Strategic priorities

As the UK's national academy for engineering, we bring together the most successful and talented engineers from across the engineering sectors for a shared purpose: to advance and promote excellence in engineering. We provide analysis and policy support to promote the UK's role as a great place from which to do business. We take a lead on engineering education and we invest in the UK's world class research base to underpin innovation. We work to improve public awareness and understanding of engineering. We are a national academy with a global outlook and use our international partnerships to ensure that the UK benefits from international networks, expertise and investment.

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

**Drive faster and more balanced economic growth**
The strategic challenge is to improve the capacity of UK entrepreneurs and enterprises to create innovative products and services, increase wealth and employment and rebalance the economy in favour of productive industry.

**Foster better education and skills**
The strategic challenge is to create a system of engineering education and training that satisfies the aspirations of young people while delivering the high-calibre engineers and technicians that businesses need.

**Lead the profession**
The strategic challenge is to harness the collective expertise, energy and capacity of the engineering profession to enhance the UK's economic and social development.

**Promote engineering at the heart of society**
The strategic challenge is to improve public understanding of engineering, increase awareness of how engineering impacts on lives and increase public recognition for our most talented engineers.
Q&A Dame Ann Dowling FREng FRS
President

Dame Ann Dowling took over the Academy Presidency from Sir John Parker in September 2014. She looks back on recent achievements and what the Academy will need to focus on in the coming year.

Q What do you think the Academy’s biggest successes have been in the last financial year?
A A number of major activities have been underway. One has been to refresh and renew the strategy. We have come up with ambitious plans for the future and a greater understanding of where the Academy wants to position itself in five years’ time — I am excited by that.

The UK has a world-class research base and we know that countries that invest in R&D prosper. So I am pleased that we have also worked very well with our sister national academies in the run-up to the General Election and have developed and disseminated clear messages on the value of investment in research and innovation.

Another important partnership project that took place was the study with the Engineering and Physical Sciences Research Council to analyse the economic value of engineering. The figures are impressive — across a wide range of different sectors we find that engineering is responsible for some 20% of gross value added in the UK and nearly 50% of exports. This is a really strong piece of evidence on which we can base our case to the new government.

I do believe that the message is getting through. There is clear recognition that to continue on the road to economic recovery, the UK needs to invest and nurture engineering businesses, research and innovation and to address the skills gap. The one thing that challenges this potential success story is having enough people with the right expertise. The Academy has been a key player in raising understanding of the engineering skills gap and ways of addressing it.

Q In which areas do you feel that the Academy needs to do better?
A The Academy is doing very well in lots of areas. We are making good progress in representing the breadth of engineering and that breadth is well reflected in our Fellowship. I think the Academy can do more to demonstrate leadership across an integrated engineering profession. Increasingly, government is saying ‘We want to talk to a joined-up engineering profession’. We absolutely recognise the importance of being able to work together with partners, and the time is right to do much more coordinated in the way we engage important stakeholders.

We also recognise the need to engage with a much greater number of our Fellows. We are trying to do this in a number of different ways, including the exploitation of new media and digital platforms for wider online engagement; increasing transparency about what is going on in the Academy; and increasing our regional activities, including formal and informal meetings for Fellows to get together. We need to ensure we are providing the right kinds of events so that Fellows get maximum value out of attending. For example, we are developing a new Fellows’ day that will take place alongside the AGM this year to showcase the Academy, its activities and Fellows, and those whom we are supporting, through the Enterprise Hub and our research and our engagement and education programmes.

Q What have been your particular priorities in the first six months of your Presidency?
A When you are new in a job, that is the time to go round and introduce yourself to people and ask the questions that you can only ask at that stage. In terms of external stakeholders, I have focused on talking to key individuals in government, and other Academies and partners about what they think of the Academy and what we do, what they think we might do differently, and the possibilities for the future. That has been really interesting and I am very pleased that the responses were uniformly positive. In particular, the Academy is seen as an organisation that delivers. Other priorities have been developing the Academy’s new strategic plan and embedding the new Trustee Board.

Another focus has been in response to the invitation to lead a review, on the behalf of government, on business-university research collaborations. This has an added bonus that has enabled me to know a greater number of Fellows through the regional workshops we held to hear their views on the factors that enable successful business-academia relationships — we have had some productive discussions.

The response from the community to the review has been excellent and we are due to have the recommendations on the desk of the new Minster for Universities and Science, Jo Johnson MP, in time for the next Comprehensive Spending Review.

The Academy is a great neutral convenor of important discussions on all sorts of topics and that is something I am really keen to see grow. Because engineering ranges from science know-how into applications. All engineers continually consider what is pragmatic and usable, and so are able to span the space from evidence through to what is achievable. That makes engineers the ideal group to have at the heart of policymaking.

The Academy has made significant progress in the last five years in demonstrating how important engineering expertise is to government. But we do not hold all the underpinning knowledge, and that is why we need to work with our sister Academies and partners, so we are able to take a broad view and then pull all that information together around recommendations that are robust and practical.

