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

President's review

In this, my last annual review as President, I am pleased to report another year of strong progress after our exceptional success in attracting new funding to the Academy last year. We now enter the next phase of our development with a clear mission defined by our new Strategic Plan and the support of many friends.

My term of office as Academy President concludes this July making this my final President's Review. Looking back over my five years as President, I see many areas where we have built upon the successes of my predecessors. The 'Facing Out' initiative – launched in 2001 at the instigation of the then senior vice president, Sir Duncan Michael – was designed to broaden the Academy's outlook from our natural engineering constituency and to engage more with the mainstream of society. I think we have succeeded in that Facing Out is now much less an initiative and more a way of life. The modernisation of our visual identity last year has undoubtedly helped us to connect better to a new, younger audience.

The Academy's policy work is our bedrock and I have been pleased to see it grow into important new areas. Amongst new projects currently underway is work on the philosophy of engineering and on the economics and morality of safety, both of which promise to provide unique and important insights. We have pressed ahead with topics such as energy and transport where the national need for rational, informed and impartial contributions is beyond doubt. This year's energy seminars were an important trailer to the Government's energy review; the development of an Academy transport policy in our Transport 2050 report has enabled us to contribute actively to an important debate.

As technology continues to push back the barriers of the possible in delivering sustained growth and well-being for society, we must remain alert to the fears and the uncertainty often generated in the wake of progress. Our 2004 report on nanotechnology (undertaken in partnership with the Royal Society) addressed this issue head on and, this year, we have continued in the same vein with a major project on privacy and surveillance. Due to report shortly, the project has concentrated on identifying how we might protect an individual's privacy and identity whilst at the same time ensuring that we reap the benefits brought about by new means of data collection. It is in these essential areas of managing and assisting the emergence of new technologies that the Academy can bring real value to the nation's public policy process.

The engineering sector itself has seen significant changes over the last five years. More British companies are moving their R&D activities overseas. The emergence of new economies in the developing world has been brought about by a communications revolution to match the improvements in transportation that preceded it. And we have seen the emergence of the Engineering and Technology Board and the merger of some of our major engineering institutions, including this year's creation of the Institution of Engineering and Technology. The Academy has been developing its role

and its relationships with these bodies in a supportive and non-competitive way.

Our work with young people has continued to grow and develop. In my first annual review, we reported that the Best Programme had contact with just over 5,000 people. This year the figure has risen to almost 25,000 young people from schools through to post-graduate level with a further 59,000 primary school children accessed through the Young Engineers' K'Nex Challenge. Alongside the Best Programme we launched the London Engineering Project – the pilot for the National Engineering Programme through which we will take engineering to young people who had not previously had the subject on their radar screens.

The first annual report of my period in office noted that “we have continued the search for new premises with potential for a good sized lecture theatre... The search goes on.” Indeed it does! I had hoped our quest may have borne fruit during these last five years but unfortunately not – although we have come close on occasion. The need for a new home is greater now than at any point in the past if we are to deliver our programmes in the most effective way possible.

It has been a privilege to serve as President of The Royal Academy of Engineering and I want to thank the many friends and colleagues, Fellows and staff alike, who have made my time at the

Academy so enjoyable. I would especially like to thank the Fellows who have served on Council and headed up our key committees, our Chief Executive Philip Greenish, and the highly talented team that comprise the Academy's Directorate here on Great Peter Street. Subject to the approval of our Annual General Meeting my successor will be Lord Browne of Madingley. The Academy is enormously fortunate to have an industrialist of John Browne's stature to lead the Academy in to its next stage of development and I know that I am

passing the baton of leadership on to a remarkable person. I wish him every success.

Lord Broers FEng FRS
President



Chief Executive's review



A YEAR MARKED BY DEVELOPMENT AND GROWTH

Last year, I reported that the major donation from the ERA Foundation and a 67% increase in our Parliamentary Grant-in-Aid in the years up to 2007/08 had given the Academy a springboard for future development. This year I can report exceptional progress in the development of a range of new programmes and activities, all of which have been guided with real clarity by the Academy's Strategic Plan 2005–2010 and its four strategic objectives. The ERA Foundation donation produced income of £340,000 last year, which we used to develop and implement eight new programmes – all successfully. You will find an outline of these developments in this Annual Review and more details in the accompanying Annual Report; I will touch on a few highlights here.

ENGAGING MORE EFFECTIVELY WITH THE PUBLIC AND THE PUBLIC POLICY PROCESS

We have seen a step change in our public engagement and communications activity. Our lecture programme has been enhanced by the introduction of an annual International Lecture, the first of which was delivered by Dr Craig Barrett, Chairman of the Board for Intel Corporation and Chair of the US National Academy of Engineering. A range of other lectures, seminars, briefings and open meetings on a wide range of topics has stimulated interest and debate amongst larger, more diverse audiences. The *Shape the Future* campaign was launched by Lord Browne of Madingley at the Science

Museum in November, in the presence of 300 guests including the then Minister for Industry and the Regions, Rt Hon Alun Michael MP. Designed to bring greater coherence to the promotion of Science, Engineering and Technology to young people, *Shape the Future* is also helping to bring together the work of a host of partner organisations.

