER REVERSAL OF NOTIONAL COST OF CAPITAL		792,502	751,904

All activities are continuing.
The notes on pages 73 to 84 form part of these Accounts.

STATEMENT OF ACCOUNT CONTINUED

Balance sheet
as at 31st March 2009

	Notes	2009 £'000	2008 £'000
FIXED ASSETS			
Tangible fixed assets	15	24,269	33,960
Investments	16	651	–
		24,920	33,960
CURRENT ASSETS			
Debtors	17	58,698	36,909
Cash at bank and in hand	18	4,836	6,546
		63,534	43,455
CREDITORS DUE WITHIN ONE YEAR			
	19	(78,954)	(88,793)
Net current liabilities		(15,420)	(45,338)
Total assets less current liabilities		9,500	(11,378)
CREDITORS DUE AFTER MORE THAN ONE YEAR			
	20	(220)	(290)
PROVISION FOR LIABILITIES			
	22	(326)	(316)
NET ASSETS/(LIABILITIES)		8,954	(11,984)
CAPITAL AND RESERVES			
Revaluation reserve	23	489	2,566
Income and expenditure reserve	23	8,465	(14,550)
Surplus/(Deficit) on Government Funds	23	8,954	(11,984)

The notes on pages 73 to 84 form part of these Accounts.



Professor David Delpy Accounting Officer
30th June 2009

STATEMENT OF ACCOUNT CONTINUED

Cash flow statement
for the year ended
31st March 2009

	Notes	2009 £'000	2008 £'000
CASH FLOW STATEMENT			
Net cash outflow from operating activities		(814,394)	(738,408)
Capital expenditure:			
Payments to acquire fixed assets	15, 16	(2,351)	(25,494)
Net cash outflow before financing		(816,745)	(763,902)
Financing:			
Grant-in-Aid received	3, 23	784,870	739,499
From other Research Councils	23	15,446	15,429
From Government departments, executive agencies and EU	23	7,454	5,880
From other bodies	23	7,265	7,427
(DECREASE)/INCREASE IN CASH	18	(1,710)	4,333
RECONCILIATION OF NET OPERATING EXPENDITURE BEFORE FINANCING TO NET CASH OUTFLOW FROM OPERATING ACTIVITIES			
Net operating expenditure		(792,502)	(751,904)
Depreciation charge/losses on disposal of assets	14	9,969	5,685
Increase in debtors	17	(21,789)	(14,752)
(Decrease)/Increase in creditors	19	(10,082)	22,247
Increase in provisions	22	10	316
Net cash outflow from operating activities		(814,394)	(738,408)
RECONCILIATION OF NET CASH FLOW TO MOVEMENT IN NET FUNDS			
Cash at 1st April		6,546	2,213
(Decrease)/Increase in cash in year	18	(1,710)	4,333
Cash at 31st March	18	4,836	6,546

Statement of
recognised gains
and losses
for the year ended
31st March 2009

		2009 £'000	2008 £'000
Loss/gain on revaluation of fixed assets in the year	15	(1,594)	357

The notes on pages 73 to 84 form part of these Accounts.

NOTES TO THE ACCOUNTS

1. Accounting policies

(a) Accounting convention

These Accounts have been prepared under the historical cost convention, adjusted to include the revaluation of certain fixed assets, complying with the Accounts Direction of 27th November 2001 given by the Secretary of State for the Department for Innovation, Universities and Skills (DIUS), in accordance with section 2(2) of the Science and Technology Act 1965.

The Accounts conform, in so far as is practicable and appropriate, with the Accounting Standards, Companies Acts, Financial Reporting Manual and specific Treasury guidance.

(b) Going concern

The Balance Sheet at 31st March 2009 shows net assets of £9m. In addition, note 24 shows costs to completion of £2,140m arising from research and training grants already committed. This reflects the inclusion of liabilities falling due in future years which, to the extent that they are not to be met from EPSRC's other sources of income, may only be met by future grants or Grant-in-Aid from EPSRC's sponsoring department, the Department for Innovation, Universities and Skills (DIUS). This is because, under the normal conventions applying to parliamentary control over income and expenditure, such grants may not be issued in advance of need.

Grant-in-Aid for 2009/10, taking into account the amounts required to meet EPSRC's liabilities falling due in that year, has already been included in the Department's Estimates for that year, which have been approved by Parliament.

