



The Royal Academy
of Engineering

Annual Report

2005/2006

Strategic Priorities

As Britain's national academy for engineering, we bring together the country's most eminent engineers from all disciplines to promote excellence in the science, art and practice of engineering. Our strategic priorities are to enhance the UK's engineering capabilities, to celebrate excellence and inspire the next generation, and to lead debate by guiding informed thinking and influencing public policy.

The Academy's work programmes are driven by three strategic priorities, each of which provides a key contribution to a strong and vibrant engineering sector and to the health and wealth of society.

Enhancing national capabilities

As a priority, we encourage, support and facilitate links between academia and industry. Through targeted national and international programmes, we enhance – and reflect abroad – the UK's performance in the application of science, technology transfer, and the promotion and exploitation of innovation. We support high quality engineering research, encourage an interdisciplinary ethos, facilitate international exchange and provide a means of determining and disseminating best practice. In particular, our activities focus on complex and multidisciplinary areas of rapid development.

Recognising excellence and inspiring the next generation

Excellence breeds excellence. We celebrate engineering excellence and use it to inspire, support and challenge tomorrow's engineering leaders. We focus our initiatives to develop excellence and, through creative and collaborative activity, we demonstrate to the young, and those who influence them, the relevance of engineering to society.

Leading debate

Using the leadership and expertise of our Fellowship, we guide informed thinking, influence public policy making, provide a forum for the mutual exchange of ideas, and pursue effective engagement with society on matters within our competence. The Academy advocates progressive, forward-looking solutions based on impartial advice and quality foundations, and works to enhance appreciation of the positive role of engineering and its contribution to the economic strength of the nation.

Annual Report 2005-2006

This Annual Report provides a detailed account of the most significant activities and events undertaken by or for the Academy during the financial year 2005-2006. It supplements but does not replace the Annual Review.

The summary Annual Review along with the full Financial Report and Accounts can be found at www.raeng.org.uk/about/annrev. Hard copies may be requested from the Academy.



Contents

ENHANCING NATIONAL CAPABILITIES	4
Enhancing excellence in engineering teaching and research	4
• Research Chairs and Senior Research Fellowships	4
• Research Fellowships	4
• Global Research Awards	4
• Industrial Secondment Scheme	5
• The Visiting Professors Schemes	5
Enabling postgraduate and professional development	5
• Engineering Professional Development Awards	5
• ExxonMobil Teaching Fellowships	6
• International Travel Grants	6
• Sainsbury Management Fellowships in the Life Sciences	6
• The Panasonic Trust	6
• The Sir Angus Paton Bursary	6
RECOGNISING EXCELLENCE AND INSPIRING THE NEXT GENERATION	7
Education	7
• National Engineering Programme	7
• Young Engineers	7
• Headstart	8
• Smallpeice Trust Schemes	8
• Engineering Education Scheme	8
• The Year in Industry	9
• The Undergraduate Programme	9
• Engineering Leadership Awards	9
• Executive Engineers Programme	9
• Sainsbury Management Fellowships in Engineering and Life Sciences	10
• Engineering Teaching Prizes	10
• Research Student Development Fellowships	10
• BNFL/Royal Academy of Engineering Education Innovation Prize	10
• Shape the Future	10
Academy Awards	11
• Prince Philip Medal	11
• The MacRobert Award	11
• The President's Medal	11
• Silver Medals	11
• Sir Frank Whittle Medal	12
• Medal for Public Promotion of Engineering	12
• Lifetime Achievement Award	12
• International Medal	12
• Special Achievement Award	12
• ERA Foundation Award	13
Fellows	13

LEADING DEBATE	15
Engineering Policy Initiatives	15
• Energy Seminars	15
• Accidents and Agenda	15
• Risk in Engineering	15
• Ethics in Engineering	15
• Philosophy in Engineering	16
• Systems Biology	16
• Privacy and Surveillance	16
• Academic Industrial Interactions	16
Engineering Policy Responses	16
• Academy Submissions to Parliamentary Committees and Government	16
Education Initiatives	18
Education Responses	19
International Matters	19
• ERA Foundation International Lecture	19
• China Meeting	19
• European Council of Applied Sciences and Engineering (Euro-CASE)	19
• Council of Academies of Engineering and Technological Sciences (CAETS)	20
• Pilot Study on Engineering Capacity Building in Sub-Saharan Africa	20
Associate Parliamentary Engineering Group	20
UK Focus for Biomedical Engineering	20
PolicyNet	20
Meetings and Events	20
• Lectures	20
• Academy Briefings	21
• Soirée	22
• Fellows' Visits	22
Ingenia Magazine	22
Website	22
ACADEMY BUSINESS	23
• Annual General Meeting	23
• Development Report	23
COUNCIL	24
ACADEMY STANDING COMMITTEES	25
ACADEMY STAFF	28
ANNEX	29

Enhancing national capabilities

The Academy encourages and supports links between academic research and industry. Its programmes develop and enhance excellence in engineering teaching and research, and enable engineers to continue their own professional development.

ENHANCING EXCELLENCE IN ENGINEERING TEACHING AND RESEARCH

Research Chairs and Senior Research Fellowships

The Academy's schemes to support Research Chairs and Senior Research Fellowships (SRFs) were established in 1987. Both provide joint funding with industry and other research organisations to support strategic research in UK universities.

Appointments are normally for a period of five years. The industrial funding is an important feature of these schemes and it is pleasing to note that every pound funded by the Academy now attracts over five pounds from industry. The current appointments for Research Chairs and SRFs are detailed in the annex.

During the year the total number of appointments of Research Chairs and SRFs, including those supported by the Leverhulme Trust, rose to 36. One SRF is jointly funded with The Daphne Jackson Trust. The Trust enables highly qualified women and men to return to their research careers in science, engineering or technology after a career break due to family commitments; these SRFs are usually for two years.

Although most appointments are supported by industry, a number have been jointly supported with other organisations. There are two

chairs jointly supported under the Engineering and Physical Sciences Research Council's (EPSRC) Innovative Manufacturing Initiative; these have both now entered their fifth and final year.

The new Leverhulme Trust Senior Research Fellowships provide an opportunity for mid-career engineering academics to be relieved of their teaching and administrative responsibilities to concentrate on full time research for periods between one academic term and a year. The award covers the cost of a replacement member of staff for the period of the Fellowship, thus ensuring no loss to the teaching of the next generation of engineers within universities. In this first year of the scheme we appointed seven Fellowships, each for durations of a year.

Research Fellowships

These Fellowships, which are now funded jointly with EPSRC, are aimed at outstanding researchers from all branches of engineering who are about to finish their PhD or have up to three years post-doctoral research experience. The scheme provides funding for five years to encourage the best researchers to remain in engineering research in UK universities or industry. Research Fellows are provided with the opportunity to establish an international track record, and they are assisted by having a greatly

reduced teaching and administrative load. The Academy appoints one of its Fellows as a Mentor to offer advice and facilitate industrial contacts.

Fellowships are awarded annually and 110 applications were received in the latest round. A rigorous selection process takes place each year. 10 new Fellowships were awarded this year, bringing the total number of awards under the scheme to 37 (see annex). The total number of appointments is planned to increase significantly after the Spending Review settlement announced by the Government in March 2005. An encouraging aspect of this scheme has been its ability to attract female researchers who account for just over 20% of all fellows in post.

Global Research Awards

The Global Research Awards scheme is designed to encourage engineering R&D networking around the world. It allows research engineers from academia or industry to work with leading technology organisations overseas for between three and 12 months, and in modules if preferred. The Academy funds 50% of the total agreed costs of the visit up to a ceiling of £35,000. During the year the scheme supported 21 research engineers for secondments covering a wide range of engineering interests in all parts of the world. Award holders current during the year are listed in the annex.

As from September 2005, the Academy has, in line with all the Research Councils, invited all requests for research funds on a Full Economic Costing (FEC) basis. Government, through the Office of Science and Technology, has provided additional funds to make university research more sustainable – the Academy's Parliamentary Grant in Aid was, for example, increased in order to meet 80% of the FEC. All new posts supported by the Academy will include the agreed FEC element as from 1 April 2006.

Industrial Secondment Scheme

This scheme provides a valuable opportunity for engineering academics in UK Higher Education Institutions to benefit from a period of industrial and commercial experience. Working on identified projects as part of the host organisation 'team', they contribute their own special expertise to the task, whilst gaining state-of-the-art knowledge which will benefit their teaching activities. The secondments enable the development of new case study material, plan new teaching modules and courses, and initiate or strengthen the links between the host organisation and the university department. Ten awards were made to a wide variety of organisations during the year (see annex for details) covering most engineering disciplines.

Responding to enquiries received over a number of years, and enabled by ERA Foundation support, a new scheme was piloted during the year. This provided for two people to be seconded from industry into academia in a reversal of the Industrial Secondment Scheme process. The expected benefits of this new scheme will be appraised before a proposed increase in activity levels.

Visiting Professors in Engineering Design for Sustainable Development

The primary aim of this scheme remains the development of case study based teaching materials, showing how engineers address the key issues of sustainable development. The Academy has always insisted that each university in the scheme develops its own case studies around multidisciplinary themes. These themes have included the built environment, water management, land reclamation, energy conservation, and manufacturing.

This scheme has now reached maturity and the funding level is reducing as each participating university comes to the end of its five year grant. A portfolio of the knowledge gained through these years was compiled and published as a set of guiding principles in the booklet Engineering for Sustainable Development launched in September 2005. The network of universities and visiting professors helps deliver the scheme's objectives of developing sustainable development competencies in engineering undergraduates.

Visiting Professors in Principles of Engineering Design

Now in its seventeenth year of operation, the purpose of this scheme is to disseminate best practice in the teaching of engineering design. It retains an almost constant number of around 120 Visiting Professors and is essentially self-funding although efforts are underway to secure additional funding.

Visiting Professors in Integrated System Design

The Integrated System Design Working Group, established under the chairmanship of Professor Peter Deasley FEng, launched this new scheme in 2004 to introduce

undergraduate engineers to the challenges of system integration. A total of eleven Visiting Professorships have been approved, and five more appointments will be made during 2006. This scheme is expected to grow to about 20-25 appointments over the next three to four years.

Visiting Professors in Building Engineering Physics

The Ove Arup Foundation and the Academy have established a consortium of engineering companies and consultancies which will support three Visiting Professors in Building Engineering Physics. This arose from the perceived need to attract some of the best civil engineering graduates to take-up careers in the building services sector. The scheme is administered by the Academy and there has been a good response from the universities approached.

ENABLING POSTGRADUATE AND PROFESSIONAL DEVELOPMENT

Engineering Professional Development Awards

This scheme supports the Academy's commitment to enhancing the potential of UK industrial engineers. Financial assistance is offered towards the cost of appropriate development programmes linked to an organisation's business plan or strategy.

In the most successful year for the scheme to date applications were received from 65 companies – two thirds of which were high tech small and medium enterprises – and a total of 57 awards were made, totalling £245,000. These awards generated a further £2.1m in indirect expenditure. The selected company training programmes involved 1144 engineers.

ExxonMobil Engineering Education Schemes

This scheme, which the Academy administers on behalf of ExxonMobil, aims to enhance the national potential of chemical engineering graduates by supporting the delivery of quality learning and training programmes at UK universities. Funds are awarded for projects as diverse as the purchase of state-of-the-art equipment, software packages and capital building projects. Application is by invitation to universities that have ExxonMobil Teaching Fellows on their staff. Awards were made in 2005 to Department of Earth Sciences at: the University of Cambridge; the Department of Earth Sciences at Royal Holloway College; the Department of Chemical Engineering at the University of Birmingham; the Department of Chemical Engineering at the University of Manchester.

International Travel Grants

This scheme, which enables young engineers to attend international conferences, made grants amounting to almost £429,000 during the year, supporting visits to more than 100 countries including Chile, Uganda, Iran, Japan, China, Russia, India and the USA. A total of 1238 applications were received of which 804 were awarded a grant.

The Academy continued to publicise the wealth of activity undertaken by travel grant awardees. Of particular note was the publicity surrounding the work being done by Andrew Medley from Warwick University into the development of miniature loud speakers. Not only was this story covered regionally and nationally, but also internationally when Andrew won the award for 'Best Student Paper' at the 149th

meeting of the Acoustical Society of America.

Sainsbury Management Fellowships in the Life Sciences

These Fellowships support young scientists of high career potential, enabling them to undertake activities related to their personal development plans. These may include learning packages, such as an MBA, national and international conference attendance, industrial visits and foreign language training. There were five Fellowships awarded in 2005 (see annex), bringing the total number to 45 since the scheme's inception.