We have introduced some new awards, including an ERA Foundation Award for entrepreneurial researchers and an International Medal, which was this year awarded by the Senior Fellow to Professor Cham Tao Soon FREng, who developed Nanyang Technological University, during the State Visit to Singapore in March 2006. Engineering Teaching Prizes have been established with the support of the ERA Foundation, and an Education Innovation Prize has been created, with the support of BNFL, to recognize organisations and individuals who have made significant and innovative contributions in the field of engineering education.

Our house magazine *Ingenia* has been re-launched and its circulation increased. Five major policy reports have been published and the Academy has responded to 11 government and parliamentary enquiries.

ATTRACTING MORE PEOPLE TO A WIDER RANGE OF ENGINEERING CAREERS

Early in this financial year, the Academy won the backing of the Higher Education Funding Council for England, for a major new programme designed to widen participation in engineering higher education. You will read about the National Engineering Programme and its pilot, the London Engineering Project, elsewhere in this review. But in brief, it has broadened our work in education enrichment and moved the Academy into the heart of activities geared towards encouraging young women and people from disadvantaged and minority communities to pursue education and careers in science, engineering and technology.

At the request of the science minister, Lord Sainsbury, we have been leading a programme of work under the title of the Technology and Engineering in Schools Strategy (TESS). Put simply, this aims to bring greater coherence to the disparate range of nationally based activities which promote engineering to young people. We are working with many partners including the G15 group of engineering institutions, the DfES and the DTI, with the aim of introducing a system which is markedly more helpful to teachers and young people by the start of the next school year (September 2006). Meanwhile, the highly respected Best Programme has continued to grow and develop. Participation rates are up and we are increasingly independent of direct financial support from the Gatsby Foundation, whose encouragement and

backing we continue to be hugely grateful for.

ENHANCING THE CONTRIBUTION OF ENGINEERING TO RAISING THE UK'S INNOVATION PERFORMANCE

The success of our bid to government in the Spending Review 2004 will give us the opportunity to expand our research and secondment programmes and to create new ones, and a sharp increase in numbers will be evident next year.

We have tested a new programme which supports the secondment of industrialists into academia, and we have instituted a set of major prizes for the most innovative of academic researchers whose research has real potential to meet business or industry needs. Both of these were established using income from the ERA Foundation donation.

We are widening our reach through regional events, encouraging better links between industry and academia. These will lead to events in every region of the UK. This remains the most challenging of our strategic objectives, and we are actively working on ways to strengthen the benefit we can provide to business and industry.

DEVELOPING THE ABILITY OF THE ACADEMY TO MAKE AN IMPACT

The Academy's strength is built on its Fellowship but our reputation depends on what we do. Our new and expanded programmes are all helping to develop our reputation as an

organisation which is making a real impact – and we have metrics which demonstrate it. Our development and fundraising activities are shaping up well as we make new friends – both personally and corporately. The generosity of Fellows in supporting our development appeal is hugely appreciated, although we have much further to go. Our search for more appropriate premises continues under the guidance of the new building committee, and with a new firm of property agents under contract – our focus continues to be in central London.

AND FINALLY

I would like to commend the work of all the Academy staff who are so committed to our objectives. We can do little without the active participation of the Fellowship, and I extend my thanks to all Fellows who have led or participated in Academy programmes, activities and events throughout a most successful year.

My final thanks must go to Lord Broers, who signs off as President this summer. Under his inspirational leadership, the Academy has built on the work of his predecessors and is, I believe, creating more impact across our objectives than ever before. There is, of course, much more to be done and we are well placed to move forward under the leadership of his successor.

Philip Greenish CBE
Chief Executive

Enhancing national capabilities

The Academy's activities are designed to enhance the UK's performance and to promote engineering innovation, at home and abroad. We build links between university and industry, help engineers continue their own professional development and encourage excellence in engineering education.



LINKING ACADEMIA AND INDUSTRY

To encourage younger research engineers to continue their work, the Academy and the EPSRC fund post-doctoral researchers (Research Fellows) over a five year period, allowing them to develop their interests in academic research as a stepping stone to a successful international research career.

1.



Dr Robert Dorey (pictured below left) was awarded a Research Fellowship to conduct research into new micro electro-mechanical systems at Cranfield University. He has built up an eight person team to enable his research work to develop medical ultrasound imagers for eyes and skin, gas sensors, and for energy generation.

The Academy co-funds Research Chairs with industry partners to enable internationally renowned academics to establish centres of excellence within UK universities. Professor Sue Grimes (pictured above left) became the first woman to be appointed a Research Chair by the Academy with the support of the SITA Environmental Trust. Professor Grimes has become the Chair in Waste Management at Imperial College London.

A GLOBAL PERSPECTIVE

The Academy helps UK engineering to benefit from the increasingly global nature of engineering with a scheme designed to encourage research and

2.

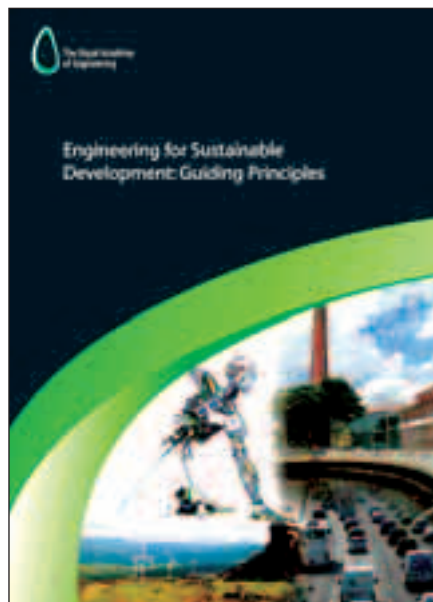
development networking around the world. The Global Research Awards provide a unique opportunity for researchers to spend time working in centres of excellence overseas for between three and twelve months. During the year, 21 research engineers went on worldwide secondments.