The negative balance sheet in 2007/08 essentially reflected a timing difference between recognising a liability in our accounts and the subsequent receipt of Grant in Aid to meet this liability. A letter of comfort was not issued by DIUS as they fully expected the recorded deficit on the Income and Expenditure Reserve to be extinguished over time, having regard to the resource and capital budgets to which EPSRC can be expected to have access. In 2008/09 EPSRC's balance sheet was positive and it has accordingly been considered appropriate to adopt a going concern basis for the preparation of these financial statements.

(c) Fixed assets and depreciation

Capital expenditure includes the purchase of land and/or buildings, construction and services projects, and equipment valued at £3,000 or more. Individual items valued at less than the threshold are capitalised if they constitute integral parts of a composite asset that is in total valued at more than the threshold. Individual items valued at less than the threshold and not forming part of a composite asset are not capitalised.

Tangible fixed assets are included at cost or at valuation. The basis of valuation is Open Market Value for existing use, where this can be established, and Current Depreciated Replacement Cost in all other cases.

Land and Buildings and major items of equipment are professionally valued at least every five years, at which time the remaining useful life of each revalued asset is also reassessed. The last valuation was in January 2006, conducted by Powis Hughes and Associates, Chartered Surveyors. The basis of the valuation was Open Market Value. Appropriate indices are used in between formal professional valuations. In 2008/09 EPSRC applied a revised index used to revalue land and buildings in a consistent manner with the other Research Councils on the Polaris House site. This has had the effect of reducing the value of this asset.

Surpluses or deficits on revaluation are taken to the Revaluation Reserve, except that any permanent diminution in value is charged to the Statement of Net Expenditure in the year in which it arises.

Increased depreciation charges arising from the revaluation are matched by annual transfers from the Revaluation Reserve to the Income and Expenditure Reserve. On the disposal of a fixed asset, that element of the Revaluation Reserve which thereby becomes realised is transferred directly to the Income and Expenditure Reserve.

Tangible fixed assets are depreciated at rates calculated to write off the costs or the valuation of each asset evenly over its expected useful life, as follows:

Freehold land	not depreciated
Freehold buildings	62 years
Specialist scientific equipment	3 – 15 years
IT equipment	3 years
Software (third party licences)	the lesser of 5 years or the term of the licence
Software (not third party licences)	5 years
Fixtures and fittings	5 years
General office equipment	5 years
Vehicles	4 years

Assets in the course of construction are not depreciated until the asset is brought into use.

(d) Ownership of equipment purchased with EPSRC research grants

Equipment purchased by an organisation with research grant funds supplied by EPSRC belongs to the organisation and is not included in EPSRC's fixed assets. Through the Conditions of Grant applied to funded organisations, EPSRC must be informed if, during the life of the research grant, the need for the equipment diminishes substantially or it is not used for the purpose for which it was funded. EPSRC reserves the right to determine the disposal of such equipment and to claim the proceeds of any sale.

(e) Equipment located elsewhere

EPSRC owns assets with a combined net book value of £15.9m which are located on premises owned by other organisations but are included in the Balance Sheet.

This figure includes the HECToR supercomputing facility, which came into operation in October 2007. At the balance sheet date the combined net book value of assets held at the facility in Edinburgh was £13.9m (2007/08 £21.2m).

A pool of scientific equipment is provided and updated by the Science and Technology Facilities Council (STFC) on behalf of EPSRC, specifically for loan to research organisations. Wherever located, this equipment remains the property of EPSRC and is therefore included in the Balance Sheet.

(f) Grant-in-Aid

Grant-in-Aid received for revenue purposes has been regarded as a contribution from a controlling party giving rise to a financial interest in the organisation. Hence, Grant-in-Aid has been accounted for as financing, not income i.e. credited to the Income and Expenditure Reserve rather than being recognised in the Income and Expenditure Account for the year. The same treatment has been adopted for other sources of financing. Grant-in-Aid for capital purposes is only credited to the Government Grant Reserve if it is for the purchase of a specific asset, with all other Grant-in-Aid credited to the Income and Expenditure Reserve.

(g) Research and development

As a research organisation, all EPSRC's research and development expenditure is charged to the Statement of Net Expenditure when it is incurred. Intellectual property rights arising from research and development funded by EPSRC are passed to the organisations performing the research.