Q What are your priorities for the future?
A The Academy is delivering across a broad front, but we are limited in what we can do because of financial constraints. We are relatively small and will continue to make the best use of our people and resources but there is so much more that we could be doing for the good of the country.

There is more we can do in terms of pulling different bodies together, whether they are big businesses, small businesses, universities or the links into government. I would like to see us scale up our activities across the board.
Philip Greenish talks about the challenges that the engineering community has faced and the Academy’s role in placing engineering at the heart of society.

Q What areas do you feel that the Academy has made particular progress during the last financial year?
A It starts with our work to support entrepreneurial researchers through the Enterprise Hub, and I think we have made significant progress from what was effectively a standing start two years or so ago. It is a game changer for the Academy and we have seen great outcomes and impact already. From talking to our Enterprise Hub members, it is clear that, while the funding they receive matters, it is the interaction and advice that they take from the Fellows acting as their mentors, the people they meet and what they learn that makes it such a success. We now need to increase the volume of Hub activities by five or 10 times to raise it to the scale we need. We also have a programme of development in place to renovate the basement of Prince Philips House into a superb physical location for all our enterprise activities.

Q Why is international engagement important to the Academy?
A Most engineering businesses of any scale in the UK are multinational in one way or another – engineering is a global endeavour and the UK’s economic growth has always depended on its international connections. So that is reason number one.

Reason number two is to contribute to and learn from other people’s thinking, to exchange of ideas and the interchange of knowledge with other corners of the world is very important. Then there is the third reason, which is that there are large parts of the world – the developing world – in which engineering and engineering skills are principal routes to enabling growth in their economies and in people’s health and wellbeing.

Q In what ways do you feel the Academy is working well alongside government and how could we do better?
A We have thought long and hard about how best to influence government, and we know that we are most effective when we work within the grain of the system in a way that does not compromise our independence. Occasionally, we might produce a report which is critical of national policy, and we are not frightened of doing so, but even then we ensure that the messages, even if uncomfortable, are framed in the right way.

We have a tremendous range of talent within the Fellowship – a resource to deploy their skills, knowledge and expertise in particular aspects of public policy – in recent years, a major issue has been creating a secure and sustainable energy supply for the UK. We believe the Academy has built an excellent reputation in providing advice and expertise to government(s), as evidenced by the increasing numbers of requests and interaction.

Q Have you particular priorities for the last year?
A I would start with the implementation of the Academy’s new governance and supporting the transition for our new President. Other priorities have been to improve how we monitor and measure the Academy’s progress in key areas. We have a new strategy, a new business plan that defines our programme delivery in more detail and a new approach to measuring and reporting key performance indicators.

At the request of some major players in industry, we have been looking in depth at what needs to be done to make a step change in the recruitment of young people to engineering roles, and in the way engineering is perceived by wider society. We have spent much of the last half of the year doing some very careful analysis. This has reinforced our knowledge of some significant deficiencies in the supply system and of remedial measures that need to be taken. These include the need for some businesses to modernise cultures and practices so that they become more appealing to young people who don’t think engineering is for them. There are some interesting and fundamental structural issues in education and training that need to be addressed, and we also now understand much better what we need to do to promote our profession – we have not been getting it right. Putting time into understanding that and developing what comes next has taken a lot of thinking and resource.

Q What have been the biggest challenges for the Academy this year?
A I think the most challenging is the sheer range of people and organisations we work with on a continuing basis. As a relatively small organisation, we have to work with, and deliver through, multiple partners. We also have the increasing challenge of managing and controlling the volume and diversity of activities we have to deliver. That is certainly positive and is in part because we are seen as an organisation that does deliver, so we are often asked to do more. However, it is a challenge because of limited staff resources, and it argues for using our networks and our supporters, and particularly our Fellows, ever more effectively.

I think the Academy should be hugely proud of the fact that it has continued to grow and develop in these austere times. Securing additional resource so that and developing what comes next will be my top priority for the coming year.
Highlights of the year by theme

University programmes
Over 50 practising engineers brought into universities and 181 university lecturers granted industrial placements to improve the quality and relevance of engineering teaching for undergraduates.
The Research Chairs and Senior Research Fellowships supported 40 UK research partnerships.

Supporting smaller businesses
Pathways to Growth grants provided up to £20,000 in funding towards training for staff in engineering and technology SMEs.
The Launched Competition helped exceptionally promising engineering entrepreneurs between the ages of 16 and 25.

Enterprise Hub
More than £600,000 committed by private supporters towards Hub activities, bringing external funding attracted to £2 million.
22 CEOs of SMEs have received mentoring from Academy Fellows.
7 new Enterprise Fellows were awarded grants of up to £85,000 each.