Dr Ahmed Elsheikh of the University of Dundee intends to apply engineering methods to ocular biomechanics, using finite element modelling to replicate the behaviour of the eye's cornea in response to disease and surgery. He has travelled to the internationally renowned School of Optometry and Vision Science at the University of New South Wales in Australia, in order to perfect the modelling of intra-ocular pressure. If successful this would improve the diagnosis and management of eye diseases, such as glaucoma.

NEW SCHEME LAUNCHED

With valuable support from the Leverhulme Trust, the Academy successfully managed the introduction of the new Leverhulme Senior Research Fellowship's Scheme. Now established as a continuing programme, the scheme releases mid-career academics from teaching and administrative duties to undertake full time research for periods of between one academic term and a year. The scheme achieves this by covering the cost of a replacement member of staff for the period of a fellowship.

3.



VISITING PROFESSORS

The Academy has a long-established and highly respected programme of Visiting Professors, through which 150 practicing engineers are currently placed into UK universities. During the year particular focus was on developing the Integrated System Design scheme, which addresses the wide perception that these skills are lacking in UK engineering graduates compared to some of our commercial competitors. This scheme has been developed to prepare students for work on the design, manufacture and construction of complex manufactured goods and infrastructure systems that are so prevalent in modern life.

SUSTAINABLE DEVELOPMENT

A new Academy guide for engineering students and their tutors was published in September 2005. *Engineering for Applying Sustainable Development: Guiding Principles* brings together much of UK engineering's current thinking on applying sustainable development in practical situations.

The guide proposes a basic framework of 12 principles based on real-life case studies. These have been developed for the Academy since 1998, when it began appointing Visiting Professors in Engineering Design for Sustainable Development at universities around the UK. These Visiting Professors, currently numbering 26, helped to generate teaching materials for engineering undergraduates that inspire an understanding of the concept of sustainable development and how engineers can contribute to its attainment.

In the guide's foreword Lord Broers writes: "Wise use of natural resources, minimum adverse impact and maximum positive impact on people and the environment are our targets. Time is not on our side to make the necessary changes in our way of life if we are to live within the limited carrying capacity of Planet Earth."

1. The first woman to be appointed Research Chair by The Royal Academy of Engineering, Professor Sue Grimes is Chair in Waste Management sponsored by the SITA Environmental Trust at Imperial College London
2. Dr Robert Dorey, a Royal Academy of Engineering Research Fellow, at Cranfield University looking at the freeform fabrication of micro scale functional ceramic devices for use in microsystems and micro electro-mechanical systems.
3. The front cover of 'Engineering for Sustainable Development' edited by Professor Richards Dodds FREng and Professor Roger Venables

Adding to success

The Academy runs a number of successful schemes that update the skills of graduate engineers and, hence, contribute to enhancing the international competitiveness of UK industry and academia. This year saw the launch of significant new Academy educational initiatives and prizes in these areas which will have an impact over the coming years.



what they expected of newly graduating engineers. Amongst a number of important conclusions, the study reported concerns of an increasing shortage of high calibre UK engineering graduates going into industry over the next 10 years. This will impact on the productivity and creativity of UK based business until it is addressed. The next phase of the study will be to compare industry views with those of universities and newly qualified graduates.

EQUALITEC

Equalitec focuses on the problems of attracting and retaining women in the IT, Electronics and Communications Sectors (ITEC). Equalitec is developing and testing a range of intervention tools to assist in the recruitment, retention and advancement of women in ITEC. The Academy's contribution to the Equalitec Diversity Forum was led by Academy Senior Vice President Professor Wendy Hall CBE.

1.

PREPARING GRADUATES

Chair of the Academy's Education and Training Committee Professor Julia King CBE FREng led a major skills study, the initial findings of which were published in March 2006. The study forms the first part of the initiative 'Educating Engineers for the 21st Century: The Industry View'. 450 small, medium, and large companies in the UK were asked

ONGOING SUCCESSES

Several ongoing Academy projects reached new highs during the year. The Engineering Professional Development Awards offer financial assistance to industrial engineers, particularly in small and medium sized enterprises to help with their professional development. A record number of applications was matched by a record number of awards

granted, totalling £245,000. These awards generate over £2 million in additional third party income. The selected companies' training programmes involved more than 1,000 engineers during the year.

The Academy's International Travel Grants scheme dispensed nearly £500,000 to 800 young engineers to support overseas study visits. One of these, Dr Holly Philips, Senior Naval Architect at the Royal National Lifeboat Institution (RNLI), used her grant to gather work experience in New Zealand and investigate best practice with the construction of composite boats.

The Panasonic Trust scheme was heavily oversubscribed once more, with grants given to 55 industrial engineers to allow them to undertake courses that would familiarise them with new

developments and technologies. Toni Rivens for example, who graduated with a Masters' degree in Power Distribution Engineering at the University of Manchester in 2005, now uses his knowledge to guide younger and less experienced engineers within his company.