(h) Foreign exchange

Transactions denominated in foreign currencies are translated into sterling at the rate of exchange ruling at the date of transactions. Any exchange differences arising in the ordinary course of business are taken to the Statement of Net Expenditure. Assets and liabilities in foreign currencies in existence at the balance sheet date are translated at the rates ruling at that date.

(i) Research grants

Subject to the terms and conditions under which research grants are awarded, EPSRC makes payments for grants on the basis of pre-determined quarterly profiles. Profiles are arranged, in overall terms, to reflect the rate and incidence of expenditure at the grant holding organisation. Payments are normally made in the period to which they relate, although EPSRC retains some latitude in timing. Grant expenditure is accounted for on an accruals basis to reflect the usage of grant funds on work carried out. Future commitments at the balance sheet date are disclosed in note 24.

(j) Value Added Tax

As EPSRC is partially exempt for VAT purposes, all items of expenditure and fixed asset purchases are shown inclusive of VAT where applicable. Residual input tax reclaimed under the partial exemption scheme is taken to the Statement of Net Expenditure as other income.

(k) Superannuation schemes

The employees of the council are members of the Research Councils' Pension Schemes (RCPS) which are defined benefit schemes funded from annual grant-in-aid on a pay as you go basis. The benefits are by analogy to the Principal Civil Service Pension Scheme, except that while the schemes provide retirement and related benefits based on final emoluments, redundancy and injury benefits are administered and funded by the council.

The scheme is administered by the Research Councils' Joint Superannuation Services with the associated grant-in-aid managed by the Biotechnology and Biological Sciences Research Council (BBSRC). The schemes' accounts are prepared by BBSRC, on behalf of the BBSRC Chief Executive as the Accounting Officer for the RCPS. A separate Account is published for the Pension Schemes. Employees' contributions to the scheme vary between 1.5% and 3.5%. The employer's contribution is agreed by the RCPS Board of Management on the recommendation of the Government Actuary's

Department and is currently set at 21.3% of pensionable pay.

The RCPS is an unfunded multi-employer defined benefit scheme. The council is unable to identify its share of the underlying assets and liabilities of the scheme on a consistent and reasonable basis and therefore, as required by FRS 17 'Retirement benefits', accounts for the scheme as if it were a defined contribution scheme. As a result, the amount charged to the Statement of Net Expenditure account represents the contributions payable to the scheme in respect of the accounting period. The actuarial valuation was carried out as at 31 March 2006 by a qualified independent actuary. The draft report is available and discussions have commenced about a possible increase in the employer contribution rate to 26% from 21.3% effective from 1 April 2010. The employers' contribution rate of 21.3% therefore applies to these accounts. The full actuarial valuation is carried out every 4 years, with the next valuation calculated as at 31 March 2010. Details are available in the accounts of the RCPS, which can be found at www.bbsrc.ac.uk.

For 2008/2009, employer's contributions of £1,893,080 were payable to the RCPS (2007/08 £1,631,594) at 21.3% of pensionable pay, based on the salary bands. Employer contributions are to be reviewed every three years following a full scheme valuation by the Government Actuary. The contribution rates reflect benefits as they are accrued, not when the costs are actually incurred, and reflect past experience of the scheme.

One EPSRC member of the RCPS retired on ill health grounds during 2008/09.

(l) Notional cost of capital

In line with HM Treasury requirements, EPSRC has included a non-cash credit in respect of cost of capital charged at 3.5% (2007/08 3.5%).

(m) Provisions

Provisions have been made in accordance with FRS 12 for redundancy costs and system termination fees arising from the transition to the Shared Services Centre. See note 22 for further details.

(n) Other operating Income

Other operating income is recognised on a receivable basis and mainly represents income from other Research Councils for services provided.

(o) Investments

Investments are stated at cost less any provision for impairment.

2. Financial instruments

FRS 25, 'Financial Instruments: Disclosure and Presentation', FRS 26, 'Financial Instruments: Measurement, Recognition and Derecognition' and FRS 29, 'Financial Instruments: Disclosures' were introduced on 1 April 2008. They require disclosure of the role which financial instruments have had during the year in creating or changing the risks an entity faces in undertaking its activities. Because of the largely non-trading nature of its activities and the way in which EPSRC is financed, EPSRC is not exposed to the degree of financial risk faced by business entities. Moreover, financial instruments play a much more limited role in creating or changing risk than would apply to a non-public sector body of a similar size. EPSRC's financial assets and liabilities are generated by day-to-day operational activities and are not held to change the risks facing EPSRC in undertaking its activities. The introduction of the new standards have required no adjustments to EPSRC's accounts.

