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This Annual Review provides a summary of the Academy's activities throughout the year. The more detailed Annual Report along with the full Financial Report and Accounts is at www.raeng.org.uk/about/annrev Hard copies are available from the Academy.
President’s review

In June 2011, we celebrate 35 years of the Fellowship. That anniversary and the approach of the end of my term as President provide a point to reflect on the Academy’s progress.

Our founders’ vision was for the Academy to strengthen and promote engineering for the national benefit, for progress in wider society and for the future of humankind.

To achieve this, the Academy is active on many fronts. We are helping to build an education system that inspires and encourages young people to choose a career in engineering. We promote engineering excellence and are supporting research that business and industry can use to grow. We are working to foster a policy framework that enables engineers to address the grand challenges that society faces. And, to underpin all that, we are articulating more broadly the role of engineers and the value they bring to society.

Working in this way, we have made real progress towards the vision of our founders but, of course, there remains a lot to do. I believe we are better placed than ever to make that contribution.

Growth
Over 35 years, the Academy has steadily grown in size, partnerships, influence and ambition. From our founding Fellowship of only 130 engineers, led by HRH The Prince Philip, Duke of Edinburgh, the Fellowship now comprises nearly 1,500 eminent engineers. We actively seek diversity in our nominations process to ensure that our Fellowship is representative of the society we serve – an initiative that is beginning to bear fruit.

In 2007, we moved to our headquarters on Carlton House Terrace, making us neighbours of our sister national academies. Our development campaign has raised over £9 million to fund our educational activities and the transformation of our building into the UK Forum for Engineering. We are immensely grateful to our Fellows and all our other supporters for their continuing generosity.

Education
A significant growth area for the Academy is our work to build an engineering workforce that can meet the needs of business and industry. We take a leadership role on education across the profession, giving high-quality advice to government and the education sector on the education and training of engineers.

In primary and secondary education, our work to inspire the next generation of engineers has created an excellent, collaborative programme both inside and outside the classroom.

In further education, we have made significant progress in campaigning for more skilled engineering technicians.

We host the new Technician Council which works for the recognition of technicians and we undertook the first ever mapping of all STEM provision in further education in England. We continue to work with business and industry on great initiatives such as the University Technical Colleges and the development of apprenticeships.

In universities, our Visiting Professors and Visiting Teaching Fellows bring real-world engineering experience into teaching and help strengthen links between higher education and industry.

Innovation
Engineering innovation inspires, excites and creates wealth and jobs. Here in the UK, we punch well above our weight in terms of world class research – a critical advantage in generating ideas and the people capable of exploiting them. But the evidence suggests that we fail to translate academic excellence into commercial success. At the Academy, we think that UK research should be concentrated on activities that can make a foreseeable contribution to the economy.

The Academy supports world class engineering research and researchers. Our Research Chairs and Senior Research Fellows undertake work of strategic importance to both the private and the public sectors. For every £1 we invest, this is matched by £12 from elsewhere. This programme now supports over £20 million of research in 20 universities, a valuable resource for UK innovation and an important link between UK research and business.

For examples of great engineering innovation and how they benefit society, we need look no further than the Academy’s awards. We have developed a range of awards, medals and prizes that encourage and recognise engineering excellence and leadership at every stage of an engineering career. The 2010 winner of the prestigious MacRobert Award was Inmarsat’s portable communications network which, among its many applications, provided a communications system for the relief operation after the Haiti earthquake.

Policy
Over time, the Academy’s contribution of engineering expertise to policy decisions has grown significantly.

During the year, our Fellows produced influential reports on some of the key national and international policy challenges of the day – including options for energy systems, the electrification of transport and the security of our global satellite navigation system. With our partners in the engineering profession, we have produced studies with and for government on water security, nuclear power plant construction and the resilience of infrastructure in the face of climate change. We have fielded engineering expertise in Parliament and on government committees and panels.

Our debates and meetings over the year provided platforms for some of the world’s most influential and inspiring engineers and researchers. The Academy has tackled some of the pressing engineering issues and questions of the day and provided a showcase for great engineering.

Engineering knows no borders and we have been more active than ever on the international scene through exchanges, visits, delegations and the international engineering networks. This year, the six national science and engineering academies from China, the USA and the UK came together for the first of three major symposia on an important new technology, synthetic biology.

Promotion
Somehow, in this country, the unique contribution of engineering had been less well understood than elsewhere, to the detriment of society and engineering alike. We have been working hard to build awareness among the media and the public of the value that engineers contribute. Our Fellows have been in great demand from all forms of print, broadcast and electronic media, helping to get engineering into the national debate.

Talking to the public about the implications of engineering has never been more important and the Academy has had a leadership role on public engagement in the engineering profession. During the year, a pioneering project to gauge young people’s attitudes to electronic patient records featured a tour of a specially commissioned piece of theatre and a series of workshops with young people.

The future
Engineering underpins the progress of society, the generation of wealth and the prosperity of humanity. The Academy will continue its work to strengthen, facilitate and promote the contribution of engineering.

Over my five years as President I have enjoyed first rate support from the Immediate Past President, Lord Browne and the Senior Vice Presidents, Professor Dame Wendy Hall and Professor Robert Mair. I am indebted to the Academy’s Council and Committees for their leadership and unfailing energy. I should like to thank them and the Academy’s Chief Executive Officer, along with his dedicated team of staff, for all that they have done and continue to do.