The Panasonic Trust

The Trust's awards scheme provides grants to help engineers undertake courses to update and retrain in new developments and technologies. The scheme granted a total of £34,000 to 55 industrial engineers, bringing the total number of awards made since its inception to 1142. All awardees received additional financial co-sponsorship from their employer.

The Trust awards Fellowships to assist recent engineering graduates to undertake a full-time Masters Degree course in environmental studies or sustainable development. The scheme was heavily oversubscribed for the 2005 Fellowships. Details of the seven recipients are given in the annex. In addition, Panasonic awards gold medals to those who achieve a distinction or equivalent pass through either the awards or Fellowship schemes. In 2005, seven such medals were awarded.

The 2005 winner of the Panasonic Trust Project Presentation Prize was Peter Robinson from the MSc course

in Renewable Energy and the Environment at the University of Reading. Peter, whose presentation was on "Small wind turbines for the urban environment: installations and economics" was rewarded with a £1000 prize and a gold medal.

The Sir Angus Paton Bursary

The late Sir Angus Paton CMG FEng FRS made an endowment to the Academy in 1986 to fund an annual bursary to recognise excellence and inspire a suitably qualified engineer to undertake a full-time Masters course related to water engineering. The 2005 bursary was awarded to Jennifer Rintoul to enable her to study the MSc course in Water and Environmental Engineering at Cranfield University.

Recognising excellence and inspiring the next generation

The Academy celebrates excellence by bestowing medals for outstanding achievement and by electing to its Fellowship the most eminent members of the engineering community. These outstanding role models, along with the Academy's Best Programme, are central to inspiring the next generation of excellent engineers.

EDUCATION

The Royal Academy of Engineering's Best Programme is a continuum of curriculum enrichment schemes in science, engineering and technology (SET). The Best Programme works in primary schools to build an enthusiasm for SET subjects, in secondary schools to promote engineering and related SET careers, in universities to support gifted engineering students and beyond university to develop the engineering leaders of tomorrow.

This year, overall participation in the Best Programme has grown with new industrial sponsors supplementing the long-standing funding received from the Gatsby Charitable Foundation which reduces year on year in accordance with an agreed business plan. Although all those responsible for the Programme must continually strive to secure ongoing funding the Programme is now all-but self sustaining.

The year has also seen the Best Programme joined by a substantial new engineering education outreach programme with funding from the Higher Education Funding Council for England (HEFCE). HEFCE has provided £2.85 million to fund the first two and a half years of a 10-year National Engineering Programme

(NEP). The London Engineering Project, the London phase of the NEP was launched in September 2005 and, providing continuation funding from HEFCE is secured, will roll out to other cities in England from 2008.

In addition to these two programmes, the Academy has been involved in other aspects of engineering education in schools. Firstly it is leading the Technology and Engineering in Schools Strategy (TESS): a process inspired by the Science Minister Lord Sainsbury to bring consolidation and organisation to the confusing plethora of curriculum enrichment schemes offered to schools.

Secondly, it has an active role in the development of the Engineering Diploma, which will be in the first group of 14-19 schools diplomas due to be launched in 2008. Finally, through its Shape the Future campaign, the Academy is connecting young people with the engineering that surrounds their daily lives: inviting them to engage with that engineering by participating in activities such as those provided by the Best and National Engineering Programmes.

National Engineering Programme
The National Engineering Programme (NEP) works with

university partners to help create attractive engineering courses and with inner-city schools to find and support students who have a capacity for higher education and an aptitude for engineering to take up those courses. The partners in the NEP are drawn from Higher Education, Government, Industry and science and technology education charities. The universities involved are London South Bank University, University of Liverpool, University of Sussex, University College London and the Cambridge – MIT Institute.

The London Engineering Project received its first funding in September 2005 in order to prepare for delivery from September 2006. To date, the project has begun the process of assembling a team of field-workers and has opened up discussions with schools in south London who will be joining the project. In addition, a system of governance has been set up with oversight from a group of Academy Fellows, a system of impact assessment has been put in place, and the task of curriculum review and enhancement is underway in the partner universities.

Young Engineers

Young Engineers is a national network of engineering clubs which provide curriculum enriching

activities in primary and secondary schools. Club activities are diverse, covering all aspects of engineering as well as providing a route into a variety of national competitions where members tackle complex engineering problems and compete for prizes. These national events include the RN and BAA challenges, the Young Engineers for Britain competition, the Young Electronic Design Awards, the K'Nex Challenge and the Club Awards. Last year, 59,000 primary school students took part in the Junior Engineers for Britain K'Nex Challenge.

The network of Young Engineers clubs is growing with 97 new clubs enrolled this year, bringing the total to 1347. Girls now make up 37% of Young Engineers. Several new initiatives are underway including the launch of a new website, an activity bank and better sign-posting of Best Programme activities. In 2005, Young Engineers achieved some notable successes, including winning top prizes at the International Science and Engineering Fair and providing the three finalists in the Isambard Kingdom Brunel Engineering Awards.

Headstart

Headstart is a well-established residential summer school programme held at 28 universities throughout the UK, showing talented students in Year 12/Scottish Year 5 how technology-based subjects can be stimulating and rewarding. During their time on campus, students engage in design, build and test projects, attend seminars and lectures, and meet young graduates.

Headstart has been creating more opportunities for students from ethnic minorities through its 'Spectrum' programme, and girls through 'Dragonfly' courses.

Between them, these two initiatives will add a further 500 students to the Headstart programme in 2006. In 2006, Headstart's diversity programme will be further enhanced by a group of girls-only courses, entitled 'Insight'.

Headstarts students are treated as undergraduates during the course to help them prepare for university life. Students visit local organisations, meet professionals at different stage of their career and usually have opportunities to explore the local area.

Some 580 schools will participate during 2006 and 34% of participants are young women. Headstart's popularity increases every year – from 200 students 10 years ago, to 1400 applicants for 2006.

In addition to their courses for students, Headstart has introduced a range of one-day seminars for teachers, in partnership with their universities. These continuous professional development courses are designed to be intellectually stimulating, relevant to the school curriculum, and a module for the teachers' portfolio of continuous professional development.

Smallpeice Trust Schemes

The Smallpeice Trust offers young people aged 13-18 the opportunity to work with experienced professional engineers on residential courses at universities and in science, technology, engineering and maths activities arranged in schools. The Smallpeice Trust provides curriculum enrichment for maths, science, technology and enterprise through the practical and creative application of engineering design and associated skills, together with business and management skills for professional development. Nearly 3,400 students attended Smallpeice courses in 2005-06.

A strong interface with industry, education and professional bodies helps to ensure that the courses are properly supported, promoted and developed. The Trust is building on these relationships to widen the scope of opportunity available to young people and to strengthen its reputation for developing and delivering courses to a high standard.

The Smallpeice Robotic Engineering course was successfully launched during 2005 and further expansion is planned in 2006 with new courses in Motorsports Engineering, Environmental Physics, Aerospace Technology and Computers in Engineering. The Trust ran an Aimhigher course in Nottingham for 85 students – 58 of whom were girls including 14 from Moslem backgrounds. It is a partner in the London Engineering Project.

Engineering Education Scheme

The Engineering Education Scheme (EES) encourages the most able young people to pursue a career in professional engineering by enabling them to work in teams on significant real industrial engineering projects. This is achieved through partnerships between schools/colleges and companies from October to April each year. The EES is a UK wide initiative operating in Scotland, Wales and Northern Ireland.

As a result of scheme participation, accreditation for teachers and engineers is available through the College of Teachers and the Science and Engineering Ambassadors scheme, respectively. The vast majority of students achieve the British Association Creativity in Science and Technology (Crest) Gold Award. EESE teams and students scooped some major awards in the BA Science Fair held in February. The students experience teamworking,

project management, report writing and key skills development during their 6 months project. The scheme is also an access organisation for the Duke of Edinburgh Award Scheme.

A Key Stage 3 version of the EESE will be piloted in 2006/07 as part of the London Engineering Project. Teams of Year 9 pupils – each six strong and supported by a company mentor – will be set STEM projects that include many facets of the senior scheme including work related learning and industrial enterprise. Subject to the success of the pilot, a regional roll out is planned for 2007/08.

This year was the 21st anniversary of the Engineering Education Scheme in England (EESE). 1330 students participated in 330 teams working on real engineering projects set by the sponsoring companies. Each team comprises four or five Year 12 students, a mentor engineer and teacher. Following 20 Scheme Launch Days in October, the teams attended 15 residential university workshops across England in December and January.

Project assessments will be held at 17 Celebration and Assessment Days in April and May 2006.

In Scotland, the scheme completed its final year in the traditional format of teams of fifth and sixth formers. From next year, the age range will be widened opening the opportunity for the scheme to have a positive influence on students before they commit to a career choice.

Participation in the EES scheme in Wales increased in 2005-2006 to 405 students from 60 schools working with 66 companies on 74 projects. In addition the scheme retains its role as a catalyst for industrial placements, and curriculum development in Wales.

The EES scheme in Northern Ireland enjoys an excellent reputation and works with 89 students from 22 schools. The ongoing success of the scheme is linked to the close working relationship with two local universities, Queens University Belfast and University of Ulster.

The Year in Industry

The Year in Industry provides extended work placements for students before university or during their degree. Seventy-five percent of the 572 scheme participants went directly into industry on completion of their undergraduate studies and 19% went to study an advanced course. Seventy four per cent obtained First or Upper Second class degrees and 78% of students came from state schools or colleges.

The students are supported throughout their placement with both Year in Industry staff mentors and company mentors. Last year one student filed a patent based on one of his ideas and a large number of other students made considerable contributions to their companies' profitability. Students have the opportunity to take the Chartered Management Institute's Certificate in Management at level three.

The Undergraduate Programme

The objective of the programme, only open to students who have participated in one or more of the school schemes of the Best Programme, is to encourage university students to retain their interest in engineering as a career – through a series of developmental activities. These include a business awareness course and personal development training courses. Eligible students are invited to register as they start their accredited BEng or MEng university course. This year, 1707 students have registered, of whom 24% are women.

Six WILD courses were held on Dartmoor. Similar to 'outward bound' activities, these weekends provide practical examples of team building in a challenging environment, and test the ability of participants to communicate effectively. The Developing Business Skills course, which was oversubscribed yet again, involved four teams competing in a simulated business game involving personnel management, sales and marketing, stock control and manufacturing.

Engineering Leadership Awards (ELA)

The ELA scheme is open to second year MEng undergraduates from all UK universities. Participants on the scheme, who are all in the top 20% in their universities, have been assessed as having clear leadership potential and are provided with the funding and opportunities to undertake an accelerated programme of personal development.

This year, 21 Engineering Leadership Awards (of which six were to women) were made to students at 10 universities. Each will benefit from a Sainsbury Management Fellow mentor as well as training and networking events organised by the Academy. They will each receive funds of £7,500 to be used over the next three years to improve foreign language skills, attend work placements (especially overseas), conduct studies of engineering business in specific sectors, and prepare for fast track careers in UK industry.

The recipients of these and the following awards are listed in the annex of the Report

Executive Engineers Programme

This programme is designed to help engineering graduates who are

highly motivated, entrepreneurial and innovative to enhance and accelerate their professional development to Chartered Engineer status. The programme in 2005 was attended by 37 graduate engineers; in addition, three previous participants attended for the networking and social components.

Sainsbury Management Fellowships in Engineering and Life Sciences

An award aimed at young Chartered Engineers which covers the cost of course fees for MBA studies. Ten Fellowships were awarded during the year. The scheme offers regular contact with chartered engineers who have international MBAs – 226 awardees have benefited since the start of the programme. In 2005 the total number of awardees through the Life Sciences scheme reached 45.

Engineering Teaching Prizes

Launched in 2005, six prizes a year worth £10,000 each are funded from a generous donation by the ERA Foundation. The prizes are for distinguished lecturers committed to promoting engineering as a rewarding career and establishing links between education and industry. Three of the prizes this year were presented at the Academy's Annual Northern Regional Lecture and Dinner Event held at the University of Leeds on 7 March 2006.

Research Student Development Fellowships

A scheme aimed at PhD and EngD students also launched in 2005 with ERA Foundation support. The scheme offers an award of £5,000 to fund a personal development and training plan. Awardees can also apply for a further prize of £5,000 on completion of their higher degree, by demonstrating an intention to pursue a UK research career in education or industry.

BNFL/Royal Academy of Engineering Education Innovation Prize

Launched in 2005 with funding for its first year generously provided by BNFL. The prize recognises organisations and individuals who have made significant contributions to engineering education, especially through innovative teaching.

Five of the finalists were:

Imperial College London's Constructionarium project; King's College London's Engineering Arts strategy; Liverpool University's www.steeluniversity.org resource; Queen University Belfast's Innovative Education for Engineers course; and Strathclyde University's series of IEE Scotland Christmas Lectures.