Liquidity risk

EPSRC's net revenue resource requirements are financed by resources voted annually by Parliament, as is its capital expenditure. EPSRC is not therefore exposed to significant liquidity risks. As described in Note 1(b), EPSRC is dependent on funding from the Department for Innovation Universities and Skills to meet liabilities falling due in future years, but there is no reason to believe that this funding will not be forthcoming.

Interest-rate risk

None of EPSRC's financial assets or liabilities is subject to interest and EPSRC is not therefore exposed to interest-rate risk.

Currency profile

At the balance sheet date EPSRC held no significant foreign currency assets or liabilities.

Foreign currency risk

EPSRC's exposure to foreign currency risk is not significant. Foreign currency expenditure and income during 2008/09 were negligible.

3. Parliamentary Grant-in-Aid

The grant of £784.9m (2007/08 £739.5m) was provided under the Department for Innovation Universities and Skills Request for Resources 2 for the financial year 2008/09.

4. Other operating income

	2009 £'000	2008 £'000
Income for services provided	3,523	4,708
Total other operating income	3,523	4,708

5. Non-operating income

	2009 £'000	2008 £'000
Unanticipated receipts this financial year relating to amounts paid or claims registered in previous year	11	89
Unanticipated receipts carried over from previous year	1	–
Total payable to Consolidated Fund Extra Receipts (CFER)	12	89

In February 2007 EPSRC opened an ESCROW account in order to facilitate the implementation of the HECToR facility. Interest credited to this account was surrendered as CFER. This account was closed in December 2008.

6. Research

Total gross expenditure on research grants shown by programme:

	2009 £'000	2008 £'000
Nanoscience	2,802	–
Next Generation Healthcare	3,710	–
Digital Economy	4,098	–
Energy Multidisciplinary Applications	532	–
Energy Research Capacity	63,899	42,198
Knowledge Transfer	13,501	4,286
Infrastructure and International	49,499	44,639
Mathematical Sciences & Public Engagement	15,727	14,172
Cross Disciplinary Research	49,359	63,958
Materials Mechanical & Medical Engineering	73,600	72,292
Information & Communication Technology	84,151	83,015
Physical Sciences	97,858	101,583
Process Environment & Sustainability	28,240	33,147
User Led Knowledge and Skills	20,367	26,513
Total expenditure on research	507,343	485,803

Gross expenditure on the Energy Research Capacity programme is inclusive of £30.6m (2007/08 £19.1m) with regard to Fusion.

7. Energy Technologies Institute LLP

Energy Technologies Institute LLP (ETI LLP) was established in 2008 as a joint initiative between the public and private sectors to encourage research and investment in new and emerging energy technologies.

ETI LLP has been established with the aim to accelerate the development, demonstration and eventual commercial deployment of a focused portfolio of energy technologies which will increase energy efficiency, reduce greenhouse gas emissions and help achieve energy and climate change goals.

EPSRC and the Technology Strategy Board (TSB) represent the public sector's 50% interest in the partnership. The Secretary of State for Innovation, Universities and Skills is a designated member of ETI LLP but EPSRC and TSB are responsible for providing the member's contributions on behalf of DIUS.

EPSRC has made payments of £3.3m (2007/08 £481k) to ETI LLP which have been expensed as EPSRC itself does not have an investment in ETI LLP.

8. Public Engagement Programme

	2009 £'000	2008 £'000
PEP Awards	2,148	2,839
PEP Fellowships	319	280
PEP Additional Programme Expenditure	5,000	1,048
Total expenditure on PEP	7,467	4,167

EPSRC has a Public Engagement Programme (PEP) for its research grant holders and Fellows. PEP Additional Programme Expenditure in 2008/09 includes payments totalling £4.7m made on behalf of Research Councils UK.

9. UK Research facilities

	2009 £'000	2008 £'000
High Performance Computing:		
University of Edinburgh (HPCx)	2,439	7,397
University of Edinburgh (HECToR)	6,324	12,796
Total High Performance Computing	8,763	20,193
Science and Technology Facilities Council facilities	3,292	3,412
Other Expenditure on Research Facilities	2,371	3,298
Total Expenditure on UK Research Facilities	14,426	26,903

EPSRC provides facilities to enable world-class research. HECToR, a high end computing facility, was introduced in October 2007. At the balance sheet date, EPSRC held assets with a combined net book value of £13.9m at the HECToR facility.