Lord Browne of Madingley FREng FRS
President
Chief Executive’s foreword

The last year has been challenging for the Academy, but has also presented a great opportunity for engineering.

Following the global financial crisis, engineering and manufacturing are firmly back on the national agenda but there is much to do if business and industry are to deliver the performance the UK requires. It is crucially important that the Academy supports this agenda effectively – through its leadership and by means of programmes to help provide the conditions for growth that an innovation-led economy requires. I will highlight some of the key challenges and changes of the year in this foreword.

Resources

The government’s 2010 Comprehensive Spending Review was undertaken against a background of stringent reductions in public expenditure. A better than expected settlement for science and research reflected the government’s recognition that the UK’s research base has a key role in supporting economic recovery through innovation. The Academy receives over £12 million of grant funding from the government annually, a further education (FE) strategy and funding following detailed work carried out by the Academy that has revealed worrying inadequacies in FE provision. E4E develops policy positions and calls for action on key priorities in STEM education, careers advice, specialist teaching and diversity in the profession.

The second leadership initiative is the Engineering the Future alliance which works with government on areas of policy with an engineering dimension to delivery. Over the year, we have continued to contribute to a conference on manufacturing, all of which has involved the senior national academies.

The purpose of these alliances is to ensure that engineering issues are taken into account at the right time in policy formation and to give Ministers, officials and experts access to the right experts. We are careful neither to lobby nor to act as spokespeople for any sector of engineering or of business and industry; our different point of access to government, as independent advisors and delivery partners, has been welcomed in the policy process.

Looking ahead

In 2010, the Academy’s five-year strategy was completed – and this review reports our progress against objectives. Our new strategy (www.raeng.org.uk/strategy), approved by Council in January 2011, covers the period of the spending review – from 2011 to 2016 – and is much shorter and more focused than its predecessor. Although brief, it is ambitious. The Council has set the Academy five high level strategic challenges: to drive faster and more balanced economic growth; to foster better education and skills; to lead the profession; to promote engineering at the heart of society and to build organisational capacity.

Enterprise

A new scheme, the Engineering Enterprise Fellowships, will be initiated in 2011 with funding secured in the Spending Review. The objective is to stimulate the translation of research into thriving businesses by providing entrepreneurial young researchers with the training and support they need to develop a business over the course of a year.

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Diversity

Creating a more diverse profession will be crucial to the future of engineering and its contribution to the UK’s performance. Under the leadership of Professor Dame Wendy Hall, our campaign for diversity in the profession has completed its first stage, in which we scrutinised and ensured that our own programmes and internal ways of working are based on best practice. Now the campaign will broaden its focus towards engaging the engineering profession and industry to take forward this important work. This will be enabled by some limited funding from government.

The Fellowship

First and foremost, our work requires the leadership and involvement of a broadly based and talented Fellowship. In 2010, the Academy welcomed the maximum number of new Fellows permitted by Charter and Statute. Our 60 new Fellows, of whom six were women, included one Honorary Fellow and six International Fellows. They join a Fellowship which provides leadership, encouragement and unstinting support to the staff both informally and through membership of committees and panels.

Leadership

The Academy made proposals to government to prioritise its activities and so create headroom for important new work in professional leadership, diversity in engineering and encouraging entrepreneurialism among researchers.

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All of this adds up to a unique combination of roles for the Academy – professional leader, catalyst, networker, advisor, mentor and focus for the best engineering talent. These are serious roles which we undertake with an immense sense of responsibility, enthusiasm, excitement and no little pride.

I conclude by thanking the President, Lord Browne, for his outstanding leadership of the Academy over five years. On the foundations laid by his great predecessors, he has brought the Academy to a level of prominence and effectiveness that we are committed to build on in years to come.

Philip Greenish CBE
Chief Executive
Recognising excellence and inspiring the next generation

The skills needed if the economy is to remain internationally competitive will increasingly be based on the STEM subjects: science, technology, engineering and mathematics. The Academy is taking a leading role in making STEM education in the UK world-class.

STEM education in schools

The award winning London Engineering Project is now in its fifth year and has worked with 50 London schools and more than 30,000 young Londoners. Its sister project in Cumbria, the Barrow Engineering Project, is in its third year, working with all the schools and colleges in the Furness area and more than 3,000 pupils, 70 teachers, 12 employers and 40 trained STEM Ambassadors.

The Tomorrow's Engineers partnership with EngineeringUK and the Lloyd's Register Educational Trust which engages school pupils with hands-on engineering is funding more than 30,000 young people to engage with activities provided by Young Engineers, the Smallpiece Trust, The Engineering Development Trust (incorporating the Industrial Trust) and Primary Engineer. Tomorrow’s Engineers provides year-round support for the sorts of STEM activities celebrated at the Big Bang Fair. The 2010 Fair, run by EngineeringUK and supported at the Academy, at the Excel Centre in London was the biggest yet, with 28,000 visitors.

Supporting excellent teaching

Through funding provided by BAE Systems, the Academy is also working with teachers in more than 80 schools and the National Network of Science Learning Centres to emphasise the technology in STEM. This augments the Academy’s STEPS at Work Programme which has provided one-day industrial placements for up to 1,300 teachers a year since 2005.