The sixth finalist, and first winner of the prize, was the University of Southampton's Design, Build, Test, Float, Fly and Race hands-on activity. They were presented with their award on 30 March 2006 at the Innovation in Engineering Education Symposium.

The Academy launched the *Shape the Future* campaign in November 2005 to help the engineering community improve its efforts to raise awareness of engineering and technology as a stimulating career option. The launch sponsors of *Shape the Future* were BP, Airbus, Bosch, The ERA Foundation, Kodak and Tyco Electronics.

Shape the Future has two main objectives. Firstly, it aims to bring greater coordination and coherence to the many science, engineering and technology (SET) activities already in existence and, secondly, it enables more young people to 'do one more thing' in SET – such as join a Young Engineers club – especially from groups not previously engaged.

The encouraging support of over 40 major organisations and initiatives that signed up to the high level objectives of the *Shape the Future* campaign plus the initial work of the Technology and Engineering in Schools Strategy (TESS) group will result in a more coordinated offering from UK engineering to the education community.

The campaign has launched the ERA Foundation photographic competition in association with Kodak, the Royal Photographical Society and the Young Engineers club network, and teamed up with Bosch and *The Independent* newspaper to organise the Technology Horizons Award essay competition for 14 to 24 year olds. The relationship with *The Independent* has resulted in the publication of a new engineering magazine, *Future*, that is distributed to all secondary schools, FE colleges and university careers office in the UK twice per year.

ACADEMY AWARDS

The Academy's Annual Awards Dinner on 2 June at Draper's Hall was made possible by the generous support of the sponsors of the evening: BNFL, BP, IBM and Rolls-Royce plc.

Prince Philip Medal

Awarded to: **Professor James Dooge FREng, retired Chair in Civil Engineering, University College Dublin.**

Professor Dooge first established his academic credentials when he was appointed Professor of Civil Engineering at University College Cork. He led the many advances in the application of linear systems theory to hydrology in general and rainfall run-off modelling processes in particular. He returned to University College Dublin in 1970 when he was appointed to the Chair in Civil Engineering, remaining until his retirement in 1984.

Professor Dooge was a member of the Irish Senate 1961–1987 and Irish Minister for Foreign Affairs 1981–1982. He was elected a foreign member of The Royal Academy of Engineering in 2000. He has continued his interest and involvement in hydrology and still publishes in leading journals. He has, over his long and varied career, encouraged many young engineers to adopt a multi-disciplinary approach to engineering hydrology.

MacRobert Award

Awarded to: **CSR plc for its single chip BlueCore™ family.**

This is the Academy's premier award and the prize of £50,000 went to CSR plc. CSR's key technology breakthrough was to pioneer a silicon chip with an integral radio

transmitter in the late 1990's. The company is now ranked number one in every Bluetooth market segment. CSR has shipped more than 100 million chips since its foundation – supplying products to customers including industry leaders such as Nokia, Panasonic, IBM, and Sony.

The other three finalists were: Agilent Technologies for acceSS7 Location, a location tracking system for mobile phones; Offshore Hydrocarbon Mapping (OHM) plc for controlled source electromagnetic sounding; and SPI for their efficient, ultra bright fibre lasers.

The President's Medal

Awarded to: **Jonathan Ive.**

Jonathan Ive leads the industrial design team at Apple which designed the iMac and iPod. The award recognises his celebrated achievements in engineering design and, in particular, the design of the iPod, which represents the very best of human interface engineering.

Silver Medals

The four medals awarded this year were presented to the following, for their outstanding contribution to British engineering and commercial development:

• **Simon Brueckheimer, Consultant Architect at Nortel.**

As Consultant Architect at Nortel, Simon Brueckheimer is a pioneer of Next Generation Networks, which are changing the face of telecommunications by integrating voice, mobile, broadband wireless and data communication into one digital system. Simon Brueckheimer also designed the first VLSI chip and related systems and paved the way for the high-quality transport of compressed voice signals over packet networks.

• **Nigel Schofield, Technical Manager – Core Technology at BOC Edwards.**

Nigel Schofield has helped to make his company, BOC Edwards, the leading supplier of vacuum systems for semiconductor preparation, with export revenue approaching \$1 billion. His regenerative machine, developed from his first prototype, is now a world-leading product as the first tool-mounted, load-lock pump for the semiconductor industry. It won the company a Queen's Award for Innovation in 2002.

• **Barry Trimmer, Research Technology and Engineering Director of Thales UK's aerospace business.**

Barry Trimmer has worked at the cutting edge of radar design for the last 25 years. He was instrumental in the antenna design for both the Searchwater radar for the Nimrod MR2, and the helicopter-based ASaC radar. In 1988 he led the technical development of a portable radar, MSTAR, for the British Army.

He has led the design of many of the algorithms and has developed new engineering protocols to manage this complex work. Searchwater 2000AEW is now fully operational in the Royal Navy's Sea Kings and has been praised for its operational flexibility.

• **Peter Price, Director of Engineering and Technology for Rolls-Royce's Civil Aerospace sector.**

Peter Price joined Rolls-Royce as a graduate trainee in 1980. He progressed quickly to become Chief Engineer for the Pegasus engines family. During 2003, he successfully led Rolls-Royce engineering efforts to secure the four-nation collaborative Europrop International GmbH TP400-

D6 turboprop as the power plant for the Airbus A400M military transport aircraft. This all-new engine will be the most powerful turboprop in the Western World.

As Director of Engineering – Defence Aerospace, Peter Price led Rolls-Royce's technical contribution on two of the world's largest combat programmes. As Chairman of the EUROJET partnership technical directors' group, he brought into production the EJ200, one of the world's most advanced combat engines

Sir Frank Whittle Medal

Awarded to: **Professor Peter John Lawrenson FEng FRS** for his design methodologies and the development of electrical machines used worldwide.

As a leading expert in electrical and electromagnetic devices, Professor Lawrenson is best known and for his work on the invention, development and commercialisation of switched reluctance drives.

Electrical machines are crucial for life throughout the developed world and the switched reluctance machine is the only radically new electrical machine since the induction motor.

With a computer brain incorporated as an integral element, it is able to satisfy an unusually wide range of applications, from the domestic to refined laboratory apparatus; pumping all our oil and water, to numerous uses in transportation vehicles. Moreover, they are providing the way forward for topical developments in various forms of electric automobiles and in most applications they can bring significant energy savings and environmental benefits.

The Public Promotion of Engineering Medal

Awarded to: **Dr Lindsay Sharp** for his work in the promotion of engineering.

Dr Sharp has, throughout his life, demonstrated a passion for interpreting and explaining major issues in science and engineering in education and social history. As Director of the National Museum of Science and Industry, he combined the encouragement of dialogue between the public, scientists and engineers with his curatorial responsibilities at the NMSI and the Science Museum.

Lifetime Achievement Award

Awarded to: **Dr Philip Woodward.** The Royal Academy of Engineering awarded its first ever Lifetime Achievement Award to Retired Deputy Chief Scientific Officer, Dr Philip Woodward, recognising him as an outstanding pioneer of Radar and for his work in precision mechanical horology.

Philip Woodward's career in the Scientific Civil Service spanned some four decades. He was responsible for one of the UK's first electronic computers (TREAC) followed by the UK's first solid state computer (RREAC). He is the author of the internationally renowned book 'Probability and Information Theory, with Applications to Radar' and in retirement wrote another classic book, 'My Own Right Time'

During the second world war, Philip Woodward developed a mathematical beam-shaping technique for radar antennae, later to become standard in the analysis of communication signals. In 1956, his work on radar information theory led Nobel Prize winning physicist John H Van Vleck to invite Woodward to give

a postgraduate course on random processes at Harvard University.

Philip Woodward's principal achievement in radar, was to evaluate the ambiguities inherent in all radar signals and to show how Bayesian probability can be used as part of the design process to eliminate all but the wanted information the echoes might contain.

International Medal

Awarded to:

Professor Cham Tao Soon FEng

The Council of the Academy approved the establishment of an International Medal to be awarded occasionally to an individual, resident outside of the European Union, for his or her outstanding and sustained personal achievement in the broad field of engineering, including commercial or academic leadership or for specific products and/or projects.

In selecting Professor Cham to receive this award, the Academy cited his achievement in developing Nanyang Technological University (NTU) from a student population of just 582 to 23,000, and expanding its initial disciplines from traditional engineering to other fields of study. The Academy noted that under Professor Cham's leadership, NTU has established a reputation for producing graduates with a practical focus and a commitment to excellence based on the strong industry links he forged.

Special Achievement Award

Awarded to: **Stephen Payne OBE**

Council approved the establishment of a Special Achievement Award and Stephen Payne became the first recipient in January 2006. Stephen Payne was awarded a Special Achievement Award, in recognition of his involvement in constructing the world's largest liner – the Queen Mary 2.

Stephen Payne introduced several innovations to the overall design of the vessel, its structure and its propulsion system. The ship is propelled by the world's four largest podded propulsors – where the propellers are turned by electrical motors mounted outside the ship in their own water tight pod. Each has innovative electronic controllers operating at a power level unique in marine engineering.

ERA Foundation Award

Awarded to:

Phil Harper

The ERA Foundation Award is the latest in the Academy's awards portfolio, made possible with the support of the ERA Foundation. Phil Harper, research assistant at the University of Sheffield, won the inaugural award, worth £40,000, for his unique sensor technology that can monitor and predict the failure of mechanical seals. Phil's winning entry outlined the technical development and commercialisation of a patented method of monitoring the critical thin liquid layer separating the stationary and rotating rings of mechanical seals, which are used in a huge range of pumping applications, such as water pumps, turbines, compressors and oil rigs.

FELLOWS

The Academy's Fellowship is chosen from the nation's most distinguished engineers. Up to 60 Fellows are elected annually from nominations made by existing Fellows. The Annual New Fellows' Dinner was held on 24 October 2005 at Draper's Hall in the presence of the Royal Fellow, HRH The Duke of Edinburgh.

New Honorary Fellows elected in 2005 were:

Sir Christopher Evans OBE

Founder and Chairman of Merlin Biosciences Limited

Lord May of Oxford

OM AC Kt FRS

Professor of Zoology, University of Oxford and Imperial College London; Fellow, Merton College, Oxford

Sir Robert Keith O'Nions FRS

Director General of the Research Councils; Visiting Professor, University of Oxford

Lord Rogers of Riverside

Chairman of Richard Rogers Architects Ltd, London, Tokyo and Berlin

New International Fellows elected in 2005 were:

Alfonso Farina (Italy)

Director, Analysis of Integrated Systems Group, SELEX-System Integrati

Kemal Hanjalic (Netherlands)

Professor Emeritus, Delft University of Technology & Visiting Professor, Technical University of Darmstadt

Man Mohan Sharma (India)

Honorary Emeritus Professor of Eminence, University Institute of Chemical Technology, Mumbai; Kothari Research Professor, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore

New Fellows elected in 2005 were:

Anthony Kenneth Allum CBE

Chairman, Halcrow Group Ltd

Trevor Mark Benson

Professor of Optoelectronics, Director, Bookham Technology Centre of Excellence in Optoelectronics Simulation & Deputy Director, George Green Institute of Electromagnetics Research, University of Nottingham

Ian David Lockhart Bogle

Head of Graduate School and Professor of Chemical Engineering, University College London

David Cebon

Reader in Mechanical Engineering, University of Cambridge and Fellow, Queens' College; Managing Director, Granta Design Ltd; Director, Cambridge Vehicle Dynamics Consortium

Howard Allaker Chase

Head of Department of Chemical Engineering and Professor of Biochemical Engineering, University of Cambridge

James Digby Yarlet Collier

Technical Director and Co-Founder, Cambridge Silicon Radio plc

Peter Alan Cundall

Principal, Itasca Consulting Group Inc; Adjunct Professor, University of Minnesota

Brian Lawrence Davies

Technical Director, Acrobot Co Ltd; Senior Research Investigator and Emeritus Professor, Imperial College London

John Allan Dodds

Professor and Director, Ecole des Mines d'Albi, Centre de Recherche Poudres et Procédés, Albi

James Dyson CBE

Chairman, Dyson

Colin M Eddie

Engineering Director, Morgan Est; Director, Underground Professional Services

John Kelvin Fidler

Vice-Chancellor and Chief Executive, University of Northumbria

Peter John Fleming

Professor of Industrial Control Systems, Director of Rolls-Royce University Technology Centre in Control and Systems Engineering, Pro-Vice Chancellor for External Affairs, University of Sheffield