10. International subscriptions

Total amounts paid in the year for current operations:

	2009 £'000	2008 £'000
European Science Foundation (ESF)	258	179
ITER (International Fusion Research)	122	–
Institute des Hautes Etudes Scientifiques (IHES)	160	160
	540	339

11. Postgraduate awards

	2009 £'000	2008 £'000
Collaborative Training Accounts	59,100	48,739
Doctoral Training Grants	76,229	78,072
Dorothy Hodgkin Postgraduate Awards	7,581	7,700
International Doctoral Scholarships	1,455	1,718
LSI Doctoral Training Centres	12,317	7,534
Roberts Skills Training	13,703	12,837
Other Awards	5,522	8,768
Total expenditure on Postgraduate Awards	175,907	165,368

EPSRC acts as a manager for the Dorothy Hodgkin Awards on behalf of Research Councils UK (RCUK). Funding toward Dorothy Hodgkin Awards is provided by the Research Councils and by industrial collaborators.

Roberts Skills Training is not an EPSRC Postgraduate Award; rather it is expenditure to deliver enhanced training for postgraduate and postdoctoral award holders. Roberts Skills Training expenditure has been separated out to reflect the significant level of expenditure.

12. Research Fellowships

	2009 £'000	2008 £'000
Academic	18,890	17,803
Advanced	16,300	14,998
European Young Investigator (EURYI)	701	799
Post-Doctoral	7,753	6,019
Senior	2,937	2,177
Other Fellowships	5,933	3,251
Total expenditure on Research Fellowships	52,514	45,047

13. Staff

(a) Staff costs

	2009 £'000	2008 £'000
Salaries and Wages		
Permanent Staff	9,251	8,076
Agency Staff & Contract Personnel	2,450	2,387
Social Security Costs	656	575
Other Pension Costs	1,983	1,720
Council and Panel Members' Fees and Honoraria	401	473
Current staff costs	14,741	13,231
Net early retirement costs (see note (b) below)	(31)	88
Total expenditure on staff costs	14,710	13,319

(b) Staff early retirement costs

Staff Early Retirement costs are negative due to an over provision in previous years.

(c) Staff numbers

Average numbers of full-time equivalent employees during the year:

	2009	2008
Senior Management	47	43
Managerial and Supervisory	193	185
Administrative Support	89	90
Average number of staff employed	329	318
Contract staff	28	31
Agency staff	10	5
Total average number of staff	367	354

Staff numbers in 2008/09 include 21 staff (2007/08 20) who are employed by EPSRC but are on secondment to the RCUK Shared Services Centre.

(d) Remuneration of senior employees

The following numbers of senior employees, including Directors, received remuneration falling within the ranges shown:

Full year equivalent remuneration	2009	2008
£100,000 and above	1	2
£90,000 – £99,999	1	1
£80,000 – £89,999	1	1
£70,000 – £79,999	1	1
£60,000 – £69,999	3	2
£50,000 – £59,999	9	12

(e) Remuneration of Council and Panel Members

The total emoluments of the Chairperson, Mr John Armitt, were £16,165 (2007/08 £15,595) including taxable benefits.

The standard honorarium paid to Council members was £6,740 (2007/08 £6,570).

The standard daily attendance allowance paid to Panel members was £160 (2007/08 £160).

	No	2009 £'000	No	2008 £'000
Council Members' annual honoraria:				
£5,001 to £10,000	12	89	12	84
Daily Attendance Fees paid to Panel Members		195		373
Social Security Costs		5		5
		289		462
Chairman's Emoluments		16		16
Total expenditure on Council and Panel Members		305		478

14. Other operating expenditure

	2009 £'000	2008 £'000
Services	5,720	6,049
Travel and Subsistence	1,855	1,969
Equipment and Supplies	217	238
Consultancies	610	442
External Auditors' Remuneration	98	40
Rent, Rates and Maintenance	741	427
General Administration	604	318
Write-offs and Recoveries	8	17
Depreciation and Loss on Disposal of Assets	9,969	5,685
Total other operating expenditure	19,822	15,185

External Auditors' Remuneration is comprised of £93k relating to the audit of the year end accounts and £5k for audit work relating to the introduction of International Financial Reporting Standards. Of this, £25k relates to work carried out in the 2007/08 financial year. EPSRC's statutory audit fee has increased as a result of hosting the SSC project. There has been no remuneration for non-audit services.