In addition, the teaching of engineering qualifications in the Further Education sector is being enhanced by professional development for engineering lecturers funded by the Learning and Skills Improvement Service, the Gatsby Charitable Foundation and BP. The Academy trained 685 FE lecturers during the year on a range of topics including instrumentation and control, engineering maintenance; engineering mathematics; sustainability; getting women into STEM and diversity.

The Engineering Further Education project, which is funded by BP and supports teaching and learning in further education colleges, was launched in September 2010. A new e-mentoring programme has been developed which sees engineering students backed by practising engineers from industry. Support for the contextualising of mathematics for engineering students is a key component of a programme of teachers’ continuing professional development. The project is currently working with 11 FE colleges nationally.

14-19 technical education

The new Coalition government, the Wolf Review of vocational education, the Academy’s hosting of the Technician Council and renewed national interest in apprenticeships have highlighted the role of practical and technical education and training in the UK. The Academy is achieving influence through its leadership of the FE STEM Data Project which is mapping out the national provision of technical and practical STEM in close detail and provides policy makers with real evidence on which to base important decisions when resources are scarce. The Academy is also playing a significant role in supporting the emergent University Technical Colleges. These schools are linked to universities and to FE Colleges, and will provide a technical education for 14-19 year olds. At least 24 will receive significant government support and the Academy is working with the Baker-Dearing Educational Trust in developing the curriculum taught in these schools.

Engineering higher education

The Engineering Leadership Award scheme reached its 15th annual cohort this year, with more than 400 awards made to date. Award holders frequently go on to attend the Executive Engineers Programme of development training which has run every year since 2000. Some 50 young engineers attended last year’s event.

The Academy leads the engineering component of the Higher Education Funding Council for England and Higher Education Funding Council for Wales funded National HE STEM project. During the year, three funding rounds in curriculum innovation, schools outreach, widening participation, diversity and educational research were successfully concluded. In the first round, eight small projects and five large scale schools outreach projects were funded in English and Welsh universities. In September 2010, a further 35 small projects were funded; with 15 more in March 2011. More than £650,000 of funding has been distributed this year to support innovative projects in engineering education.

Bob skeleton is an extreme winter sport in which athletes slide head-first down an ice covered track on a sled that holds them just centimetres above the surface. In order to answer the question Athlete or Machine? students identify the factors that influence the performance of the Bob skeleton and then investigate each one through practical, mathematical and scientific activities.

The Royal Academy of Engineering has been working in partnership with BAE Systems to produce a suite of engineering resources for schools which help teachers illustrate the role of engineering in society and how engineers shape and improve our lives. One of these is a 30 page resource that brings together science, technology, engineering and mathematics to help pupils tackle the question: Athlete or Machine? – which is more important in the sport of Bob Skeleton?

Below: In the Academy resource Athlete or Machine? students use different engineering skills to make a working model of a bob skeleton.
Engineering excellence

Some of the many ways in which the Academy recognises excellence is through the election of Fellows, presentation of awards and medals. The Academy’s wide range of awards covers every aspect of engineering.

MacRobert Award

The Academy’s MacRobert Award is the UK’s premier prize for innovation in engineering. It is awarded annually to an individual or small team for an outstanding innovation of benefit to society which has also achieved commercial success. It seeks to demonstrate the importance of engineering and the role of engineers and scientists in contributing to national prosperity and international prestige.

In 2010, the winner was Inmarsat for its groundbreaking Broadband Global Area Network. The service, which provides internet data connectivity anywhere on earth, is widely used for remote connectivity for business, government, broadcasters, aid and relief agencies and emergency services. The service brings TV reports from remote areas anywhere in the world and the system can carry voice and data messages. The Inmarsat development team received a £50,000 prize in recognition of its pioneering work.

Sir Frank Whittle Medal

Named after Academy Fellow and exceptional aeronautical engineer Sir Frank Whittle OM KBE CB FREng, the award was given in 2010 to Professor Sir Richard Peacher CBE CB FREng.

Silver Medals

The Academy’s Silver Medals are awarded to outstanding individuals in recognition of their personal contributions to UK engineering. Their success in creating and bringing to market a particular idea or innovation is celebrated each year at the Academy Awards Dinner. There were four recipients in 2010.

Dr Andrew Harter, CEO of RealVNC Ltd, a company he founded in 2002 to promote the software system Virtual Network Computing (VNC). VNC provides remote graphical access to a computer screen. It has many applications, including systems maintenance, remote help and support, distance learning, collaboration and mobile working. His company now employs 50 people in Cambridge, with 70,000 customers in over 150 countries.

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A highly influential public health policy advisor, he is also one of the most distinguished engineers working in the field of health. His work has spanned the control of AIDS, tuberculosis, malaria and waterborne diseases. The medal was awarded for his novel engineering-based approach to managing aid and tackling some of the most virulent diseases.

New Fellows

The Academy’s Fellowship consists of Britain’s most eminent engineers, elected by their peers in recognition of the excellence of their own achievements in engineering. Last year, 60 people joined the Fellowship including leading industrialists, pioneering inventors and senior academics. A majority of the new Fellows attended a ceremony held at the Drapers’ Hall in the presence of the Senior Fellow, HRH The Prince Philip, Duke of Edinburgh.