TEACHING AWARDS

The Academy launched six new Engineering Teaching Prizes to attract more high quality lecturers into higher education. The six recipients in this inaugural year of the Engineering Teaching Prizes – each worth £10,000 – were all from northern England and Scotland, which enabled the Academy to present the prizes at its Northern Regional Lecture in Leeds. Favourable publicity about the prizes has sent a clear signal that engineering lecturers are valuable and valued in their profession.

NEW EDUCATION INNOVATION PRIZE

The Academy awarded its first Innovation in Engineering Education Prize, in association with BNFL. This new award recognises individuals and institutions, for their innovation and imagination in engineering teaching. The University of Southampton took the prize for its *Design, Build, Test, Float, Fly and Race* initiative, a team-based, hands-on activity designed to provide participants from schools and universities with three challenging tasks in three days.

Tasks include building a balsa wood glider, a radio controlled car and an electric speedboat to give them a taste of the three engineering courses taught at Southampton. The programme culminates in a race day, when the teams compete against each other and give presentations about their work. Southampton staved off tough competition from five other finalists to secure the prestigious £10,000 award.

1. Dr Kenji Takeda – seen here in the University of Southampton's wind tunnel – was part of the team that won the Academy's new Innovation in Engineering Education Prize
2. Peter Robinson, winner of the 2005 Panasonic Prize, flanked by Robin Bond FREng of the Panasonic Trust and Katerina Syngellakis, Project Engineer and supervisor of Peter's MSc project



2.

Recognising excellence and inspiring the next generation

The Best Programme is the Academy's longest standing commitment to inspiring the next generation of engineers. Participation levels are now higher than ever with a record number of youngsters taking part in hands-on activities designed to excite enquiring minds. And the Academy has launched substantial new education initiatives in the past year, including outreach programmes and the *Shape the Future* campaign.

1.



AN INSPIRING BEST PROGRAMME

The Best Programme works in primary schools by building an enthusiasm for science, engineering and technology (SET) subjects. In secondary schools it promotes engineering and related SET careers. The Best Programme helps support gifted engineering students in universities and after university it works to develop the engineering leaders of tomorrow.

The network of Young Engineers clubs that provide activities in primary and secondary schools, has now grown to 1,347 clubs nationwide. The clubs offer diverse activities covering all aspects of engineering, as well as providing a route into national competitions, where members tackle complex engineering problems and compete for prizes. These

2.



national events included the Young Engineers for Britain competition, whose winner Tanya Budd (pictured above) went on to win more national prizes and even an international lifeboat award in the USA with her innovation, the Hypo Hoist.

The Best Programme saw an increase in the participation of its pre-university activities. Some 3,400 students attended Smallpeice Trust courses which give 13–18 olds the opportunity to work with experienced professional engineers at residential courses. And the Headstart scheme held residential summer schools at 28 universities showing talented students in Year 12/Scottish Year 5 how technology-based subjects can be both stimulating and rewarding.

This year was the 21st anniversary of the Engineering Education Scheme in England, which this year helped 1,330 able young people wanting to pursue a career in professional engineering team up with companies on real industrial projects. The Year in Industry scheme enabled a further 572 students to take on extended work placements before university or during their degree.

NATIONAL ENGINEERING PROGRAMME

In addition to the ongoing success of the Best Programme, the Academy put in motion a substantial new engineering education outreach programme. The Higher Education Funding Council for England (HEFCE) has provided the Academy with £2.85 million to fund the first two and a half years of a 10-year National Engineering Programme (NEP) to bring engineering within reach of four target groups: women, students from families with no experience of higher education, black and minority ethnic students, and adult learners.

The London Engineering Project (LEP), 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 its leadership of the Best Programme and the NEP, the Academy is using its unique multi-disciplinary role

shape the future

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 those from groups not previously engaged.

Shape the Future is the voice of the Technology and Engineering in Schools Strategy (TESS). 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 14–24 year olds.

The Academy's 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 offices in the UK twice a year.

1. Pupils at Bacon College Southwark, one of the schools participating in the London Engineering Project
2. Winner of the Young Engineer for Britain 2005, Tanya Budd, with her prize-winning innovation the HypoHoist – a man overboard recovery device that recovers a casualty out of the water and back onto the safety of a yacht
3. Lord Browne FREng, Group Chief Executive of BP, Professor Wendy Hall FREng, and Rt Hon Alun Michael MP, then Minister for Industry and the Regions, tour the exhibitions at the *Shape the Future* launch

in the engineering community to facilitate new ways of engaging with the young engineers of tomorrow.

RAISING AWARENESS

First of all, at the Science Minister's request, the Academy has developed and is leading the Technology and Engineering in Schools Strategy (TESS). This is a new mechanism by which the engineering community of institutions, learned societies, charities and industry will work together to present a coordinated promotion of engineering and technology careers in schools.

The Academy is also taking part in the development of the new 14–19

specialist diploma in engineering, to be offered through schools and colleges from September 2008. The Engineering Diploma will provide a fresh way of engaging young people in the world of engineering.

Finally, through its *Shape the Future* campaign, the Academy is connecting young people with the engineering that surrounds their daily lives (see boxed insert). This campaign invites youngsters to engage with this engineering by participating in activities such as those provided by the Best Programme and the NEP on those promoted by TESS.



Academy Awards

One of the many ways the Academy recognises excellence is through the presentation of awards and medals. The Academy's suite of awards covers every aspect of engineering. This year some new categories were added to the list of awards.



1.