Vincent Francis Fusco

Chair of High Frequency Electronic Engineering and Director, International Centre for System-on-Chip and Advanced Microwireless, Queen's University, Belfast

Michael John Glover

Technical Director and Deputy Director, Tunnel Rail Link Project; Director, Ove Arup and Partners

Dougal Jocelyn Goodman

Director, The Foundation for Science and Technology; Chairman, The Risk Group

Anagnostis Hadjifotiou

Visiting Professor: Essex University, UCL and University of Wales (Bangor)

Sir (Charles) Anthony Richard Hoare

Senior Research Scientist, Microsoft Research Ltd

Howard Peter Hodson

Professorial Fellow of Girton College; Professor of Aerothermal Technology, Whittle Laboratory Cambridge

Andrew George Inglis

Executive Vice President and Deputy Chief Executive, Exploration and Production, BP plc

Michael Anthony Jackson

Visiting Professor, The Open University and University of Newcastle-upon-Tyne

(Guy) Antony Jameson

Thomas V Jones Professor of Engineering, Stanford University

Nicholas Jenkins

Professor and Group Leader, Electrical Energy and Power Systems Group, Department of Electrical Engineering and Electronics, University of Manchester

Nicholas Robert Jennings

Professor of Computer Science, University of Southampton; Chief Scientific Officer, Lostwax

John Robert

Chief Executive, TWI Ltd

Geoffrey Kirk

Chief Design Engineer - Civil Aerospace, Rolls-Royce plc

John Leggate CBE

CIO and Group Vice President, BP plc

Michael Robert Lloyd

Director - Gas Turbine Operations, Rolls-Royce plc

Christopher Robin Lowe

Director, Institute of Biotechnology & Professor of Biotechnology, University of Cambridge

(Patrick) Enda O'Connell

Professor of Water Resources Engineering, and Director of Earth Systems Engineering, University of Newcastle-upon-Tyne

Richard L Olver

Chairman, BAE SYSTEMS plc, Deputy Chairman TNK-BP

David N Payne CBE

Director, Optoelectronics Research Centre, Southampton University

Amanda Karen Petford-Long

Senior Scientist, Argonne National Laboratory; Adjunct Faculty Member, Northwestern University

Roger David Pollard

Dean, Faculty of Engineering, University of Leeds

Malcolm H Pope

Professor of Biomedical Physics & Bioengineering, University of Aberdeen; Professor of Occupational Medicine, Honorary Consultant, Aberdeen Royal Infirmary

Keith Ridgway OBE

Research Director University of Sheffield, Advanced Manufacturing Research Centre with Boeing, University of Sheffield

Peter William Rogers

Managing Director, Stanhope plc, Chairman, Strategic Forum for Construction

Adrian Shooter

Chairman and Chief Executive, Laing Rail Ltd; Chairman, Chiltern Railway Co Ltd, Deputy Chairman Association of Train Operating CO's

Derek Turner CBE

Traffic Operations Director, The Highways Agency, Visiting Professor, University College London

William Webb

Head of Research, Ofcom UK, Vice-President IEE

Bernard Lawson Weiss

Professor of Microelectronics and Pro-Vice Chancellor, University of Surrey

Nicholas John Peter Wirth

Managing Director, Wirth Research Ltd; Technical Director, Digital Flow Solutions; Technical Director, RoboScience Ltd

Philip John Withers

Professor of Materials Science, Manchester University

Alan John Wood CBE

Chief Executive, Siemens plc; President, EEF; Chairman, CBI South East; Chairman, German-British Chamber of Industry and Commerce

DECEASED FELLOWS

The Academy was advised of the deaths of the following Fellows during the past year:

- **Dr P B Ahm** CBE FREng
- **Prof J M Alexander** FREng
- **Mr C F Alsop** FREng
- **Mr A F Beardmore** OBE FREng
- **Dr E S Booth** CBE FREng FRS
- **Rev Dr E C B Corlett** OBE FREng
- **Prof N A Dudley** CBE FREng
- **Sir Ronald Ellis** FREng
- **Dr R W Hobbs** FREng
- **Mr T O Leith** OBE FREng
- **Professor M McLean** FREng
- **Prof J M Meek** CBE FREng
- **Dr W C Nixon** FREng
- **Sir Frederick Page** CBE FREng FRS
- **Mr F D Penny** CBE FREng FRSE
- **Mr D J Pickerell** FREng
- **Prof J J Sparkes** FREng
- **Dr D Train** MC FREng
- **Sir Alan Veale** FREng
- **Dr A A Wells** OBE FREng FRS
- **Mr G F Whitby** OBE FREng
- **Mr J S Whyte** CBE FREng
- **Prof G R Wray** FREng FRS

Leading Debate

The Academy engages in the process of policy development on issues that have an engineering dimension. It does this at both national and international levels by formulating own-initiative policy statements and submitting expert evidence to parliamentary and government bodies. The range of our work in public engagement is diverse, encompassing a variety of meetings, lectures, seminars and other meetings and events.

ENGINEERING POLICY INITIATIVES

Energy Seminars

A major series of seminars covering all aspects of energy policy concluded in November 2005. Organised under the direction of Philip Ruffles CBE RDI FEng FRS, the topics covered – and the Chairs for each session – were:

- **Energy Demand**
Professor David Fisk CB FEng
- **Renewables**
Dr. David Lindley OBE FEng
- **Fossil Fuels**
Professor Alan Williams CBE FEng
- **Infrastructure**
Dr. Malcolm Kennedy CBE FEng FRSE
- **Oil and Transport**
John Baxter FEng
- **Nuclear Fission**
Dr. Brian Eyre CBE FEng FRS
- **Security of Supply**
Professor Nigel Lucas FEng

As the seminar series developed, the numbers attending increased from an average of 70 who could fit into the Academy's Conference Room, to 100 for the later ones which necessitated a larger venue. A report presenting the overall findings of the seminars is about to be released in time for it to be submitted for the Government's 2006 Energy Review.

Accidents and Agenda

A working group was established under the leadership of Trevor Truman

OBE FEng to examine the processes that follow from accidents or incidents in which potentially large forces or dangerous substances could cause severe consequences in terms of loss of life, injury, and plant or environmental damage. The group completed its task and published its report *"Accidents and Agenda"* in September 2005.

From its examination of a number of accidents and incidents that could have developed into major accidents, the working group concluded that there was no case for radical change in the British approach but it did observe that constant attention was required if standards were to be sustained. Accident rates in the UK compared favourably with most other countries.

Risk in Engineering

The Academy's programme on risk is led by John Turnbull FEng. During the year it has focussed on risk and safety, specifically the costs of safety, and the economic and moral issues involved in deciding the level of investment to be made in this area.

A seminar *The Economics and Morality of Safety* was held on the 16th February 2006. An audience of 130 heard a series of presentations examining the issues faced by many different sectors in deciding how much to spend on the safety of a product, process or system. The economic and moral issues were

addressed as were the safety and management practices needed to be put into practice. The debate concluded with a call for more commonality of approach.

Ethics in Engineering

The activities of two working groups on ethics and engineering were presented at a conference co-chaired by Academy President, Lord Broers, and Professor John Uff CBE QC FEng at the British Library on October 13th 2005. Seven speakers lectured on a range of ethical debates from the perspectives of philosophy, medicine, science, institutions, education and the law.

Over 150 attendees heard of the progress made in reaching agreement on a Statement of Ethical Principles for engineers, and on the development of a detailed curriculum map for the teaching of ethics in undergraduate engineering courses. The proceedings of the conference were published with the title *'Ethics and the Engineer: Embedding ethics in the engineering community'*.

The Working Group concerned with ethics has been chaired by Chris Earnshaw FEng, and has worked closely in conjunction with EC(UK) in the preparation of the Statement of Ethical Principles, which has the support and/or endorsement of the majority of the larger engineering institutions. Further amendments

and simplifications to be made to a final statement will be taken forward during the course of 2006-07.

The Working Group on the teaching of ethics, chaired by Andrew Haslett FREng, has been actively involved in the refinement and development of a curriculum map, which details how the teaching of ethics can be embedded in university engineering courses.

Philosophy of Engineering

A new project focussing on the philosophy of engineering commenced with a seminar on 27th March 2006. The seminar was a 'brainstorming' session, with philosophers and engineers discussing what engineering is and identifying the philosophical issues that surround it. Four speakers gave short presentations: Dr Robert Hawley FREng and Professor Igor Aleksander FREng on 'What is engineering?' and Professor Jo Wolff (Philosophy, UCL) and Professor Peter Simons (Philosophy, Leeds) on 'Where is the philosophy in engineering?' After the conclusion of the seminar series, the Academy intends to publish a report covering the major topics of concern, and perceptions of how philosophy and engineering may mutually inform the study and practice of each.

Systems Biology

Systems Biology is a rapidly advancing field of enquiry that applies the concepts of systems engineering and

mathematical modelling to improve the understanding of complex biological systems. These can involve ageing as well as pathological processes whose understanding relies upon comprehension of the interaction between the component parts of the system.

The Academy is working in partnership with the Academy of Medical Sciences. A joint working party co-chaired by Professor Richard Kitney OBE FREng and Sir Colin Dollery FMedSci will explore the opportunities, benefits and needs of this new field. Input has been received from a number of organisations including the Research Councils, the Wellcome Trust, universities and industry. It will report in autumn 2006.

Privacy and Surveillance

In addition to its many benefits, modern technology can raise social and ethical issues that society must address. A working group chaired by Professor Nigel Gilbert FREng AcSS has been established to explore concerns surrounding the need to protect privacy when collecting data about the general public and when using methods of surveillance in public spaces. The report will propose strategies for protecting an individual's privacy and identity whilst ensuring that benefits are gained from new means of data collection.

Interested parties have been invited to

provide evidence and a draft report based upon the working group's deliberations (informed by the evidence received) is nearing completion. A subsequent call for evidence targeted at the media will be issued in September 2006.

Academic Industrial Interactions

A series of events is underway to explore issues surrounding best-practice in Academic-Industrial interactions. Held on a regional basis, each seminar is hosted by a local university and involves the local Regional Development Agency. The first event – chaired by John Baxter FREng on 23rd February 2006 at Manchester University – focussed on 'Industrial Funding for Research – Barriers and Incentives to working in the UK'. The series will continue in June 2006 with a seminar concentrating on SMEs in the supply chain.

ENGINEERING POLICY RESPONSES

A central element of the Academy's work is to respond to Select Committee inquiries, Government consultations and requests from other bodies. Each response represents the collated views of Fellows invited to respond on issues within their field of expertise.

Science and Heritage

The Academy submitted evidence to the House of Lords Select Committee on Science and Technology on how

science, engineering and technology (SET) can preserve and improve access to the UK's cultural heritage. Examples of Fellows' experience of creating technologies to produce digital images, and set up online databases of relevant sites were sent to the committee. The submission encouraged the protection of SET heritage itself.

Management of Risk

The House of Lords Select Committee on Economic Affairs asked for evidence on 'Government Policy on the Management of Risk'. The Academy had already published 'Societal Aspects of Risk' which addressed many of the Committee's questions and further suggestions were made on how risk can be successfully managed in an engineering context. These include the importance of companies or organisations having clear risk policies, and the need to create a work culture in which errors or near misses are reported without fear of blame.

Environmental Pollution

The Academy responded to the Royal Commission on Environmental Pollution's consultation for potential topics for the Commission's 27th Report. As well as providing feedback on proposed topics, the Academy suggested a special report on the framing of the environmental debate around nuclear energy.

Corporate Manslaughter

Following a response to the Home Office on the draft Corporate Manslaughter Bill, the Academy was asked to give evidence to the Sub-Committee of the Home Affairs Committee and the Work and Pensions Committee. Keith Batchelor FEng and Jeffrey Smith FEng represented the Academy and contributed to the hearing on aspects such as the potential costs of the Bill, whether serious injury should be included in its scope and the dangers of forcing UK industry to be overly risk-averse.

Department of Health Consultation

The Academy responded to the Department of Health (DoH) Consultation on '*Best Research for Best Health: A New National Health Research Strategy*'. The Academy response, which drew on members of UK Focus for Biomedical Engineering, encouraged the use of a multidisciplinary perspective touching on engineering, technology, health sciences and medicine. Some of the aspects of the strategy proposed by the DoH appeared ambitious but it was felt that such plans could trigger laudable effort and beneficial results.

Water Management

The House of Lords Select Committee on Science and Technology issued a request for

evidence on Water Management. The Academy's response focussed on a number of themes including: metering as a way of managing water demand; the effect of climate change on supply-demand relationships; conveying to the public the importance of water as a resource and emphasising that whilst the South East of England faced the greatest challenges to water supply, a national perspective that included the regional transfer of water should be considered.