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Leading debate

The Academy engages in a wide range of activities promoting links between engineering, government and wider society. The Academy seeks to build relations with policy makers nationally and globally to ensure that engineering is at the heart of policy in crucial areas such as energy, transport, health and security. It also encourages debate and dialogue between engineers and the wider public to ensure that engineering is visible to society and sensitive to its opinions and concerns.

Engineering the Future

The engineering community has strengthened its relationships with government this year, through the Engineering the Future group, an alliance of UK professional engineering organisations. Two major reports were commissioned by government departments and the profession produced joint responses giving a united voice to a number of inquiries and consultations.

The Department for Environment, Food and Rural Affairs commissioned Engineering the Future to produce a report on the contribution that engineering can make to adaptation to climate change. Infrastructure, Engineering and Climate Change: Adaptation focused on the need to create resilient infrastructure, in sectors such as communications or transport, but across the entire infrastructure system. The report underlined how engineers, regulators and the public and private sectors need to work together to allow planning at a systems level, to ensure resilience.

The Office of Nuclear Development asked Engineering the Future to carry out a study on Nuclear Lessons Learned. The report investigated the lessons from recent and current nuclear build projects, including Olkiluoto in Finland and Flamanville in France, which are relevant to the proposed new nuclear power plant programme in the UK. The report identified the design and licensing issues that need to be resolved before the start of construction and noted that first-of-a-kind plants are more expensive and take longer to build.

Policy work

Last year’s Academy report, Generating the future, identified the need to radically reduce the carbon emissions from transport by cutting its reliance on fossil fuels. This year, the Academy produced a report on Electric Vehicles, which examined the electrification of road transport. This included issues such as infrastructure changes to enable the mass rollout of electric cars, ensuring that there are sufficient charging stations and simple ways to pay for power.

A set of lectures based on the theme of Engineering the Olympics, was staged to look at the contribution of engineers to the 2012 Olympic and Paralympic Games. The talks highlighted how UK engineers are contributing to the success of the games, including constructing world-class venues for the games as well as supporting and enhancing athletes’ performance through sports engineering.

The supply chain for the offshore wind industry was the focus of a workshop which considered the ‘greener’ supply chain in the UK. The meeting brought together leaders from across the industry, including developers, suppliers, financiers, policymakers, port owners and education providers. The discussions identified the critical needs that must be met to support this emerging sector, from skills to infrastructure.

Global Navigation Space Systems: reliance and vulnerabilities

The Academy published a report in March 2011 entitled Global Navigation Space Systems: reliance and vulnerabilities. The study, led by Dr Martyn Thomas CBE FREng, warned that society may have become over-reliant on satellite radio navigation systems such as GPS to gain accurate data for positioning, navigation and timing.

GNSS dependency is now widespread across the world. As well as the ubiquitous satnav, the signals are used by data networks, financial systems, shipping and air transport, agriculture, railways and emergency services. The range of applications using the technology is now so broad that, without adequate independent backup, signal failure or interference could potentially affect safety systems and other critical parts of the economy. The European Commission estimates that an €800 billion portion of the European budget is already dependent on GNSS.

The Academy’s report looked at security awareness and recommends that critical services include GNSS vulnerabilities in their risk register and that these are reviewed regularly and mitigated effectively. Research councils were encouraged to support R&D into enhancing the resilience of GNSS-dependent systems.

Public engagement activities

The Academy has continued to support public engagement with engineering through a variety of activities.

The Academy was a major partner in the annual Cheltenham Science Festival where more than 1,500 people attended the Academy’s engineering debates, discussions and interactive demonstration sessions.

During the year the Academy published a report on the findings from a two-year public dialogue and theatre engagement programme. The report gathered together the attitudes and views of young people to privacy and security of their personal information. It highlighted the potential uses and possible abuses of electronic patient records in the NHS.

The Academy also became a signatory of the Concordat for Engaging the Public, along with a number of the UK’s major research funding bodies. The concordat was launched by Rt Hon David Willetts MP, Minister for Universities and Science in December 2010.

The Academy made 20 Public Engagement Awards and one Public Engagement Fellowship in the fifth round of the public engagement grants programme, Ingenious. Ingenious is supported by the Department of Business Innovation and Skills and distributes funding for schemes that bring creative public engagement to engineering projects.

Biomedical engineering

The Academy hosts the Panel for Biomedical Engineering. This body provides a forum through which the principal organisations concerned with biomedical engineering in the UK can communicate, debate and jointly act upon issues that affect this area. The panel hosted an all-day conference on sports engineering, where delegates considered performance, ethics in Paralympic technology, muscle oxygenation studies in athletes and the role of sports science and engineering in preparing British athletes for competition.

The Academy jointly hosted a meeting in Parliament with the Parliamentary and Scientific Committee. During this meeting and accompanying dinner, specialist speakers spoke about the ageing population in the UK, regenerative medicine and mobile health technologies to support patients with long-term illness. A series of briefing papers followed up on these themes and have been published on the Academy website.