15. Fixed assets

	Freehold land & buildings £'000	Assets in the course of construction £'000	Office & scientific equipment £'000	Totals £'000
Valuation				
Balance as at 1st April 2008	8,518	1,294	35,936	45,748
Additions (see note below)	–	1,804	69	1,873
Transfer of constructed assets	–	–	–	–
Revaluation for year	(2,334)	–	(375)	(2,709)
Disposals	–	–	(1,128)	(1,128)
Valuation at 31st March 2009	6,184	3,098	34,502	43,784
Depreciation				
Balance as at 1st April 2008	3,233	–	8,555	11,788
Charge for the year	95	–	9,854	9,949
Revaluation adjustments	(886)	–	(229)	(1,115)
Disposals	–	–	(1,107)	(1,107)
Depreciation at 31st March 2009	2,442	–	17,073	19,515
Net book value:				
at 31st March 2009	3,742	3,098	17,429	24,269
at 1st April 2008	5,285	1,294	27,381	33,960

These assets are funded solely from Grant-in-Aid

The asset in course of construction represents EPSRC's agreed share (8.24%) of the capital costs to date of the Research Councils UK Shared Services Centre.

Included in Freehold Land and Buildings is £697k (2007/08 £960k) in respect of Freehold Land which is not depreciated.

The last professional valuation of land and buildings was in January 2006, conducted by Powis Hughes and Associates, Chartered Surveyors. The basis of the valuation was Open Market Value for existing use. The valuation was made in accordance with RICS Appraisal and Valuation Manual. Between formal professional valuations appropriate indices are used.

16. Investment assets

	2009 £	2008 £
Shared Service Centre 'A' Shares	1	1
Shared Service Centre 'B' Shares	650,960	–
Total investment	650,960	1

During the year, EPSRC added to its investment in the RCUK Shared Services Centre Ltd (SSC) through the acquisition of B shares. B shares convey ownership rights to the holder, including any distributions or proceeds from sale of the SSC. The seven Research Councils each acquired an 'A' share, carrying a vote per share, in 2007/08. The RCUK Shared Services Centre Ltd was incorporated on 1 August 2007 and has been operating a shared service centre, delivering services to the Research Councils, since May 2008. For the period ending 31 March 2009, the draft financial statements for the company show a loss of £1.4m against a turnover of £25.8m. The balance sheet totals are £7 'A' Shares and £7,900,000 'B' Shares issued to the Research Councils, and £7.1m cash.

As no Research Council owns more than 21% of the issued share capital, the investment has been classified as "Other investment".

NOTES TO THE ACCOUNTS CONTINUED

17. Debtors

	2009 £'000	2008 £'000
Debtors:		
Other Central Government Bodies	44,126	19,839
Public Corporations and Trading Funds	26	–
Debtors held in Escrow	–	34
Other Debtors	2,916	4,460
Prepayments and accrued income:		
Other Central Government Bodies	4,727	2,721
Public Corporations and Trading Funds	–	873
Other Prepayments and Accrued Income	6,903	8,982
Total debtors	58,698	36,909

Other Central Government Bodies includes the sum of £34.5m (2007/08 £14.4m) relating to amounts owing by other Research Councils in respect of the cost of SSC assets in the course of construction. Other Debtors includes £146k (2007/08 £143k) relating to debtors due after more than one year.

18. Cash at bank and in hand

	2009 £'000	2008 £'000
Office of the Paymaster General (OPG) Account Balance	4,826	6,470
Commercial Account Balance	10	76
Total cash at bank and in hand	4,836	6,546

19. Creditors due within one year

	2009 £'000	2008 £'000
Creditors:		
Other Central Government Bodies	–	389
Other Creditors	13,526	5,188
Accrued expenditure:		
Other Central Government Bodies	1,407	6,291
Other Accrued Expenditure	57,655	68,675
Deferred income:		
Other Central Government Bodies	1,503	1,662
Other Deferred Income	4,863	6,588
Total creditors	78,954	88,793

20. Creditors due after more than one year

	2009 £'000	2008 £'000
Early retirement costs	220	290

21. Notional cost of capital

	2009 £'000	2008 £'000
Notional cost of capital	239	857

EPSRC is not funded for interest-bearing debts, but to ensure that the Statement of Net Expenditure bears an appropriate charge for the use of capital employed, a notional interest charge has been included.