Sustainable Housing

The House of Commons Environmental Audit Committee made a call for evidence on sustainable buildings. The Academy's response covered issues such as the likely efficacy of voluntary codes for sustainable building; the degree to which government plans to deal with environmental problems associated with housing construction; and the infrastructure problems that may arise due to the Office of Deputy Prime Minister's plan to focus housing growth in the South East of England.

Transport White Paper

Towards the end of 2005, the Academy was invited to respond to the European Commission's mid-term review of the European Transport Policy White Paper. The Academy was able to offer a

substantial response owing to the gathering of evidence and the publication of its *'Transport 2050'* report a few months before. The Academy submitted recommendations on the challenges, the UK context, a strategy of action and a fifty year vision of transport policy. The lead Fellow on this was Professor A D May OBE FREng.

Science Policy in Wales

Written evidence was submitted to the *"Science Policy in Wales"* inquiry being conducted by the Economic Development and Transport (EDT) Committee of the National Assembly for Wales. The submission introduced the Committee to the Academy's activities in general but more specifically on those relevant to Wales. The Chief Executive and Director of Engineering Affairs appeared before the EDT committee in Cardiff in March 2006 fielding a diverse range of questions varying from the gender gap to the challenges of innovation and research and development in industry.

Consultations

Letters were sent from the Chief Executive to: The Office of Science and Technology addressing the *"Guidelines on Scientific Analysis in Policy Making"* and to Research Councils UK commenting on the *"RCUK Position Statement on Access to Research Outputs"*.

EDUCATION INITIATIVES

Educating Engineers for the 21st Century: The Industry View

The first phase of this Academy study was completed with the publication of the Henley Management College report and the Academy Commentary in March 2006. This was a major study involving over 440 companies that investigated UK undergraduate engineering education from the perspective of the current and future needs of Industry. It concluded that over the next ten years there will be an increasing shortage of high calibre UK engineering graduates going into industry which will impact on the productivity and creativity of UK based business unless it is addressed.

The next stage of the Academy review will involve testing the industry views – together with the recommendations and conclusions derived from them – with universities and graduates. Current best practice in the UK and overseas will be examined, from which an action plan will be developed with recommendations for universities, companies, government, professional institutions, the Academy itself and others involved in engineering.

Equalitec Diversity Forum

On 25 September 2005 Professor Wendy Hall CBE FREng chaired the Academy's first Equalitec Diversity

Forum. This focussed on the problems in attracting and retaining women in the IT, Electronics and Communications Sectors. The Academy will work closely with its partners in the project to determine the generic issues, identify best practice for their resolution and disseminate results throughout industry. The second Forum on 11th May 2006 will examine effective ways for enhancing productivity through diversity.

Innovation In Engineering Education Symposium

Lord Sainsbury of Turville Hon FREng, Parliamentary Under Secretary of State for Science and Innovation, gave the opening address at the Innovation in Engineering Education Symposium held at the RSA on 30th March 2006 which was attended by 150 delegates from industry, government and academe.

The meeting, chaired by Professor Julia King CBE FREng, reviewed the challenges to delivering the engineering education curriculum posed by industry's current and future requirements as laid out in the Academy's *Educating Engineers for the 21st Century* study. Professor Daniel Hastings of MIT presented the US National Academy of Engineering *The Engineer of 2020 project*. Current innovative projects and schemes devised to meet this

challenge were also presented. The six finalists for the RAEng/BNFL Education Innovation Prize mounted exhibitions of their projects and Dr Sue Ion OBE FEng, Director of Technology at BNFL presented the prize to the winning team from Southampton University.

EDUCATION RESPONSES

Throughout the year, the Academy made a number of other submissions related to education matters. Based on the Academy's earlier study on the *Pregraduate Experience of Engineering* the Academy advised and supported the Council for Industry and Higher Education's report on *Work Based Learning*. The Academy also acted in close cooperation with the ECUK and the Engineering Professors' Council in gaining agreement on the Quality Assurance Agency's *A Revised Benchmark Statement for Engineering*.

The Academy welcomed the Department for Education and Skills' consultations on *Youth Matters* whose findings underpin the objectives of the London Engineering Project and the National Engineering Programme. The Academy is monitoring closely European developments, in particular the adoption of the Bologna Process and has expressed reservations to Universities UK on the current inconsistencies in the proposed *European Qualifications Framework*.

Similarly in response to the Universities UK *'Measuring and Recording Student Achievement – UK Honours Degree: Provision of Information'* the Academy supports the provision of greater detail of student achievement through the publication of detailed transcripts of project and examination performance (a Diploma Supplement) but considers that the well established UK Honours classification system should be retained.

Higher Education Funding Council for England (HEFCE)

The Academy responded to two HEFCE consultations: the *'Review of the Teaching Funding Method'* and *'Sustainable Development in Higher Education'*. The Academy stressed it could make a very positive contribution by creating an environment which reduced both the sustainable development of estates and sustainable development within the curriculum. A proposal that funding should be made available for a 'teaching fellowship' scheme enabling the transfer of academics across departments was proposed.

INTERNATIONAL MATTERS

ERA Foundation International Lecture

The inaugural ERA Foundation International Lecture, *'Future Technology Horizons'*, is reported in the section on Meetings and Events.

China Meeting

A meeting, *'Doing Business with China: The Benefits and Barriers'*, was held on 9th March 2006. The objective was to draw on the Fellowship's expertise and corporate knowledge to inform the Academy's future activities related to China. The meeting was chaired by the President with speakers including Lord Browne of Madingley FEng, Lord Powell from the Office of the Deputy Prime Minister's China Task Force and Martin Manning FEng of Arup.

European Council of Applied Sciences and Engineering (Euro-CASE)

A Euro-CASE Board Meeting was held on 23rd March 2006 at the Austrian Academy of Sciences in Vienna. The Academy's Honorary Secretary for International Activities, Peter Saraga OBE FEng, led the Academy's representation. Topics discussed included Euro-CASE finances, the future of the International Science and Technology (IST) Prize, the procedures of Euro-CASE activities and a round up of the current Euro-CASE projects.

It was preceded on 22nd March by the European IST Prize awards ceremony. This lucrative prize is awarded to groundbreaking products that represent the best of European innovation in information technology. This year three British companies – 3Dsolar, Creist, and Zootech – featured among the 20 nominees.

Council of Academies of Engineering and Technological Sciences (CAETS)

The CAETS Convocation in July 2005 was held in Cairns, Australia and focused on 'Oceans and the World's Future'. With the importance of the oceans as an immense but fragile resource and the crucial connection between oceanic and atmospheric climate this was an important subject in need of consideration. Amongst the world experts giving presentations was Richard Snell FREng and the meeting concluded with a set of 10 recommendations to be followed through by the CAETS secretariat and member Academies. Lord Broers FREng FRS, Peter Saraga OBE FREng and Philip Greenish CBE attended on behalf of the Academy.

Pilot Study on Engineering Capacity Building in Sub-Saharan Africa

The International Committee has commissioned Dr Helen Bartlett to undertake a pilot study on engineering capacity building in sub-Saharan Africa. The study will last three months and consist of a review of the relevant literature and similar studies or projects, a series of interviews with appropriate experts and Fellows and a final report on the findings. The report will be reviewed initially by a working group headed by Prof Peter Guthrie OBE FREng before being put before the International Committee for its consideration.

ASSOCIATE PARLIAMENTARY ENGINEERING GROUP

The Academy provides the secretariat to the Associate Parliamentary Engineering Group (APEG). This is the sole Parliamentary Group providing a focus in Parliament for issues of concern to the wider engineering community. APEG, chaired by Bill Olnor MP, has a membership which includes MPs, Peers, businesses, academia and

other individuals. Its programme consists of a number of seminars held in the House of Commons by distinguished engineers and business leaders on topics of public and parliamentary interest with an engineering and public policy theme. Last year's programme included talks on the nuclear industry and BedZed – the groundbreaking carbon neutral town; the engineering behind some of the UK's major sporting projects including Wembley Stadium and the London 2012 Olympics; and the skills agenda for the UK motor sector. Information on the APEG programme – to which all Fellows are invited to attend as Academy guests – can be found on the group's website at www.apeg.org.uk.

UK FOCUS FOR BIOMEDICAL ENGINEERING

The Executive Committee of the UK Focus, chaired by Professor Richard Kitney OBE FREng, met four times during the year.

Sir Christopher O'Donnell, Chief Executive of Smith & Nephew plc, presented the inaugural UK Focus for Biomedical Engineering annual lecture in November 2005. In his address on 'Innovation in Medical Technology Global Reality and UK Promise', Sir Christopher reflected on the slow adoption of innovative medical technology by the UK healthcare industry and the National Health Service, comparing this situation with that in continental Europe and the United States. He highlighted inertia in the UK market and warned that unless it was overcome, international companies would export their innovative ideas and products to more receptive markets.

The Committee initiated a series of briefing meetings during 2005 with the objective of making a particular

biomedical engineering topic more accessible to a broader range of non-specialists. The first event was held in July with three eminent speakers addressing important aspects of Systems Biology.

POLICYNET

Established as a forum for policy officers and others from a range of organisations in the science, engineering and technology community, PolicyNet membership is now in excess of 100 people drawn from 43 organisations. Two meetings were held during 2005-06: Fiona Clouder-Richards, Head of Science and Innovation at the Foreign and Commonwealth Office gave PolicyNet members an insight into the development of the FCO's Science and Innovation Network and the role of science in international relations. James Wilsdon, Head of Science and Innovation at think tank DEMOS spoke about the public value of science.

MEETINGS AND EVENTS

Lectures

An important aspect of the Academy's role is to act as a forum for debate. Transcripts and presentations for the many public lectures, discussion meetings, briefings and debates it holds are available in the 'Past Events' section of the Academy website at www.raeng.org.uk.

The Hinton Lecture is the Academy's flagship lecture and in 2005 it was given by Lord Browne of Madingley FREng, Group Chief Executive of BP plc and Academy vice president. In his lecture, 'The Power of Engineering', the themes he explored included population growth, urbanisation, energy usage and climate change.

The 2005 Lloyd's Register Lecture '*Safety Appraisal Criteria*' was presented by Professor Andrew Evans, Lloyd's Register Professor of Transport Risk Management at Imperial College London. Held in April 2005 the lecture looked at long term trends in fatal transport accidents, considered frameworks for risk assessment and the wider consequences of accidents.

A one-day meeting entitled '*Radical Innovation in Advanced Nanomaterials*' was held on 9th November 2005. Chaired by the DTI's Director General of Innovation, David Hughes FREng, a series of speakers considered prospects for radical innovation through nanoscience and technology that will impact society in the form of new consumer-led products.

This was followed in the evening by the inaugural presentation in the Vodafone-sponsored Lecture Series in Mobile Telecommunications and Networks. Dr Irwin Mark Jacobs, co-founder of QUALCOMM Inc. spoke on '*Innovations in the Commercialisation of CDMA for wireless communications and future directions*'. The second speaker in the series was Professor Joseph McGeehan CBE FREng, Director of the Centre for Communications Research at Bristol University and Managing Director of Toshiba's Telecommunications Research Laboratory. He spoke in February 2006 on '*Wireless Communications; ideas that change the world*'.

Lord Broers used his 2006 New Year's Reception and Lecture as an opportunity to present the Academy's first *Special Achievement Award* to the guest speaker Stephen Payne OBE. In his lecture, Stephen Payne, Chief Designer for the Queen Mary 2, detailed the challenges and innovations involved in building a

super liner twice the size of the QE2. The 6th Annual Northern Regional Lecture and Spring Dinner took place at the University of Leeds in March 2006. Professor Robin Smith FREng described the challenges in piecing together the various steps in chemical processes to design complete manufacturing systems.

Amory Lovins, Chief Executive Officer of the Rocky Mountain Institute, was invited by The Royal Academy of Engineering and Forum for the Future to present in March 2006. He talked to 300 guests at RIBA on '*Nuclear Power: economics and climate protection potential*', arguing that observed market behaviour suggests that nuclear power worldwide has been overtaken by decentralised technologies on both the supply and demand side.

The inaugural ERA Foundation International Lecture, '*Future Technology Horizons*', was given on 9th March 2006 by Dr Craig Barrett, Chairman of the Board for Intel Corporation and Chair of the US National Academy of Engineering. The lecture centred around Dr Barrett's thoughts on the impact of digital technology and electronics on today's environment. The audience of 280 were also told of new fields that will emerge over the next decade including silicon photonics, single molecule detection and dynamic physical rendering. Dr Barrett's closing message, that he felt was important, was to change before you have to. This, he held, has enabled Intel to become the world's largest chip maker.