Media activity

The media team continued to achieve regular coverage in print, broadcast, electronic and social media including record coverage for the report Global Navigation Space Systems: reliance and vulnerabilities.
International matters

**Synthetic biology symposia**

The Academy has joined forces with the Royal Society and the engineering and science academies of the USA and China for a set of high level international symposia addressing the exciting new field of synthetic biology. The first symposium, jointly hosted by the Academy and the Royal Society, brought together leading biology. The first symposium, jointly hosted by the Academy and the Royal Society, brought together leading institutions in Sub-Saharan Africa, and strengthening networks of engineers within Africa and between Africa and the UK. The partnership was launched at the Academy by the Kenyan Prime Minister – and engineer – Rt Hon Raila Odinga. It runs workshops in African countries bringing together policy makers and engineers to discuss the key issues influencing Africa’s social and economic development.

**Frontiers of Engineering**

The Academy hosted the first ever EU-USA Frontiers of Engineering symposium, an intensive three day meeting bringing together 60 of the most gifted engineers under the age of 40 from Europe and the USA to discuss cutting edge research at the boundaries of traditional disciplines. The event – which covered themes such as bio-inspired engineering and augmented reality – provided a welcome opportunity for future stars of engineering to meet and collaborate across disciplines. The Academy administers the Frontiers of Engineering programme on behalf of the umbrella group of European engineering academies, Euro-CASE, in partnership with the USA National Academy of Engineering.

**Competing in the Global Economy debates**

The Academy held a highly successful series of debates in which senior engineers and other interested people from government, think tanks, business, and academia were invited to discuss important issues affecting UK competitiveness in international markets. Motions debated included the impact of foreign ownership of UK businesses and the role of manufacturing in rebalancing the UK economy. Key messages emerging from the series have been captured in a report to policy makers and will form the basis of future Academy work in this area.

**ERA International Lecture**

Anne Lauvergeon, Chief Executive Officer of the French nuclear and renewable energy conglomerate AREVA, spoke to an audience of senior engineers, policymakers, business people and students at the Academy’s ERA International Lecture. She praised the UK’s energy market reforms and gave a strong endorsement of nuclear energy as part of the “past, present and future” of the UK’s energy mix – as long as the right investments were made in skills and high quality public dialogue.

Lectures and events

**Forum for debate**

A key role played by the Academy is to act as a forum for debate and exchange. Throughout the year, a broad range of lectures and events were held by the Academy, transcripts of which can be found at www.raeng.org.uk/events. Videos and podcasts can be found at www.raeng.tv.

The annual Lloyd’s Register Educational Trust lecture was given by Dr Anne-Marie Warrs, Environmental Adviser at Lloyd’s Register, under the title A low carbon world – is it realistic? Dr Warrs flagged up the need for the developed world to adapt and accelerate its innovation to maintain its competitiveness. Advances in the low carbon era, she said, will not happen without the involvement and support of engineers.

The Academy’s flagship Hinton Lecture was delivered by Dr Lyn Evans CB FREng, FRS, the project leader of the Large Hadron Collider (LHC). He explained how the world’s largest and highest-energy particle accelerator has been designed to recreate the conditions that existed one picosecond after the Big Bang. Dr Evans described some of the fundamental questions in science that the LHC will address as well as some of the innovative design features of this colossal scientific instrument.

Steve Holliday FREng, Group Chief Executive of National Grid, delivered the Academy Lecture Power to the People. He outlined the crucial decisions that need to be made in the coming years in order to deliver low carbon energy for the UK. He said that the UK faces a pivotal year as decisions need to be made on replacing critical assets, many of which are now 50 years old.

The Academy also hosted a new lecture series during the year under the banner Prime Innovators, in which engineers at the top of different professions discussed innovations being undertaken in their areas of expertise. Alex Burns, Chief Executive Officer of Williams F1, responsible for implementing the group’s diversification strategy, gave an insight into the operational management of the Formula 1 team.

Dr Mike Lynch CB FREng, Chief Executive Officer of Autonomy, is a technology entrepreneur. He talked about the ability of computers to handle and, at some level, understand email, text, telephone calls and video, which is revolutionising practical computing.

In the third lecture of the series, Professor Sir Martin Sweeting CB FREng FRS, Executive Chairman of Surrey Satellite Technology Ltd, drew attention to the huge scope of modern ‘microsatellites’ which are able to dramatically reduce the size, cost and manufacturing times of small and highly capable satellites, fundamentally changing the economics of space.

Tristram Caryfere, structural engineer, Principal and Arup Fellow, described some of the projects that he had helped to create, most notably the Beijing National Swimming Centre, also known as the ‘Water Cube’, the innovation that was recognised by the 2009 MacRobert Award.

Finally, Professor Sir Richard Friend FREng FRS talked about the challenges of introducing radical innovation into the manufacturing environment. He discussed how scientific innovation can be developed to have commercial applications.

As part of the ongoing Vodafone Lectures series, Professor Brian Collins CB FREng, Chief Scientific Adviser to DfT and BIS, talked about The engineering of intelligent transport systems and services. Natasa Milic-Frayling, Principal Researcher at Microsoft Research Cambridge, discussed The Art and Science of Social Computing, examining the way computer technology has revolutionised the way that people communicate.
The Academy’s activities are focused on enhancing the UK’s performance and promoting engineering innovation at home and abroad. The Academy builds links between university and industry, helps engineers continue their professional development and encourages excellence in engineering research.

Establishing international research networks

International collaborations and global research networking are key to remaining internationally competitive. The Academy’s Global Research Awards have helped provide opportunities for engineering researchers to spend substantial periods of time at an overseas institute to gain access to knowledge, technologies or skills that are not currently available within the UK. Awardees develop lasting collaborations and, once back in the UK, can pass on their newly acquired knowledge to colleagues and students.