In accordance with HM Treasury guidance, the cost of capital is calculated as 3.5% (2007/08 3.5%) of the average of net assets or liabilities during the year. Because the average of the net assets of EPSRC are negative, the cost of capital is a credit rather than a charge, and has been included in the Statement of Net Expenditure.

22. Provisions for liabilities

	2009 £'000	2008 £'000
Shared Services Centre Development		
Contribution to other Research Councils' severance costs	241	234
Contribution to system termination charges	85	82
Total provision	326	316

The Research Councils and the Research Councils UK Shared Services Centre Ltd are in the process of developing a Shared Service Centre to carry out the central functions of HR, Finance and IT across the Research Councils. As a result some research councils will incur redundancy costs, particularly where existing staff live a distance away from Swindon where the Centre is situated.

The Research Councils have collectively agreed that they will be jointly liable for all necessary redundancies. The Councils calculated their likely redundancy liabilities in order to make a 2007/08 provision, and have updated this as at 31st March 2009. A funding allocation model was developed and agreed by all the Research Councils and this identified the proportion of SSC project spend and liability that each individual Council would incur. The total provision for redundancies has been apportioned using this model. The table below shows, for each Council, the amount that they need to provide for redundancies of their own staff. Some Councils will incur a cost for terminating their existing systems, and these costs are also being shared. It then notes the proportion of the total liability it will incur and the amount of provision that that represents. The figure below this denotes the contributions that an individual Council has from the other Research Councils. The bottom line shows the net provision they have recorded in each Council.

	AHRC £'000	BBSRC £'000	EPSRC £'000	ESRC £'000	MRC £'000	NERC £'000	STFC £'000	Total £'000
Opening provision required for council's own redundancies	68	152	-	-	999	1,620	-	2,839
Opening provision required for system termination fee	-	-	-	-	1,000	-	-	1,000
Opening total provision	68	152	-	-	1,999	1,620	-	3,839
Net movement in provisions	-	279	-	-	31	(711)	520	119
Closing total provision	68	431	-	-	2,030	909	520	3,958
% of provision to be borne by each council	1.33%	20.54%	8.24%	1.83%	26.98%	20.54%	20.54%	100%
Provision required to be borne by each council	53	813	326	72	1,068	813	813	3,958

Further costs may be incurred in future years.

23. Reconciliation of movements in Government funds

	Revaluation Reserve £'000	Income and Expenditure Reserve £'000	Government Funds £'000
Opening Balance	2,566	(14,550)	(11,984)
Transfer from Revaluation Reserve to Income and Expenditure Reserve	(483)	483	-
Net surplus/(deficit) on revaluation of tangible fixed assets	(1,594)	-	(1,594)
Grant-in-Aid Financing received in year	-	784,870	784,870
Funding from other Research Councils	-	15,446	15,446
Funding from Government Departments, Executive Agencies and the EU	-	7,454	7,454
Funding from other bodies	-	7,264	7,264
Net Expenditure for the Year after reversal of notional cost of capital	-	(792,502)	(792,502)
Closing balance	489	8,465	8,954

24. Research and training grant commitments

The future costs to completion of research and training grants at 31st March 2009 are estimated to be £2,140 million. It is anticipated that this expenditure will be spread over the following four years in the proportions 4:3:2:1.

25. Capital commitments

Capital commitments, at the end of the financial year, for which no provision has been made, are as follows:

	2009 £'000	2008 £'000
Shared Services Centre (Fujitsu Services Ltd)	17,100	24,000
HECToR (Cray Inc/University of Edinburgh HPCX Ltd/ Numerical Algorithms Group)	33,500	47,000
	50,600	71,000

The Fujitsu Services Ltd capital commitment represents commitment on behalf of all of the Research Councils for the future committed spend on the Shared Services Centre. After the other Councils' share has been taken into account EPSRC's capital commitment will be reduced to £1.4m. Costs incurred by EPSRC to 31st March 2009 have been recognised through the Statement of Net Expenditure and the Asset in the Course of Construction.

Contractual commitments of £19.6m existed at 31st March 2009 with regard to the upgrade and service provision of the supercomputer HECToR, the first phase of which was delivered in September 2007.

There is also a contractual commitment of £13.9m with Numerical Algorithms Group for the provision of Systems Engineering Support for the supercomputing facility for the remainder of the service.