Academy Briefings

Patricia Galloway, the first female President of the American Society of Civil Engineers, lectured at the briefing '*The Engineer in Society*' in

April 2005. Joanne Coleman and Marie Noell Barton MBE also spoke. This Academy briefing addressed the lack of diversity in the profession explored the role of the engineer in a global economy and considered ways to engage the public.

Dr Irving Wladawsky-Berger, IBM Vice President for Technical Strategy and Innovation, looked at how the world's economy might be reshaped by innovations in IT in his May 2005 Academy Briefing '*Enabling a Business Process Revolution*'. He considered whether the emergence of collaborative industry ecosystems would produce new levels of productivity and asked what this would mean for education, healthcare and standards of living.

THE REITH LECTURES

The Academy's President Lord Broers FREng FRS, gave the 2005 Reith Lectures, which were broadcast on BBC Radio 4 from 6th April to 4th May. In the five lectures entitled '*The Triumph of Technology*', Lord Broers set out his belief that technology can and should hold the key to the future.

The programmes featured talks and Question & Answer sessions on 'Innovation and Management', 'Collaboration', 'Risk and Responsibility', 'Nanotechnology and Nanoscience' and 'Technology will Determine the Future of the Human Race'. There was considerable interest generating articles in both print and on the internet. The complete lecture series was printed both in paperback and hardback by Cambridge University Press in October 2005.

At 'What do Engineers really need to learn about Sustainability' in September 2005, Professor Roland Clift OBE FEng, led a panel of speakers discussing the recent revision of professional accreditation requirements by Engineering Council (UK). These will require candidates for registration as professional engineers to demonstrate competence in addressing sustainability issues.

Annual Soirée

In June 2005, the Academy's Annual Soiree was hosted by the University of Southampton at its National Oceanography Centre. Professor Bill Wakeham FEng, Vice-Chancellor of the University, and Academy President Lord Broers welcomed the Guest of Honour, HRH The Duke of Edinburgh, the Academy's Senior Fellow, who unveiled a plaque to mark the official renaming of the Centre.

The Soirée took place on the eve of the International Review of the Fleet held as part of the programme of events to commemorate the bicentenary of the death of Admiral Lord Nelson at the Battle of Trafalgar. It provided an opportunity for the University to showcase its engineering research and education facilities to 300 guests, including a wide audience of academics, industrialists and many other dignitaries from the local community.

Fellows' Visits

A small group of Fellows gathered at the home of Professor Bill O'Riordan FEng in May 2005 to attempt take-offs and landings in his simulation cockpit. Staying with the aeronautical theme – albeit on a slightly larger scale – a larger group of Fellows went

to Broughton, North Wales to see the factory where the final assembly of wings for the Airbus A380 take place. Tight schedules for the plane meant that manufacture started before the factory was complete and the Fellows were told and shown how this huge task had been achieved.

In November 2005, Professor Minoo Patel FEng hosted Fellows visiting Cranfield College of Aeronautics. Combined with presentations on the air operations and airline economics research carried at Cranfield, the Fellows were given presentations that demonstrated the value of the College of Aeronautics to the aerospace and air transport industries.

In January 2006, Fellows visited Beaufort Court in Hertfordshire, head office of wind energy company Renewable Energy Systems. It had formerly been the Ovaltine company's Model Poultry and Dairy Farm but over the past five years had been rebuilt and powered using five integrated sources of renewable energy. Ian Mays hosted the visit and explained the challenges of turning an historic building into a zero-emissions commercial development.

INGENIA MAGAZINE

The *Ingenia* Editorial Board, led by Editor-in-Chief Dr Scott Steedman FEng, directs the course of the Academy's quarterly flagship magazine. The magazine is mailed out directly to 3,800 people and circulated to 1,200 more. *Ingenia* carries articles that cover a broad range of engineering disciplines these included, telecommunication responses to the July 2005 London

bombings, the relationship towards autism and engineering, and how a British team helped parachute a space probe onto Titan.

The Academy was pleased to welcome BAE SYSTEMS as a new sponsor of the magazine during the year, to join Arup, Mott MacDonald and Rolls-Royce plc. A readership survey is being prepared to identify areas for enhancements over and above the well-received redesign of the magazine.

WEBSITE

The Academy's website had an increase of 20% in the number of people that logged on to the site during the year. The average number of people visiting www.raeng.org.uk is now 53,000 'unique visitors' a month. A large number of people are downloading the Academy's reports and publications, thus significantly increasing the reports' reach (2,000 people a month downloaded the 'Accidents and Agenda' report) and thus reducing the amount needed to be printed.

During the year both the Best Programme's website and the Engineering Leadership Award's online presence were redesigned and a new website for *Shape the Future* was created.

Academy Business

ANNUAL GENERAL MEETING

The 29th Annual General Meeting was held at the Royal Aeronautical Society, London on 6 July 2005, with the President in the Chair. Four Honorary Fellows, forty-four Fellows and three International Fellows were elected. The Annual Review and Accounts for 2004–2005 were adopted, Officers and Members of Council were elected, and increases in subscription rates and entrance fees to take effect from 1 January 2006 were approved.

After the formal business of the AGM concluded, presentations were given by: Caroline Westall, GKN OffHighway Systems, a former Engineering Leadership Award holder; Dr Eva Sorensen, University College London, a participant in the Industrial Secondment Scheme, together with her supervisor Dr Tom Knox of BP International; and Dr Jennifer Hastie, University of Strathclyde, a RAEng/EPSC Research Fellow.

DEVELOPMENT REPORT

Tangible progress has been made in the year with welcome new support received from the Fellowship and from new corporate, trust and public sector sources. In the coming twelve months, efforts will be focused on developing these contacts, in order to gain more support for the Academy's education programme and to grow the Academy's Building Fund.

The Academy's case for support has highlighted its education activities and, in the context of our Building Fund, the way in which a new building

will offer opportunities to deliver our programmes more effectively. The challenge is to exploit these positive factors and achieve long term support that is mutually rewarding.

There is a growing awareness of our educational role and the benefits of a relationship with the UK's national academy of engineering. Good progress has been made in developing the Academy's corporate contacts. Fellows have contributed to a series of small, 'round table' President's Dinners which have introduced our guests to the Academy generally, as well as exchanging views on a specific aspect of energy, ethics or education. The President has undertaken a number of regional visits during the year, meeting Fellows as well as senior corporate executives.

The Academy secured a grant of £2.85million from the Higher Education Funding Council for England to launch the London Engineering Project pilot of our new National Engineering Programme. Corporate interest in this project led to the involvement of RWE Thames Water, EDF Energy and Transport for London. New funds committed for the Best Programme and Shape the Future exceeded £250,000; companies giving us new support included BP, Airbus, Tyco Electronics, Bosch, Kodak and *The Independent*.

Donations from Fellows, principally to the Building Fund, continue to be received and are much welcomed (see Annex for list of donors). The majority of pledges have been fulfilled and this has contributed to the strong investment performance of the Building Fund, such that aggregate

funds now total £2.5 million. This is halfway to the Academy's goal for property capital funds – a significant milestone. There are some, but not yet enough, encouraging prospects outstanding. Given the proactive search effort, the likelihood of locating a suitable property is increasing.

A legacy leaflet was included for the first time with the Fellows' subscription renewals – and it will become an annual feature to encourage Fellows to remember the Academy in their Wills, and thus support UK engineering and the next generation of engineers. A small legacy has been received and another, very substantial one has been proposed. Such gifts are enormously appreciated and will be publicly acknowledged whenever possible.

In anticipation of building new relationships and continuing to raise the Academy's profile, two new brochures are now available to support our efforts. *The Heart of Engineering* offers a high level introduction to the Academy, and *Investing in a Stronger Future* sets out our reasons for seeking additional funding support at this time. It was particularly appreciated to have included special messages from the Senior Fellow and from the Prime Minister.

Finally, investment in an Academy-wide contact relationship management system has commenced with the first phase due for completion in July 2006. We are confident that, with some accompanying changes to our work processes, this system will facilitate well-coordinated relationship building and fund-raising effectiveness.

Council

The Council – which held four ordinary meetings during the year – directs and manages the Academy and governs and controls its affairs, delegating as appropriate some of its functions to Standing Committees, each of which reports regularly to Council. As the Academy is a registered charity, the Officers and Members of Council fulfil the role of Trustees. As at 31 March 2006

OFFICERS AND MEMBERS OF COUNCIL

President

Lord Broers FREng FRS

Past President (ex officio)

Sir David Davies CBE FREng FRS

Senior Vice President

Prof W Hall CBE FREng

Vice Presidents

Lord Browne of Madingley FREng

Prof R Eatock Taylor FREng

Dr S E Ion OBE FREng

Mr P Saraga OBE FREng

Dr R S Steedman FREng

Prof R A Williams FREng

Honorary Treasurer

Mr F C Price FREng

Hon Sec for International Activities

Mr P Saraga OBE FREng

Hon Sec for Education and Training

Prof J E King CBE FREng

Ordinary Members

Mr R Benaim FREng

Prof D Fisk CB FREng

Sir Peter Gershon CBE FREng

Prof P J Gregson FREng

Mr N D Haste OBE FREng

Mr C G Hodge FREng

Prof R Holdaway FREng

Dr I D Nussey OBE FREng

Prof J D Perkins FREng

Prof D I A Poll OBE FREng

Dr M Shears CBE FREng

Sir Martin Sweeting OBE FREng FRS

Sir John Taylor OBE FREng FRS

Mr J P Weston CBE FREng

Chairman Membership Committee

(ex officio)

Prof M J H Sterling FREng

Chief Executive

Mr P Greenish CBE

Director, Finance & Administration

(Secretary to Council)

Mr A Thomas

Academy Standing Committees

Awards Committee

The Awards Committee is responsible for identifying and recommending to Council appropriate candidates for all relevant prizes and Awards, whether in the Academy's gift or not, with the exception of National Honours and the MacRobert Award.

Chairman:

Prof R A Williams FEng

Members:

Prof D Fisk CB FEng
Prof M Hamlin CBE FEng FRSE
Mr R B Haryott FEng
Prof A Hopper FEng
Prof C J Humphreys CBE FEng
Prof R I Kitney OBE FEng
Mr T Lazenby RDI FEng
Prof J N Randle RDI FEng
Dr P Watson OBE FEng
Prof P N T Wells FEng FRS
Prof C R Whitehouse FEng
Mr P Greenish CBE
Mr T McLaughlan

Committee Secretariat:

Miss A Abbott

Education and Training Committee

The Education and Training Committee's role is to oversee and be responsible for the Academy's activities in engineering education and training, and to maintain links with other bodies working in these fields.

Chairman:

Prof J E King CBE FEng

Members:

Dr A R Begg FEng
Prof L F Gladden OBE FEng
Dr D Grant CBE FEng
Dr S W Huntington FEng
Prof J P K Seville FEng
Prof J V Wood FEng

Ex Officio:

Prof G J Davies FEng
Prof P J Deasley FEng
Prof R G Dodds FEng
Mr E H Norie OBE FEng
Prof M J Withers FEng

Committee Secretariat:

Dr R W Ditchfield
Mr I J Bowbrick

Engineering Policy Committee

The Engineering Policy Committee's role is to advise and be responsible to Council for the engineering policy of the Academy, and for all matters concerned with the application of engineering knowledge and principles (other than education and training). It should identify, monitor and promote attention to emerging and generic issues of importance to engineering in pursuit of this role.

Chairman:

Dr S Ion CBE FEng

Members:

Mr J Baxter FEng
Prof T W Broyd FEng
Prof S F Davies FEng
Dr K W A Guy FEng
Eur Ing Dr R P Harris FEng
Dr M G Howse OBE FEng
Prof M J Kelly FEng FRS
Prof A D May OBE FEng
Prof S M Richardson FEng
Mr I C Ritchie CBE FEng FRSE
Mr J E Roberts CBE FEng

Ex Officio:

Dr P J Hargrave FEng
Prof R Holdaway FEng
Prof R I Kitney OBE FEng

Committee Secretariat:

Mr B G Doble

Finance and Audit Committee

The Finance and Audit Committee is responsible for all financial and auditorial affairs of The Royal Academy of Engineering. This includes management of Academy budgets, external investment fund managers, insurance policy, risk register, audit arrangements and compliance with external financial reporting standards.