Professor Sheila MacNeil from the University of Sheffield was one such awardee. She travelled to Australia to visit Swinburne University of Technology, Melbourne, and the University of Auckland’s Bioengineering Institute. Her primary research interests are in soft tissue engineering – skin, oral mucosa, urethra and cornea, with a strong focus on translating research for clinical benefit. In Australia she explored how different surface coatings could promote increased cell growth and so improve the healing of wounds. The time spent at the host universities has enabled Professor MacNeil to access world-class facilities, skills and expertise that are not currently available in the UK.

Engineering young researchers

The Academy’s Research Fellowship scheme, run jointly with the Engineering and Physical Sciences Research Council, enables young researchers to continue their academic research following completion of their PhD. These five-year Research Fellowships provide the long-term stability necessary to develop a future career at the highest level of international research. The Academy funds 50 Research Fellows across 22 universities covering all areas of engineering research and the intense competition for these Fellowships ensures that the quality of incumbents is uniformly high.

Dr Ross Hatton is a Research Fellow at the University of Warwick whose research focuses on understanding the science that underpins the operation of organic solar cells. Every hour, enough energy arrives at the surface of the earth from the sun to meet humanity’s energy requirements for a year. The challenge is to harvest even a small proportion of this energy in an economically viable and sustainable way.

The aim is to improve the output and versatility of the solar cells while reducing production costs. Dr Hatton, who has since become a lecturer, and his group have achieved cost savings by reducing the quantity of gold necessary in their manufacturing and by moving away from the traditional ridged design to flexible solar cells which can be used more widely. The first generation of these organic solar cells are set to be commercially available within a year, with operational lifetimes and efficiencies matched to portable consumer electronics.

Transferring industrial practice to academia

The Industrial Secondment Scheme facilitates knowledge transfer between industry and academia by enabling academics to spend up to six months in industry where they can apply their skills and expertise to real-world industrial projects. The benefits include increasing the productivity and competitiveness of the industry and developing industrially relevant engineering curricula, thereby enhancing university engineering courses.

Dr David Swaffield of the University of Southampton spent six months at Converteam UK Ltd in Rugby. As a young academic with minimal experience in industry he was keen to gain exposure to the commercial world to better understand the environment and pressures faced by engineers in industry.

Dr Swaffield’s secondment involved the testing and fault rectification of a rotating transformer for the ‘Hydrogenerie’ generator and the development of Non Destructive Testing methods. This resulted in a case study for his postgraduate-level High Voltage Insulation Systems module, and provided valuable experience for improving the lectures on the design of electrical insulation for large motors and generators.

Dr Swaffield also took part in the testing of a wind turbine generator which, when combined with the other activities, formed a strong collaborative base between Southampton University and Converteam staff to be built upon in the future.

Building a high speed rail network for the UK is a long-term project which should eventually link all the major cities with 800 miles of new high speed track. The maintenance costs of the network will be a substantial part of the overall operating cost, and Professor Smiths’ research is seeking to minimise this.

There are likely to be new types of track implemented as well as the production of lighter trains. There will also be increased strain placed on the UK’s electricity generation and distribution capacity will need to be compensated for. These and other such considerations require thorough examination to ensure the effective implementation and maintenance of the high-speed network, and the Research Chair scheme provides the required stability, time, industry input and academic freedom to best enable this.

Establishing international research networks

International collaborations and global research networking are key to remaining internationally competitive. The Academy’s Global Research Awards have helped provide opportunities for engineering researchers to spend substantial periods of time at an overseas institute to gain access to knowledge, technologies or skills that are not currently available within the UK. Awardees develop lasting collaborations and, once back in the UK, can pass on their newly acquired knowledge to colleagues and students.

Professor Sheila MacNeil from the University of Sheffield was one such awardee. She travelled to Australia to visit Swinburne University of Technology, Melbourne, and the University of Auckland’s Bioengineering Institute. Her primary research interests are in soft tissue engineering – skin, oral mucosa, urethra and cornea, with a strong focus on translating research for clinical benefit. In Australia she explored how different surface coatings could promote increased cell growth and so improve the healing of wounds. The time spent at the host universities has enabled Professor MacNeil to access world-class facilities, skills and expertise that are not currently available in the UK.

Engineering young researchers

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*Engineering Professional Development Awards*

For any company competing in the global market, it is essential that its employees’ skills must reflect the latest cutting-edge technology and business practice. The Engineering Professional Development Awards ensure that UK engineers possess the most up-to-date skills by awarding funds to support training programmes that focus on developing a company’s engineering staff.

David McGlasson is responsible for managing design projects for the petrochemical and nuclear industries. Employed by Bendalls Engineering, a UK manufacturer of pressure vessels and high integrity steel fabrications for the nuclear, oil, gas, petrochemical and renewable energy industries, he wanted to enhance his professional development in structural steelwork design, analysis and manufacture. Expertise in this area would help the business enter the nuclear new build and decommissioning markets where the need for a fully integrated design and manufacture service is growing.