PRINCE PHILIP MEDAL

This medal is awarded periodically to an engineer of any nationality who has made an exceptional contribution to engineering as a whole through practice, management or education. In 2005 it was awarded to Professor James Dooge FREng, retired Chair in Civil Engineering, University College Dublin.

Professor Dooge led the many advances in the application of linear systems theory to hydrology in general, and rainfall run-off modelling processes in particular. Whilst researching and teaching at universities he was also playing a leading political role in Irish politics, being member of the Irish Senate 1961-1987 and then Irish Minister for Foreign Affairs 1981-1982.

MACROBERT AWARD

The Royal Academy of Engineering's MacRobert Award is the UK's pre-eminent award for innovation in engineering. CSR plc won the prestigious gold medal and the development team collected a £50,000 prize in recognition of their pioneer work in developing its single chip

BlueCore™ family. CSR's key technology breakthrough was to pioneer a silicon chip with an integral radio transmitter in the late 1990's. CSR has shipped more than 100 million chips since its foundation to customers including industry leaders such as Nokia, Panasonic, IBM, and Sony.

THE PRESIDENT'S MEDAL

Awarded on an occasional basis, the President's Medal is one of the Academy's highest accolades and is presented to people who have helped deliver engineering excellence. It was awarded in 2005 to Jonathan Ive of the industrial design team at Apple that 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

These medals are awarded to individuals under the age of 50 in recognition of outstanding personal contributions to British engineering that lead to market exploitation.

There were four recipients in 2005:

- Simon Brueckheimer, as consultant architect at Nortel, 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.
- Nigel Schofield, a technical manager with Core Technology at BOC Edwards, has helped to make his company the leading supplier of vacuum systems for semiconductor preparation, with export revenue approaching \$1 billion.
- Barry Trimmer, an engineering director of Thales UK's aerospace business, 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.
- Peter Price is Director of Engineering and Technology for Rolls-Royce's Civil Aerospace sector. He successfully led the Rolls-Royce engineering effort 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.

SIR FRANK WHITTLE MEDAL

This medal is awarded for outstanding and sustained engineering achievement which has contributed to the well-being of the nation. In 2005 it was awarded to Professor Peter Lawrenson FREng FRS for his design methodologies and the development of electrical machines used worldwide. Professor Lawrenson is best known for his work on the invention, development and commercialisation of switched reluctance drives.

MEDAL FOR THE PUBLIC PROMOTION OF ENGINEERING

One of the Academy's more recent awards, the Public Promotion of Engineering Medal, is given in recognition of work done to promote engineering to the public. In 2005 it was awarded to Dr Lindsay Sharp who, throughout his life, has demonstrated a passion for interpreting and explaining major issues in science and engineering in education and social history. Whilst Director of the National Museum of Science and Industry (NMSI), he combined encouragement of dialogue between the public and scientists and engineers with his curatorial responsibilities of the NMSI and the Science Museum.

LIFETIME ACHIEVEMENT AWARD

The Academy awarded its first 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. His 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

A major new award this year is the International Medal, awarded for outstanding and sustained personal achievement in the broad field of engineering, including commercial or academic leadership or for specific products and/or projects. The inaugural awardee was Professor Cham Tao Soon FEng, who was presented with his award by HRH Prince Philip during a state visit to Singapore (pictured left). 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.

SPECIAL ACHIEVEMENT AWARD

Stephen Payne OBE was awarded the Academy's first Special Achievement Award in recognition of his leading role in creating 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 – and each is powered by innovative electronic controllers again at a power level unique in marine engineering.

THE ROYAL ACADEMY OF ENGINEERING ERA FOUNDATION AWARD

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.

NEW FELLOWS

The Academy's Fellowship consists of Britain's most eminent engineers, elected by their peers in recognition of the excellence of their own achievements in engineering. Last year 51 people joined the Fellowship including four new Honorary Fellows: Sir Christopher Evans OBE, Lord May of Oxford OM AC Kt FRS, Sir Keith O'Nions FRS and Lord Richard Rogers of Riverside. The Annual New Fellows' Dinner was held in October 2005 at Draper's Hall in the presence of the Senior Fellow, HRH The Duke of Edinburgh.

1. Professor Cham Tao Soon FEng is presented with the International Medal by the Academy's Senior Fellow HRH The Duke of Edinburgh with Academy Vice Presidents, Peter Saraga OBE FEng (left) and Richard Williams FEng (right).
2. Stephen Payne OBE winner of the Special Achievement Award was the Chief Designer of the Queen Mary 2. The QM2 is pictured here just before her maiden voyage on 12 January 2004.



Leading debate

The Academy assists in the development of policy on all kinds of societal issues that have an engineering dimension. It does this at both national and international levels, by formulating policy statements and submitting expert evidence to parliamentary and governmental bodies. The range of our work in public engagement and policy projects is diverse, but here are some examples from the past year.



1.

FUTURE ENERGY POLICY

Energy has been at the top of the British and European political agenda during the year. This has been reflected in the Academy's extensive programme of studies and reports which have sought to contribute to policy development.

In a move to address the complexities and major challenges of energy policy the Academy published a comprehensive report of detailed deliberations at a series of seminars. Each led by a Fellow with specific expertise, individual seminars brought together specialists to explore topics including renewables, fossil fuels, energy infrastructure, nuclear fission and security of supply. The Academy is presenting the findings of the discussions for consideration by the Government's 2006 Energy Review.