26. Contingent liabilities

EPSRC had no contingent liabilities as at 31st March 2009.

27. Related party transactions

(a) EPSRC is a Non Departmental Public Body (NDPB) sponsored by the Department for Innovation, Universities and Skills (DIUS). It complies with the Financial Reporting Standard on Related Party Transactions (FRS 8) issued by the Accounting Standards Board, as amended for Central Government use by HM Treasury.

DIUS is regarded as a related party. During the year, EPSRC had a number of material transactions with DIUS and with other entities for which DIUS is regarded as the parent Department (viz. the Economic and Social Research Council, the Biotechnology and Biological Sciences Research Council, the Science and Technology Facilities Council, the Natural Environment Research Council, the Medical Research Council, the Arts and Humanities Research Council and the Technology Strategy Board). In addition, EPSRC had material transactions with other Government Departments and with other Central Government Bodies (viz. the Ministry of Defence, HM Treasury and the Department for Environment, Food and Rural Affairs).

EPSRC also entered into material transactions with the RCUK Shared Services Centre Ltd.

(b) During the year EPSRC announced the following grants to organisations in respect of proposals from members of EPSRC Council:

Organisation	Proposer	Grant reference	Value £000
University of Cambridge	Professor L Gladden	EP/G011397/1	1,076
University of Exeter	Professor R Sambles	EP/G022550/1	218

The relevant Council members were not involved in the approval of these grants.

NOTES TO THE ACCOUNTS CONTINUED

27. Related party transactions continued

(c) During the year EPSRC announced the following numbers and cumulative values of grants and postgraduate and fellowship awards to organisations where Council members occupied senior positions in the organisation:

Organisation	Research grants		Partnership for Public Engagement Awards		Postgraduate Awards		Research Fellowships	
	No.	£'000	No.	£'000	No.	£'000	No.	£'000
University of Cambridge	71	35,470	–	–	6	24,271	12	4,378
University of Dundee	8	3,282	–	–	4	663	–	–
University of Exeter	12	7,740	–	–	4	4,165	1	244
Imperial College London	71	44,295	–	–	8	38,982	13	6,305
University of Manchester	55	27,269	2	40	11	35,337	3	1,407
Sheffield Hallam University	2	2,605	–	–	1	128	–	–
University of Southampton	47	25,744	2	216	8	25,477	3	1,081
University of Surrey	12	5,806	–	–	7	18,468	–	–

No Council member was involved in the approval of grants or awards to the organisation where he/she is a member of staff.

(d) EPSRC operates a process of peer review of proposals for research grants, as part of which 'Colleges', panels formed of senior members of the academic and industrial communities, evaluate grant proposals for technical merit and then propose a ranking for funding. EPSRC receives their recommendations but is not bound by them, taking as it does other significant factors into account, such as the availability of funds and Government policy. These panel members are not therefore regarded as Related Parties within the context of FRS 8.

(e) EPSRC has adopted a Code of Practice for all those who assist the work of the Council, which embraces the 'Seven Principles of Public Life' drawn up by the Nolan Committee and endorsed by Parliament. This is designed to remove any staff member from any decision-making process under which he/she or any of his/her close family may benefit.

During the year, EPSRC identified those members of staff who could be regarded as being in positions of financial influence, and required a declaration from each of any financial transactions with EPSRC under which the staff member or a member of his/her immediate family was in receipt of a significant amount of money from EPSRC, and where the staff member was able to exercise any influence over the transaction.

Such a declaration was also required from members of Council, the Resource Audit Committee, the Technical Opportunities Panel, the Societal Issues Panel and the User Panel. A Council Members' Register of Interests is available for viewing on EPSRC's website.

29. Post balance sheet events

On 5 June 2009, the Government announced the creation of a new Department for Business, Innovation and Skills (BIS) whose key role will be to build Britain's capabilities to compete in the global economy. The Department was created by merging the Department for Business Enterprise and Regulatory Reform (BERR) and the Department for Innovation, Universities and Skills (DIUS). The sponsorship responsibility for the Council passed to BIS on that date.

There is no reason to believe that the expected government funding underlying the Council's going concern assertion will be affected by this change.

There were no further post balance sheet events between the balance sheet date and 8th July 2009, the date when the Accounting Officer approved the Accounts. The Financial Statements do not reflect events after this date.

Feedback

We welcome feedback on all our publications. Comments on this Annual Report should be sent to:

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ISBN 978-0-10-296111-9