To this end, David McGlasson joined a part-time, distance-learning BEng in Mechanical Engineering that comprised a set number of modules as well as one week of intensive study at Blackpool College. He has since put his newly-found skills into practice in the engineering and management of an evaporator vessel at Sellafield, the UK’s largest nuclear investment project. Thanks to him, Bendalls Engineering achieved this by providing funding for individuals to study courses designed to develop or update their knowledge and skills. These can be in new or emerging technologies and the various fields of engineering, manufacturing, materials science, environmental technology and IT.

Mitesh Chandegra worked full time at URS/Scott Wilson while studying for his MSc in Geotechnical Engineering on a part-time basis at the University of Birmingham. He achieved a distinction in Geotechnical Engineering in 2010 and received the Midland Geotechnical Society’ prize for ‘Best Overall Student’ and ‘Best Project’.

A number of hi tech industries require specialist skills that are only available through the study of a Masters degree. The Academy has made a major investment in funding the study of specialist second degree courses in the fields of energy supply and environmental technology. The Panasonic Trust Fellowships and Petrofac Fellowships for the Enhanced Graduate Engineer support some of the most competent and highly driven graduate engineers. Competition is intense with more than 200 applicants chasing the 12 awards supported by these schemes each year.

**Continuing Professional Development**

The objective of the Panasonic Trust Awards is to encourage and support the professional development and retraining of engineers in the UK. It achieves this by providing funding for individuals to study courses designed to develop or update their knowledge and skills. These can be in new or emerging technologies and the various fields of engineering, manufacturing, materials science, environmental technology and IT.

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By undertaking this course on a part time basis for four years and working full time Mitesh Chandegra was able to apply the knowledge gained on the course to appropriate projects he worked on. The flexible training allowed him to expand his theoretical understanding and design skills in a broad range of subjects within geotechnical engineering including: physical and mechanical properties of soils, earthworks, foundation design, earth retaining structures, environmental ground engineering and geomechanics.

Mitesh says: “The MSc has given me a greater depth of understanding and confidence in geotechnical engineering and has allowed me to continue working on a number of high profile projects at URS/Scott Wilson including; Blackfriars Station, East London Line and Crossrail Paddington Station Design.

In addition to supporting the UK’s technical skills base, the Academy is involved in developing the industrial leaders who will drive these industries forward to achieve their full wealth creating potential. The Sainsbury Management Fellows’ scheme plays a significant role in helping to develop the next generation of industrial leaders. The scheme’s alumni, the Sainsbury Management Fellows, include chief executives, company directors and company owners. These individuals also support the Academy by helping select and mentor undergraduate students in the Engineering Leadership Advanced Awards scheme.
The Academy’s making things better Campaign aims to raise £16.5 million to expand education and engagement activities and create a Forum for Engineering. Achieving this goal will help create the next generation of engineers and support the Academy’s work to move engineering to the centre of society.

The Academy’s £16.5 million making things better Campaign made great headway during the year. Commitments towards education and engagement work and creating a Forum for Engineering reached £9.05 million. By financial year end nearly 90% of funding for the Forum had been raised. Repeating the welcome trend of previous years, the Academy successfully expanded its range of funders, affirming its position as a trusted and effective partner.

The fundraising year was marked by an exceptional gift of £2.5 million towards the Forum for Engineering building fund from a private philanthropist. Major gifts in support of this project were also received from The Michael Bishop Foundation and Dr Wilem Frischmann FREng.

Academy Fellows continued their strong support of the Campaign, both financially and in providing introductions to potential new funding sources. An appeal to all Fellows, launched in early 2011 to help complete funding of the Forum project, is being generously supported and the Forum project is on track for an August 2011 start.

The Forum will strengthen the Academy’s ability to engage and inspire a range of audiences with engineering. The new facilities, including including multi-use rooms for exhibitions and conferences and a 170-seat lecture theatre, will allow the Academy to do more with and for its many partners and beneficiaries.

Major education programmes have been supported by generous gifts from BAE Systems, BP, Shell International, The Ove Arup Foundation and Petrofac Services. These programmes have taken many forms, from the development of learning resources, support of after-school clubs, industry-relevant engineering skills for undergraduates and increasing the Academy’s ability to effect change in further education.

The Gatsby Charitable Foundation’s contribution to the Academy’s long-term growth and development – and to engineering in general – has been immense. The Foundation’s support continues with funding for the Sainsbury Management Fellowships. And for our work supporting the professional development of engineering teachers and lecturers through the Technology Enhancement Programme.

The Academy’s international activities attracted funding from new supporters, such as ARM and Autonomy Corporation, helping build valuable links with our sister academies across the world.

It is a tribute to the standing of the Academy and the quality of its work that donors and sponsors, have continued their strong commitment in an economic downturn. This is particularly valued at this pivotal stage in the Academy’s development.

*Note: Third party income arises from donors who agree to support Academy projects but make contributions directly to those projects without passing through the Academy’s books. Although these funds are not under the direct control of the Academy they would not have become available without the involvement of The Academy.