ETHICS

The Academy continued with its programme of policy initiatives with important work in the areas of risk and ethics. 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 FREng at the British Library titled 'Ethics and the engineer: Embedding ethics in the engineering community' involving experts from the worlds of medicine, science, philosophy, institutions, education and the law.

During the year, the Academy's ethics initiative took a significant step forward with the preparation and publication of a Statement of Ethical Principles, providing four fundamental principles which guide an engineer in achieving the high ideals of professional life. The Academy feels that the values enshrined in the code – accuracy and veracity; honesty and integrity; respect for life, law and the public good; and responsible leadership: listening and informing – need to be adopted by individual engineers throughout their working life.

ACCIDENTS AND AGENDA

A working group, established under the leadership of Trevor Truman OBE FREng, examined 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's resulting report 'Accidents and Agenda' incorporated specific recommendations designed to sustain and improve on the low accident rates in powerful plants and equipment in the UK and to extend the use of protocols and best practice. In a sign of its relevance and topicality, it has become one of the most frequently downloaded reports from the Academy's website.



2.

ACADEMIC-INDUSTRIAL INTERACTIONS

A series of events have begun to explore issues surrounding best-practice in Academic-Industrial interactions. Held on a regional basis, with each seminar being hosted by a local university along with its Regional Development Agency, the series began in Manchester, courtesy of Professor John Perkins FEng, Vice President and Dean of Engineering and Physical Sciences at the University of Manchester. The focus of the event was 'Industrial Funding for Research - Barriers and incentives to working in the UK'. Remaining events will address different aspects of the subject under the leadership of Professor Michael Kelly FEng FRS and will lead to a final report of interest to all those concerned to make the most of the country's human capital.

PHILOSOPHY

To complement the Philosophy of Science, which has featured for some time in universities' philosophy studies, the Academy has recently proposed an additional strand, examining the Philosophy of Engineering. The work is now underway after the first in a series of seminars to bring-together engineers and philosophers with a view to identifying common ground and future developmental actions.

INTERNATIONAL ACTIVITIES

The Academy continued to play a full part in the activities of two organisations of academies on the European and world stages: Euro-CASE (the European Council of Applied Sciences and Engineering); and CAETS (the International Council of Academies of Engineering and Technological Sciences).

At the CAETS Convocation in Cairns, Australia, the focus was on 'Oceans and the World's Future', a subject of acute importance at a time when climatic and oceanic connections are under great pressure. The event heard expert presentations and led to a set of recommendations which have since been widely circulated to opinion leaders worldwide.

FOCUSING ON AFRICA

Building engineering capacity in sub-Saharan Africa was the focus of a pilot study commissioned to investigate how the Academy might play a worthwhile role in an area where many agencies are already active. The Academy commissioned an investigatory report on what the Academy could contribute to help alleviating poverty in the region.

Professor Peter Guthrie OBE FEng will chair the steering group that considers the pilot study. The Academy will now

look for partners and funding bodies before deciding which of the plans of action it undertakes.

CHINA STRATEGY

Another area of growing importance for the Academy during the year was China. A strong cast of speakers including Academy President Lord Broers FEng FRS, Lord Browne, Group Chief Executive BP and Lord Powell of the Government's China Task Force, discussed 'Doing Business with China' at a meeting with Fellows in March 2006.

This gathering of some of the most senior UK engineers enabled the Academy to collate experiences and this evidence will lead to an Academy strategy for future relations with China.

1. This report published in October 2005 was an examination of the processes that follow from accidents or incidents of high potential

2. The conference 'Ethics and the Engineer' took place at the British Library and launched a Statement of Ethical Principles and an Ethics Curriculum Map.

Initiating dialogue about engineering matters

In addition to guiding public policy, the Academy promotes dialogue and debate on topical engineering matters. It does this in a number of ways including enlisting high profile and influential guests to speak and write for its lectures and magazine, *Ingenia*. This year Academy President Lord Broers took the lead when he was selected as BBC Radio 4's 2005 Reith lecturer.



1.

LECTURES AND EVENTS

An important aspect of the Academy's role is to act as a forum for debate. Lectures and discussion meetings were held throughout the year across a wide spectrum of topics. For specialist and non-specialist audiences alike, the events are focused on topical engineering issues with a public policy component.