Chairman:

Mr F C Price FREng

Members:

Mr C V Betts CB FREng

Mr M J Earwicker FREng

Dr I D Nussey OBE FREng

Prof R W E Shannon CBE FREng

Prof P N T Wells FREng FRS

Committee Secretariat:

Mr A Thomas

International Committee

The International Committee's role is to advise and be responsible to Council for promoting the international interests of the Academy. In pursuit of this role the Committee's interests include oversight of the Academy's relations with the Council of Academies of Engineering and technological Sciences (CAETS) and the European Council of Applied Sciences and engineering (Euro-CASE)

Chairman:

Mr P Saraga OBE FREng

Members:

Prof G J Davies FREng

Prof P M Guthrie OBE FREng

Prof R Holdaway FREng

Prof M A Loughton FREng

Prof W O'Riordan FREng

Prof G R Tomlinson FREng

Committee Secretariat:

Dr A Walker

Membership Committee

The Membership Committee is responsible for considering candidates for election to The Royal Academy of Engineering and for submitting a list of not more than 60 names to Council for approval before each Annual General Meeting. Each of the five Members of the Committee chairs a Panel covering a specific area of expertise.

Chairman:

Prof M J H Sterling FREng

Ex Officio:

Lord Broers FREng FRS

Chairmen:

Panel 1 Mr A D Roche FREng

Panel 2 Prof P M Guthrie OBE FREng

Panel 3 Dr D Grant CBE FREng

Panel 4 Prof J Garside CBE FREng

Panel 5 Prof J J O'Reilly FREng

Committee Secretariat:

Mrs J Wagstaff

(see overleaf for details of other Panel members)

Additional Panel Members:

Panel 1 (Mechanical, aeronautical, marine and manufacturing engineering)

Dr R A Ainsworth, Mr J Baxter,
Dr J Ferrie CBE, Mr K G Jackson,
Mr R J Parker, Prof D T Pham OBE,
Prof D Williams.

Panel 2 (Civil, structural, public works and building services engineering)

Prof R J Chandler, OBE,
Mr P R Head OBE, Prof A E Long,
Mr R F Emmerson, Prof D N Lerner,
Prof A E Long, Prof P K Stansby,
Mr T J Thirlwall.

Panel 3 (Electrical, electronic, control engineering and computing)

Prof H D Griffiths, Prof C J Harris,
Prof G W Irwin, Dr W S Jones OBE,
Prof D J N Limbebeer, Mr K J Ralls,
Dr J E Roberts CBE, Mr E A Wallis.

Panel 4 (Chemical, fuel, process, mining and materials engineering)

Prof J S Archer CBE, Mr K E Batchelor,
Prof R S Benson, Dr S E Bold,
Prof B D Crittenden, Prof P J Gregson,
Prof S M Richardson, Mr S P Vbranch.

Panel 5 (Informatics)

Prof P Brook, Prof A E Chessell,
Mr M F Cowlshaw, Prof P M Grant,
Prof A Hopper, Prof J A McDermid,
Prof R C Nicol, Prof I C Ritchie CBE.

Research and Secondment Schemes Committee

The role of the Research and Secondment Schemes Committee is to advise and be responsible to Council for the supervision of research and secondment schemes other than those concerned with education and training.

Chairman:

Prof W R Eatock Taylor FREng

Members:

Prof M J Adams FREng
Dr J W Arthur FREng FRSE
Prof H K D H Bhadeshia FREng FRS
Mrs A E Chessell FREng
Prof W N Dawes FREng
Prof H D Griffiths FREng
Dr P J Hargrave FREng
Dr D M C Horsley FREng
Prof J V Kittler FREng
Prof M S Snaith FREng
Prof H R Thomas FREng
Prof D E Winterbone FREng

Ex Officio:

Prof G R Tomlinson FREng

Committee Secretariat:

Mr A Eades

Academy Staff

Chief Executive

Philip Greenish CBE

Personal Assistant

Éva Culleton-Oltay

COMMUNICATIONS

Director, Communications

Tom McLaughlan

Manager, Events & MacRobert Award

Clare Huddlestone

Manager, Events & Awards

Amy Abbott

Events Assistants

Jacqueline Cox, Katherine How

Head of Campaigns

Dave Rowley

Manager, Communications

Jane Sutton

Publications and Web Editor

Dominic Joyeux

Assistant Publications Editor

Isla McMilan

ENGINEERING AFFAIRS

Director, Engineering Affairs

Keith Davis

Secretary

Sylvia Hearn

Head of Engineering Policy

Brian Doble

Policy Advisors/International

Richard Ploszek, Dr Alan Walker,

Dr Natasha McCarthy,

Dr Loredana Santoro

Manager, Research Support

Rob Barrett

Assistant Manager, Research Support

Dr Chris Coulter

Research Administrator

Angus Baker

Manager, Engineering Projects

Anthony Eades

DEVELOPMENT

Director, Development

Sarah Philbrick

Development Executive

Kim Bond

FINANCE AND ADMINISTRATION

Director, Finance & Administration

Ashley Thomas

Secretary

Janet Weekes

Manager, Finance

Margaret Stewart

Finance Assistant

Karen Russell

Manager, Membership

Joanne Wagstaff

Membership Administrator/
Librarian/Archivist

Hema Lingham

Head of IT

Hakan Altinisik

IT Assistant/Web Administrator

Barry Weekes

House Services Manager

Nigel Palmer

Reception/Security

Paul Morant

Manager, Facilities & Catering

James Lucey

Facilities Assistants

Terry Woolgar, Craig Clarke

EDUCATION AFFAIRS

Director, Education Affairs

Dr Robert Ditchfield

Secretary

Patricia Frome

Manager, Engineering Design Education

David Foxley

Manager, Postgraduate and
Professional Development

Ian Bowbrick

Assistants, Postgraduate and
Professional Development

Anne Mahabal, Pauline Stillman

BEST PROGRAMME

Director, Best Programme

Professor Matthew Harrison

Manager, Pre-University and
Undergraduate Programmes

Dr Peter Revell

Administrator,

Education Programmes

Sandra Palmer

Administrative Assistant

Joanne Page

Manager, Education Communications

Dr Claire McLoughlin

Education Officer

Lynda Mann

London Engineering

Project Co-ordinator

Heather Hawthorne

Implementation Manager

Dawn Fitt

Best Programme Leaders:

Engineering Development Trust:

Dr Gordon Mizner

Engineering Education Scheme

England: Mark Williams

Engineering Education Scheme

Northern Ireland: Brian Campbell

Engineering Education Scheme

Scotland: Susan Andrews

Engineering Education Scheme

Wales: Austin Matthews MBE

Engineering Leadership Awards:

Dr Peter Revell

Executive Engineers Programme:

Dr Peter Revell

Headstart:

David Ozholl

Sainsbury Management

Fellowship Scheme:

Ian Bowbrick

Smallpeice Trust Courses:

Andrew Cave

The Year in Industry:

Roy Bromley

Young Engineers:

Stuart Ellins

Annex

RESEARCH CHAIRS AND SENIOR RESEARCH FELLOWSHIPS

Four new Research Chairs were appointed during the year, bringing the total number of awards to 36. The holders are:

Research Chairs in Innovative Manufacturing (co-sponsored with the Engineering and Physical Sciences Research Council)

Name	Co-sponsor	Subject	University
Prof D Kehoe	EPSRC (IMI)	E-business modelling for manufacturing supply networks	Liverpool
Prof P Sharratt	EPSRC (IMI)	Innovative manufacturing for the process industries	Manchester

Research Chairs

Name	Co-sponsor	Subject	University
Prof C Baker	Thales UK Ltd	Intelligent radar systems	UCL
Prof S Biggs	BNFL	Particle science and technology	Leeds
Prof N Cowern	Philips & Applied Materials	Nanoscale materials processing	Surrey
Prof D Fisk CB FREng	BP	Engineering for sustainable development	Imperial College
Prof A Forsyth	Rolls-Royce	Electrical systems for extreme environments	Manchester
Prof C Garner	Perkins Engines Company Ltd	Applied thermodynamics	Loughborough
Prof S Grimes	SITA	Environmental waste management	Imperial College
Prof P M Guthrie			
OBE FREng	AEA Technology & DETR	Engineering for sustainable development	Cambridge
Prof G Hankinson	Advantica	Pipeline technology	Loughborough
Prof R Kalin	Keller Ground Engineering	Environmental engineering	Queen's Univ. Belfast
Prof M Johnson	Rolls-Royce	Power electronics	Sheffield
Prof C Lawrence	Schlumberger	Oilfield process engineering	Imperial College
Prof D McFarlane	BAE Systems	Service support engineering	Cambridge
Prof B Mulgrew	BAE Systems	Multi-sensor signal processing	Edinburgh
Prof M Newborough	Scottish Power	Energy and environmental engineering	Heriot-Watt
Prof R Raghunathan	Bombardier Aerospace	Aerospace engineering	Queen's Univ. Belfast
Prof A Sheno	Lloyd's Register	Lightweight structures	Southampton
Prof R Smith	AEA Technology/Hitachi	Future rail research	Imperial College
Prof J Torero	BRE	Fire safety engineering	Edinburgh
Prof A Zisserman	Microsoft	Computer vision engineering	Oxford
<i>appointment pending</i>	Welsh Development Agency	Power electronics	Swansea
<i>appointment pending</i>	BAE Systems	Systems engineering	Loughborough

Senior Research Fellowships

Name	Co-sponsor	Subject	University
Mr H Chivers	GCHQ	Large scale distributed computing	York
Dr H Ford	Daphne Jackson Trust	Fibre-optic based optical coherence tomography	Cranfield
Dr P Gardner	Microsoft	Active web data	Imperial College
Dr R Moore	ICI & Cytec Engineered Materials	Performance of polymeric adhesives	Imperial College
Dr A Sayma	Rolls-Royce	Large scale numerical simulations of air-breathing engines	Imperial College

Leverhulme Trust Senior Research Fellowships

Name	Subject	University
Prof J Cooper	Development of novel adaptive aircraft wing shape technologies	Manchester
Dr C Edwards	Sliding mode observers for fault detection, isolation and sensor fault tolerant control in micro/nano satellites	Leicester
Prof D Hills	A radically new quantitative procedure for designing against fretting fatigue	Oxford
Dr M Kraft	Modelling the flame synthesis of carbon nanotubes	Cambridge
Dr P Midgley	Electron tomography for materials science	Cambridge
Prof B Nuseibeh	Analysing and specifying the security requirements of computer based systems	Open University
Prof W Zimmerman	Systems biology and chemical engineering	Sheffield

RESEARCH FELLOWSHIPS

The total number of awards is 37. The holders are:

Name	Subject	University
Dr M Booth	Adaptive nano-optics	Oxford
Dr E T Bowman	Mechanisms of granular slides	Cambridge
Dr M Bustard	Bio-electric systems – a novel bioprocess intensification strategy	Heriot-Watt
Dr S Calverley	Embedded electrical machines	Sheffield
Dr J Chew	Developing dynamic gauging as a surface layer probe	Cambridge
Dr R Clark	Enabling technologies for next-generation ICE variable-valve-timing systems	Sheffield
Dr R Dorey	Fabrication of functional ceramic devices	Cranfield
Dr H El Mubarek	Point defects engineering: a new method of dopant diffusion suppression in semiconductors	Southampton
Dr M Ghogho	Space-time processing for mobile communications	Leeds
Dr E Grace	Next generation DVD: chiral beams for ultra high capacity multiplexed optical data storage	Imperial College
Dr N Green	Integrated electrokinetic microsystems for bioparticle analysis	Southampton
Dr K Groom	Advanced semiconductor laser engineering	Sheffield
Dr J Hall	Handling uncertainty in coastal engineering systems	Bristol
Dr J Hastie	Visible and ultraviolet surface emitting semiconductor lasers for life science applications	Strathclyde
Dr M Jackson	Consolidation and behaviour of continuous solid state processing of titanium from emerging reduction methods	Imperial College
Dr J Jones	Development and optimisation of porous bioactive scaffolds for bone and cartilage regeneration	Imperial College
Dr E C Kerrigan	Robust control of constrained dynamic systems	Cambridge
Dr V Khomenko	Design and verification of asynchronous circuits	Newcastle
Dr I Kinloch	Nanotubes in advanced engineering materials	Cambridge
Dr A Kohn	Correlating microstructure and anti-ferromagnetic domains in thin films for spin electronic applications	Oxford
Dr P Lettieri	Fluidised bed processes for sustainable development	University College London
Dr K Miller	Improved imaging of brain function and connectivity	Oxford
Dr J Mackenzie	Efficient high power planar waveguide lasers	Southampton
Dr M McLoone	Cryptographic algorithms for system-on-chip	Queen's, Belfast