### Academy funding

#### Sources of income and destination of expenditure

<table>
<thead>
<tr>
<th>Year</th>
<th>2011 £ million</th>
<th>2010 £ million</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>20.8</td>
<td>19.1</td>
</tr>
<tr>
<td><strong>Sources of income</strong></td>
<td></td>
<td></td>
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<tr>
<td>Grants</td>
<td>12.6</td>
<td>12.1</td>
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<tr>
<td>Contracts</td>
<td>4.3</td>
<td>4.0</td>
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<tr>
<td>Gifts and donations</td>
<td>2.3</td>
<td>1.7</td>
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<tr>
<td>Investment income</td>
<td>0.9</td>
<td>0.7</td>
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<tr>
<td>Other income</td>
<td>0.7</td>
<td>0.6</td>
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<tr>
<td><strong>Destination of expenditure</strong></td>
<td></td>
<td></td>
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<tr>
<td>– engaging effectively with the public</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>– attracting more people into engineering</td>
<td>3.2</td>
<td>3.1</td>
</tr>
<tr>
<td>– enhancing the contribution of engineering</td>
<td>10.8</td>
<td>10.4</td>
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<tr>
<td>– developing the Academy</td>
<td>0.9</td>
<td>0.9</td>
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<tr>
<td>Costs of generating funds and governance costs</td>
<td>0.4</td>
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<tr>
<td><strong>Third party support attracted to Academy programmes</strong></td>
<td>39.7</td>
<td>38.5</td>
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#### Academy income

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<tbody>
<tr>
<td><strong>Third party support</strong></td>
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<tr>
<td><strong>Direct income</strong></td>
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*Numbers are rounded to £0.1 million*
Academy highlights 2010/2011

April 2010
Event
PolicyNet General Election Sessions
Speakers: Adam Afriyie MP, Shadow Minister for Science and Innovation. And Speaker: Dr Evan Harris MP, Shadow Science Minister
Lecture
2010 Lloyd’s Register Educational Trust Lecture and Dinner
A low carbon world – is it realistic?
Chair: Dr Anne-Marie Warris, Environmental Adviser, Lloyd’s Register

May
Briefing
The interface between law and engineering
Chair: Sir Vivian Ramsey, Judge in charge of Technology and Construction Court
Event
The Africa-UK Engineering for Development Partnership UK Launch Workshop on the theme of Building Engineering Physics
Event
Visiting Professors workshop
Chair: John Armit, Chair, Olympic Delivery Authority

June
Lecture
Vodafone Lecture Series in Mobile Telecommunications and Networks
The engineering of intelligent transport systems and services
Speaker: Professor Brian Collins FREng, Chief Scientific Adviser to DfT & BIS
Event
The Engineering Academy of Japan/ Royal Academy of Engineering Symposium on Green manufacturing and Eco-innovation

July
Event
Academy’s Annual General Meeting
Lecture
The 2012 Olympic and Paralympic Games: how engineers will make it happen
Chair: John Armit, Chair, Olympic Delivery Authority

September
Event
The Governance of Autonomous Systems
A meeting held in collaboration with the UCL Centre for Ethics and Law
Event
GO-Science
A reception for participants on the Academy/GO-Science engagement programme
Event
Engineering Leadership Advanced Awards
Annual training 3-day event

October
Lecture
Vodafone Lecture Series in Mobile Telecommunications and Networks
The Art and Science of Social Computing
Speaker: Nataša Milic-Frayling, Principal Researcher, Director, Research Partnership Programme, Microsoft Research, UK

November
Event
2010 New Fellows’ Briefing and Dinner
In the presence of the Senior Fellow HRH The Duke of Edinburgh
Debate
Competing in the Global Economy – Debate I
Motion: This House believes that the advantages of foreign ownership of the UK corporate sector outweigh the disadvantages
Event
Engineering Leadership Advanced Awards

December
Event
Hinton Lecture
Back to the Big Bang – the Large Hadron Collider
Speaker: Dr Lyn Evans CBE FRSE, Project Leader, Large Hadron Collider
Lecture
Prime Innovator lecture series – lecture II
Changing the economics of Space
Speaker: Professor Sir Martin Sweeting, Chief Executive Officer, AREVA

February
Lecture
Prime Innovator lecture series – lecture V
Semiconductor technology with molecules
Speaker: Professor Sir Richard Friend FREng FRSE, Cavendish Professor of Physics, University of Cambridge
Lecture
Pre-history of the Fellowship of Engineering
Speaker: Dr Peter Collins, Director of the Royal Society Centre for History of Science

March
Guest Lecture
Power to the people
Speaker: Steve Holliday FREng, Chief Executive, National Grid
Lecture
Joint Academy/RSE Annual Lecture
The Twin Towers: 10 years – 10 Lessons on Sustainable Infrastructure
Speaker: Professor Jose Toero-Cullen FRSE, BAE/RAE Chair in Fire Safety Engineering, Director of the BRE Centre for Fire Safety Engineering
Lecture
11th Annual Regional Public Lecture
Friction and Where Our Energy Ends Up
Speaker: Professor Rob Deyer-Joyce, Head of Dept of Mechanical Engineering, Sheffield
Lecture
Sports Engineering Conference
UK Focus for Biomedical Engineering
Professor Lionel Tarassenko FREng, Director, Institute for Biomedical Engineering, University of Oxford

Transcripts and publications from most of the lectures and seminars mentioned are available at www.raeng.org.uk
Videos available at www.raeng.tv
Printed reports. Digital versions are also available online at www.raeng.org.uk
As Britain’s national academy for engineering, we work to further the profession’s contribution to society and the economy. Along with our partners in the engineering profession, we work with business and industry, schools and universities, the public and policymakers to enhance, support and promote engineering today and for the future.