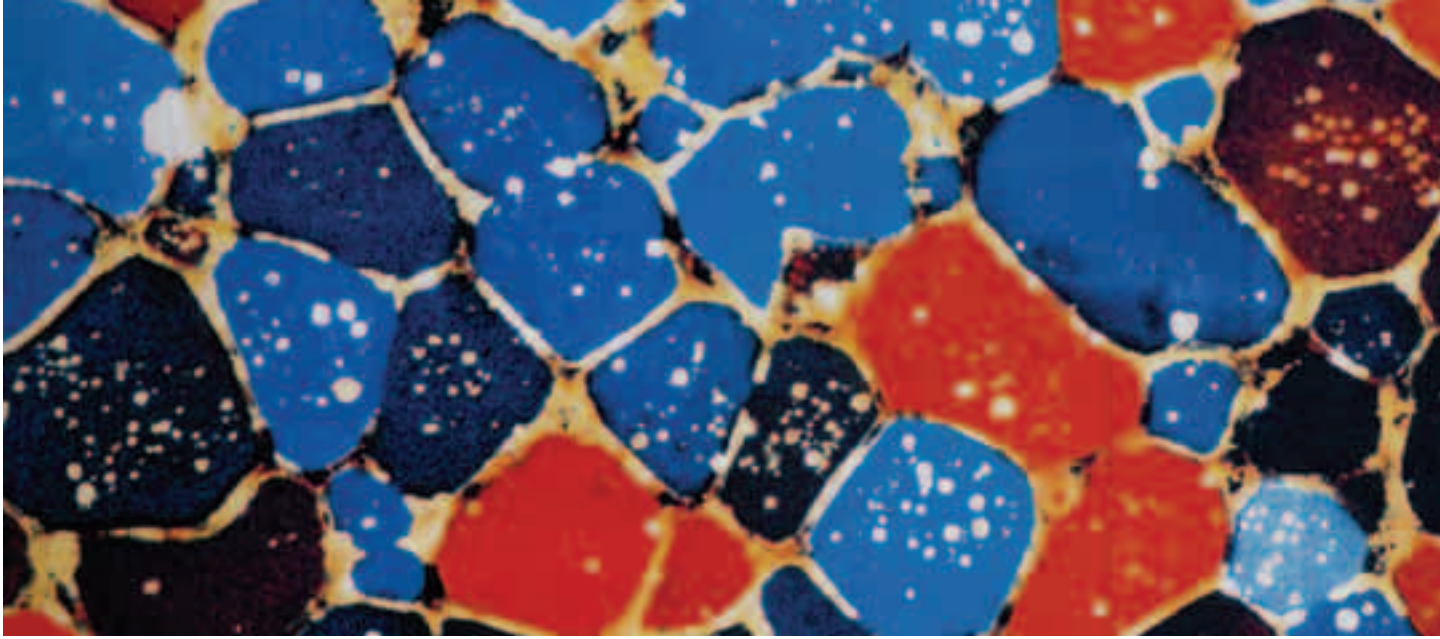
A key date in the Academy's calendar is the Lloyd's Register Lecture on risk management. Delivered this year by Professor Andrew Evans, his lecture on 'Safety Appraisal Criteria' looked at the long-term trends in fatal transport accidents.

The Hinton Lecture is the Academy's flagship lecture and was given in 2005 by Lord Browne of Madingley, Group Chief Executive of BP. His lecture 'Power of Engineering' explored how engineering brings solutions to major issues such as population growth, urbanisation, energy usage and climate change.

In November 2005 the Academy launched a Vodafone-sponsored lecture series in Mobile Telecommunications and Networks. Dr Irwin Mark Jacobs gave the inaugural lecture on 'Innovations in the commercialisation of CDMA for wireless communications and future



2.



3.

directions'. Professor Joseph McGeehan CBE FREng followed with 'Wireless Communications; ideas that change the world'.

Amory Lovins, Chief Executive Officer for the Rocky Mountain Institute was invited by the Academy, in partnership with Forum for the Future, to talk to 300 guests on 'Nuclear Power: economics and climate protection potential'. In a passionate lecture, he outlined his belief that nuclear power has been overtaken worldwide by decentralised technologies on both the supply and demand side.

In a major new initiative supported by the ERA Foundation, Dr Craig Barrett, Chairman of the Board for Intel, presented the Academy's inaugural International Lecture, 'Future Technology Horizons', in March 2006. The lecture focused on the impact of technology in the evolving digital world and what the future might hold, and gave an insight into one of the world's biggest technology companies.

WEBSITE

For the first time the Academy's website published transcripts of each of the year's lectures so that people who had missed the events, or who wanted to read through them again, could do so. Reports issued during the year were also published in their entirety and this has

become an important way of broadcasting the research and responses that the Academy produces. Up to 2,000 people per month download individual reports worldwide. All reports and lecture texts are made available at no charge.

INGENIA

The Academy's quarterly magazine continued to attract articles of interest and authors of note throughout the year with Sir David King, James Dyson CBE, Sir Keith O'Nions and many others putting pen to paper. Subjects ranged from the telecommunications aftermath of the London bombings, the development of driverless vehicles, engineering a trustworthy web, the advantages of thixoforming properties and an investigation into why railway rails crack.

The Academy is grateful to *Ingenia's* sponsors: Arup, BAE Systems, Mott MacDonald and Rolls-Royce plc.

REITH LECTURES

Academy President Lord Broers gave the 2005 Reith Lectures, broadcast on BBC Radio 4 in April and May 2005. The five lectures examined the way technology has shaped life since the beginning of civilisation, how technologies develop and the reality and excitement of the modern creative process.

Lord Broers concluded his series of lectures by exploring how we might engage in more effective dialogue with society about the development of technology.

James Dyson endorsed the follow-up book of the lectures, saying "Lord Broers' lectures have opened up the discussion; the focus should now be on changing attitudes towards technology and the engineering profession. It's about the present and the future. Experience and experimentation, not repetition and rigid rules."