RESEARCH FELLOWSHIPS *continued*

Name	Subject	University
Dr P McSharry	Non-linear analysis of biomedical signals	Oxford
Dr M Migliorato	Atomistic simulations of the structural and electronic properties of semiconductor materials for nanotechnology	Sheffield
Dr I Miguel	An automated constraint modelling assistant	St Andrews
Dr A Morgans	Active control of combustion instabilities	Cambridge
Dr F Simonetti	Super resolution sub-surface sensing	Imperial College
Dr S Speller	Superconducting metamaterials for near field NMR microscopy applications	Oxford
Dr E Stride	Characterisation and design of coated microbubbles for ultrasound imaging and cancer therapy	University College London
Dr A Taylor	Novel polymer-silicate nanocomposites	Imperial College
Dr K Teo	Next generation electronics using carbon nanotubes	Cambridge
Dr G Treece	Mitigation of imaging artefacts in 3D ultrasound	Cambridge
Dr R Wilcox	Vertebroplasty: innovations in cement application	Leeds
Dr R Willden	CFD modelling of the high mode vortex induced vibrations of long flexible pipes	Imperial College
Dr V Zarzoso	Blind signal separation for communications	Liverpool

GLOBAL RESEARCH AWARDS

Award holders current during the year are:

Secondee	Employer	Project Title	Host
Prof G Airey	University of Nottingham	Moisture damage evaluation and micro-structural characterisation of asphalt mixtures	Texas A&M University, USA
Dr T Blakeborough	University of Oxford	Development of real-time testing of hybrid structures	University of California, Berkeley, USA
Dr S Chen	University of Southampton	Optimising control system integrity for finite precision implementation	Zhejiang University, Peoples Republic of China
D T Curtis	University of Newcastle	Unifying concepts in the design of biological water treatment systems	Stanford University, USA
Dr P Dong	University of Dundee	Morphological and ecological processes of the Yellow River estuary and adjacent coastline	East China Normal University, People's Republic of China
Dr A Elsheikh	University of Dundee	Corneal biomechanics and their effect on intra-ocular pressure measurement	University of New South Wales, Australia
Dr M Folley	Queens University, Belfast	An investigation of wave powered desalination	Instituto Tecnológico de Canarias, Spain
Dr C Gervet	Imperial College	A geometrical approach embedded into finite set constraint programming languages: application to combinatorial and network designs	Brown University USA
Dr M Halsall	University of Manchester	Nitride semiconductor devices for THz electronics	iQuest, University of California, Santa Barbara, USA

GLOBAL RESEARCH AWARDS *continued*

Secondee	Employer	Project Title	Host
Dr R Harrison	Loughborough University	Technologies and methods for the lifecycle engineering of modular reconfigurable manufacturing automation systems	Schneider Automation, France/ Georgia Institute of Technology, USA
Prof D Hayhurst FREng	University of Manchester	Multi-factional materials and shape morphing Structure; analysis, optimization and design	University of California, Santa Barbara, USA
Dr D Jones	University of Wales, Bangor	Control and guidance of autonomous rotorcraft for power line inspection	CSIRO, Australia
Dr P Lee	Imperial College	Through-process simulation of cast aluminium components for automotive applications	University of British Columbia, Canada
Dr C Li	University of Dundee	Development of risk assessment models for corrosion affected reinforced concrete infrastructure	University of Newcastle, Australia
Mr P Li	Imperial College	Through process modelling of aluminium castings	University of British Columbia, Canada
Dr L Louca	Imperial College	Predictive modelling of damage in marine composite structures under shock loading	US Naval Academy, Maryland, USA
Dr S Sangwine	University of Essex	Vector signal and image processing using quaternions	Laboratoire des Images et Signaux (LIS), France
Dr W Shen	University of Portsmouth	Impact integrity of pressurised pipelines supported by foundation	Shanghai Jia Tong University, People's Republic of China
Prof N Thornhill	University College London	Detection and diagnosis of distributed disturbances	ABB, Norway
Dr Y Wang	University of Manchester	Using CFD modelling in performance based fire engineering selection of building lining materials	Lund University, Sweden
Dr Z You	University of Oxford	Mathematical origami and deployable structures	MIT Computer Science and Artificial Intelligence Laboratory, USA

INDUSTRIAL SECONDMENT SCHEME

Nine awards were made during the year:

Industrial Secondment Awards

Awardee	Subject	University	Host Organisation
Dr H Hall	Knowledge management	Heriot-Watt	TFPL
Professor S Brandani	Chemical adsorption issues	UCL	UOP Ltd
Mr D Ferguson	Highway design procedures	Queen's Belfast	Owen Williams Ltd
Dr F Wang	Environmental engineering	Heriot-Watt	RES
Dr N Rowson	Formulation engineering	Birmingham	Imerys
Dr J Hale	Remote monitoring	Newcastle	AES
Dr K Fernandes	Integrated process planning	York	Shepherd Construction
Dr C Tizaoui	Water management	Bradford	Yorkshire Water
Dr A Steed	Software engineering	UCL	Electronic Arts

VISITING PROFESSORS IN PRINCIPLES OF ENGINEERING DESIGN SCHEME

The scheme now has 120 Visiting Professors at the following universities:

University of Aberdeen; Aston University; University of Bath; University of Birmingham; University of Bradford; University of Brighton; University of Bristol; Brunel University; University of Cambridge; University of Cardiff; University of Central Lancashire; City University; University of Coventry; Cranfield University; De Montfort University; University of Dundee; University of Durham; University of Glasgow; Heriot-Watt University; University of Hertfordshire; University of Hull; Imperial College; University of Kingston; University of Leeds; University of Leicester; University of Liverpool; University of Loughborough; University of Manchester; University of Newcastle upon Tyne; University of Nottingham; Open University; University of Oxford; Oxford Brookes University; University of Plymouth; Queen Mary, University of London; Queen's University Belfast; Royal College of Art; Salford University; University of Sheffield; University of Southampton; Strathclyde University; University of Surrey; University of Sussex; University of Ulster; The University of Manchester; University of Warwick

VISITING PROFESSORS IN ENGINEERING DESIGN FOR SUSTAINABLE DEVELOPMENT

Name	Subject area	University
Prof B Mould	The built environment	Brighton
Prof J Purseglove	Water and environmental management	Hertfordshire
Prof J Hulse	Chemical and process engineering	Newcastle upon Tyne
Prof R Booth	Renewable and sustainable energy	Oxford
Prof C Ainger	Sustainable construction	Cambridge
Prof D Bartholomew	Energy conservation in the built environment	De Montfort
Prof K Snowdon	Design manufacture and disposal of electronic products	Loughborough
Prof C Duff	Processing, recycling and dematerialisation	Surrey
Prof B Hanna CBE	Energy and the built environment	Ulster
Prof J Lopez-Merono	Manufacturing and materials	Aston
Prof G Acres OBE	The hydrogen economy	Birmingham
Prof G Howarth	Product design and waste prevention	Bournemouth
Prof H Eccles	Contaminated land remediation	Edinburgh
Prof D Welsh	Power generation in developed and developing countries	Bristol
Prof J Poole	Environmental protection	Cardiff
Prof B Carroll	Sustainability assessment of infrastructure projects	Glasgow
Prof R Dodds FREng	Consumer goods	Glasgow
Prof R Venables	Sustainability of large infrastructure projects	Queen's University, Belfast
Prof J McDougall	Whole life engineering	Sheffield Hallam
Prof C Engel	Chemical processing	Manchester
Prof M Fletcher	Water as a resource	Bradford
Prof A Emery	Natural resource extraction	Bath
Prof S Halliday	The link between engineering and architecture	Strathclyde
Prof L Walker	Methods for assessing sustainability	Sheffield
Prof D Raffo	Product development	Leeds

VISITING PROFESSORS IN INTEGRATED SYSTEM DESIGN

Visiting Professors	University
Prof P Wiese	Bath
Prof Jan Baeyens	Birmingham
Prof C Pearson and Dr I Shams	Brunel
Prof D Stupples	City
Prof M Henshaw	Cranfield
Prof K Brunson, Prof R Hyde and Prof D Williams	Edinburgh
Prof P Davies	Loughborough
Prof J Gittus FREng, Prof G Skates and Prof R Stone	Plymouth
Prof J Hsu	Queen's University Belfast
Prof C Lyde	Surrey
Prof K Robinson	University College London

ENGINEERING PROFESSIONAL DEVELOPMENT AWARDS

The companies receiving awards were:

Abraham Consulting Engineers	Icore International Ltd	Smiths Aerospace
Airbus UK Ltd	J L French	Solent Composites Ltd
Albacom Ltd	King Automotive Systems Ltd	Sortex Ltd
BCMZ Precision Engineering	Leicester City Council	Stadco Ltd
Berck Ltd	Lightweight Medical Ltd	Technical Support Associates
Brimar Engineering Services	LSW UK Ltd	Trio Design & Engineering
Cabletec ICS Ltd	Martinrea Industries UK Ltd	TRW Automotive
Cadogan Consultants	Meridian Technologies	Tyco Ltd
CDP Ltd	MITIE	Tyco Electronics UK Ltd
CJ Tools Ltd	Novelis	Tyco Healthcare
Crawford NBS Division	Obsidian Research Ltd	Unilever UK (Leeds)
Cultech Ltd	Precision Plastic Components Ltd	Virtual Interconnect Ltd
Cunningham Lindsey UK	REACT Engineering	Waterman Birmingham
EEF South	Rolls-Royce plc	Waterman Environmental
Engments Ltd	RPS Consulting Engineers	Waterman Leeds
EPConsult Ltd	Scientific Vacuum Systems Ltd	Waterman Manchester
Expedition Engineering	Siemens Traffic Controls	Waterman Sheffield
Geo W King Ltd	Siemens VDO	Waterman Structures Ltd
Grimley Smith Associates	Slack & Parr Ltd	Wright Machinery Ltd

SAINSBURY MANAGEMENT FELLOWSHIPS IN ENGINEERING

Ten Fellowships were awarded in 2005, bringing to 226 the total number since the scheme's inception:

The Fellowships were made to:

Recipient	University	Recipient	University
Alpesh Amin	MIT	Martin Buttenshaw	LBS
Ricardo Concho	Harvard	Robert Deeming	Harvard
Andrew Hogwood	INSEAD	Graham MacGregor	INSEAD
John Marsh	IMD	Federico Suria	INSEAD
Uma Somasunrarajah	INSEAD	Jack Woodhouse	LBS

ERA FOUNDATION ENGINEERING TEACHING PRIZES

This year's prize winners were:

Recipient	University
Dr Graham Ault	University of Strathclyde
Dr. Ian Cotton	University of Manchester
Dr Malcolm Joyce	Lancaster University
Dr Euan McGookin	University of Glasgow
Dr Anthony Rossiter	University of Sheffield
Dr Tim Short	University of Durham

ERA FOUNDATION RESEARCH STUDENT DEVELOPMENT FELLOWSHIPS

This year's awardees were:

Recipient	University
Yasir Ahmed	University of Manchester
Andrew Hazell	Imperial College London
Alasdair McDonald	University of Edinburgh
James Niblock	Queen's University Belfast
Tim Woolmer	University of Oxford

RAENG/BNFL ENGINEERING EDUCATION INNOVATION AWARD

The inaugural award went to the University of Southampton's 'Design, Build, Test, Float, Fly and Race' activity.

SAINSBURY MANAGEMENT FELLOWSHIPS IN LIFE SCIENCES

In 2005 the total number of awardees through the scheme reached 45, with Fellowships being confirmed to:

Dr Susan Burton
Dr Andrea Humphries
Dr Sanjeev Kumar

Dr Don O'Sullivan
Dr Daniel Ozanne

THE PANASONIC TRUST

Seven new **Fellowships** were awarded during 2005:

Recipient	University
Hilary Branfield	University of Southampton
Niall Gibson	University of Strathclyde
Mark Harding	Loughborough University
Simon Lamb	University of Cambridge
Michael Pepler	University of Reading
Nicola Pinckney	Cranfield University
Ben Sang	Loughborough University

THE PANASONIC TRUST

Seven **Gold Medals** were awarded in 2005 to:

Recipient	University
Gillian Woodburn	University of Strathclyde
Allyson Walker	University of Strathclyde
Steven Hunt	University of Cambridge
Peter Robinson	University of Reading
Aaron Stevens	Loughborough University
Ian Richardson	University of Reading
David Holland	University of Sheffield

BUILDING FUND

Since the launch of the Development Appeal to the Fellowship in summer 2004, donations have been received from 203 Fellows listed below and total £425,000. Donations have been allocated to the Building Fund except where otherwise instructed. This Fund now totals £2.5 million and benefits from the donations of additional Fellows in earlier years.

- Mr H E K Allen FREng
- Brigadier J R Appleton
OBE HonFREng
- Mr J A Armit CBE FREng
- Professor V Ashkenazi FREng
- Sir Robert Atkinson DSC**
RD FREng
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- Mr D A Ball FREng
- Mr J Banks FREng
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- Lord Bhattacharyya CBE FREng
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