1. Dr Craig Barrett, Chairman of the Board for Intel Corporation, giving the International Lecture on Future Technology Horizons in March 2006
2. Sue Lawley, presenter of the Reith Lectures with Lord Broers.
3. Front cover of *Ingenia* 26 showing a micrograph of an aluminium alloy in the process of thixoforming

Financial summary

Summarised statement of total resources available and related expenditure as a result of academy activities

For the year ended 31 March (amounts in £000s)		2006	Restated 2005
Income	Grants	6,834	6,918
	Contracts	1,333	1,185
	Gifts and Donations	267	8,382
	Investment Income	1,044	621
	Other Income	614	524
	Direct Income as per Statement of Financial Activities	10,092	17,630
	Third Party Income in Support of Programmes (see below)	20,278	16,497
	Total Income	30,370	34,127
Expenditure	Costs of Generating Funds	223	260
	Charitable Activities:		
	- Engaging Effectively with the Public	1,683	1,499
	- Attracting More People into Engineering	2,117	2,360
	- Enhancing the Contribution of Engineering	4,495	4,307
	- Developing the Academy	1,192	740
	Governance Costs	61	67
	Direct and Other Expenditure as per Statement of Financial Activities	9,771	9,233
	Third Party Expenditure on Programmes (see below)	20,278	16,497
	Total Expenditure	30,049	25,730
Summarised Consolidated Balance Sheet as at 31 March		2006	2005
	Tangible Fixed Assets	108	98
	Investments	21,039	17,565
	Current Assets	4,298	3,775
	Current Liabilities	(4,946)	(4,276)
	Defined Benefit Pension Scheme Liability	(1,283)	(835)
	Net Assets	19,216	16,327
	Accumulated Funds	19,216	16,327

SUMMARISED FINANCIAL STATEMENTS INCLUDING THIRD PARTY INCOME AND EXPENDITURE

The summarised financial statements shown above contain numbers extracted from the full unqualified audited annual accounts approved by Council on 15 May 2006 and subsequently submitted to the Charity Commission. They also include figures for third party income and expenditure.

Only those funds under the direct control of the Council are included in the audited annual accounts. Third party

income and expenditure arises from donors who agree to support Academy projects but make contributions directly to those projects without passing through the Academy's books. Although these funds are not under the direct control of the Academy they would not have become available without the involvement of the Academy. The Council believes that the total resources and expenditure, including those from third parties, which have been applied to projects as a result of the Academy's involvement is a very relevant measure of its activities. Accordingly a statement

of total resources available and related expenditure is set out above.

The summarised financial statements do not contain sufficient information to allow for a full understanding of the financial affairs of the Academy. A copy of the full Financial Report and Accounts may be downloaded from the Academy's website. The summarised financial statements were approved by Council on 15 May 2006 and were signed on its behalf by Lord Broers, President and Mr F C Price, Honorary Treasurer.

INDEPENDENT AUDITORS' STATEMENT TO THE COUNCIL OF THE ROYAL ACADEMY OF ENGINEERING

We have examined the summarised financial statements of The Royal Academy of Engineering for the year ended 31 March 2006 set out above.

Respective responsibilities of the Council and auditors

The Council is responsible for preparing the summarised financial statements in accordance with the recommendations of the Charities SORP (as revised in 2005). Our responsibility is to report to you our opinion on the consistency of the summarised financial statements

with the full financial statements and Annual Report. We also read the other information contained within the Annual Review and consider the implications for our report if we become aware of any apparent misstatements or material inconsistencies with the summarised financial statements.

Basis of Opinion

We conducted our work in accordance with Bulletin 1999/6 'The auditors' statement on the summary financial statement' issued by the Auditing Practices Board for use in the United Kingdom. As indicated above, the summarised financial statements include

third party income and expenditure which are not included in the full financial statements.

Opinion

Except for the inclusion of third party income and expenditure, in our opinion the summarised financial statements are consistent with the full financial statements and Annual Report of The Royal Academy of Engineering for the year ended 31 March 2006.

London
15 May 2006

PKF (UK) LLP
Registered Auditor

Development report

The clarity provided by the Academy's Strategic Plan and the benefit of a dedicated development resource have both contributed to the Academy obtaining more financial support in the current year.

Encouragingly, support has been achieved from a number of new partners as well as long-standing sources such as the Gatsby Charitable Trust, Parliamentary Grant-in-Aid, and the more recent gift from the ERA Foundation. Fellows too continue to volunteer their expertise and time as well as contributing directly to our fund-raising appeal.

Garnering support requires the successful demonstration of the Academy's relevance and expertise, along with its ability to deliver what is needed by our stakeholders today. At a practical level this is evident in our educational enrichment work where, by engaging effectively with growing numbers of young people, we are helping industry with future recruitment. Increasingly, more young people from a

wider range of backgrounds are participating in our programmes and this will be of both personal and national benefit given the inextricable links between engineering, innovation and the well-being of our economy and society. At the policy level, a greater appreciation of the expertise volunteered by the Fellowship and the Academy's unique national role, provide further reasons for partnership.

Development is a long term business with specific short term objectives. The Academy is committed to doubling its annual support to young people by raising a further £2 million per annum; and to raising £5 million in capital to create a new home where we can better deliver our objectives. Good progress is being made.

In the year, new corporate and charitable support exceeded £350,000 for our Best Programme and *Shape the Future* campaign, and the Higher Education Council for England made a very welcome £2.85 million grant to launch our London Engineering Project. All these activities are targeted at young people. New donations were also received from Fellows and these contributed to a substantial increase in our Building Fund which now stands at £2.5 million.

Relationship building efforts will continue on many fronts with the confidence that our vital work merits support by delivering excellent value to beneficiaries and supporters alike.

The Council (as at 31 March 2006)

The Council 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.

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(ex officio)
Prof M J H Sterling FREng

Chief Executive
Mr P Greenish CBE

Director, Finance & Administration
(Secretary to Council)
Mr A Thomas