International schemes
Under the Newton Fund, the Academy provided entrepreneurship training for 149 researchers from 8 emerging powers.
The Africa Prize received entries from 15 countries in sub-Saharan Africa.
The four African entrepreneurs chosen as Africa Prize finalists will each receive at least £10,000 to progress their innovations.

Queen Elizabeth Prize for Engineering
Dr Robert Langer FREng won the £1 million prize for his revolutionary medical advances and leadership in engineering.
The QE Prize announcement achieved a global media reach of over 500 million.
The QE Prize Ambassador network now has over 200 engineers (50% of whom are women).

Partnerships
The Engineering the Future alliance produced a report on the changing shape of the Universe of Engineering, which is helping set a new strategic direction for the profession.
In collaboration with other national academies, the Academy held events at party conferences and jointly published Building a stronger future to make case for continued investment in science and innovation.
The Academy supported the development of the Engineer Your Future exhibition at the Science Museum, which had more 150,000 visitors between its opening in December 2014 and March 2015.

Influencing education policy
Education for Engineering (E4E) played a leading role in implementing key recommendations in the Perkins Review of engineering skills.
The Academy provided secretariat for Dowling Review of university-business research collaboration.
Does teaching advance your academic career? gave new evidence on perceptions of the value of teaching for career progression across senior management and university lecturers.

Diversity
33 signatories to the Engineering Diversity Concordat for Professional Engineering Institutions, covering 99% of total registrant population.
56 employers and Sector Skills Councils engaged through the Diversity Leadership Group, employer projects and 10 Steps campaign.
To date, 709 companies have co-supported Academy researchers. 20% of Academy’s researchers have been women, vs <10% nationally.

Energy and society
Wind energy report
Published in April 2014, the report analysed how wind turbines will match the government’s commitment to providing 15% of energy from renewables by 2020.
The report found that at current fuel and carbon prices, onshore wind energy is more expensive than gas or coal plant but is one of the cheapest low carbon sources of electricity.
The UK has the world’s greatest amount of installed offshore wind generating capacity (currently 4GW of installed capacity). Offshore wind brings more and complex engineering challenges, but engineers are providing innovative solutions.

Other energy highlights
Produced in response to a government request, the Counting the Cost report analysed the economic and social cost of electricity shortfalls.
Dame Sue Ion DBE FREng was awarded the President’s Medal in recognition of her outstanding service to the nuclear industry as well as the wider world of engineering.
Gave influential evidence to the House of Lords Science and Technology Committee’s inquiry on the resilience of electricity infrastructure.

Infrastructure and transport
Academy transport awards
Professor C C Chan FREng was awarded the Prince Philip Medal in recognition of his role in the development of electric vehicles as we know them today.
Eur Ing Mark Wallace CEng was given the Sir George Macfarlane Medal for managing complex engineering design projects, and dedication to promoting careers in the rail industry.
Chris Young became an Academy Silver Medallist for his role in helping develop the world’s most efficient aircraft engine, the Rolls-Royce Trent XWB.

Transport initiatives
NATS Chief Executive Richard Doakins gave a lecture about the advances being made at the UK’s air traffic control centres.
The inaugural Ingenio Live debate, Steering into the unknown, discussed some of the challenges faced in developing driverless cars.
Rolls-Royce was one of 3 companies shortlisted for the the MacRobert Award, for the innovation involved in producing the world’s first vertical take-off system for a supersonic fighter jet.
The Academy's first strategic priority is to maximise the contribution of engineering to powering innovation and growth in the UK. This year has seen a step change in the activities that the Academy undertakes in this area, ranging from the expansion of support provided to fledging entrepreneurs through the Enterprise Hub to a substantial increase in policy activity targeted at improving the climate for research and innovation in the UK.

With a Fellowship drawn equally from academia and industry, the Academy is well-placed to provide advice on how investments in research can be harnessed to create wealth and deliver improvements in wellbeing for the nation.

During 2014–15, the Academy provided major inputs to the government’s consultations on long-term capital investment in science and research and its Science and Innovation Strategy. One of the key points addressed was the importance of a stable policy framework to give businesses and others the confidence to invest. The need for coherence across relevant areas of government policy, including skills and immigration, was also highlighted, as was the importance of boosting public investment in innovation.

The Academy worked with partners to build a compelling case for continued investment in research and innovation, in preparation for the spending review that is expected to follow the May 2015 election. In collaboration with the Engineering and Physical Sciences Research Council (EPSRC), the Academy commissioned a review of the economic return to the UK on investment in engineering research and associated training. The review provided further evidence of the substantial contribution of engineering to the economy, concluding that at least a fifth of UK gross value added and half of all exports are attributable to engineering.

The Academy complemented this review by producing an overview of the case for investing in research and innovation: Building a Stronger Future, published in partnership with its sister national academies.

In addition, the President, Dame Ann Dowling, was invited by the Minister of State for Universities, Science and Cities, the Rt Hon Greg Clark MP, to conduct a review of business-university research collaboration. The Dowling Review is due to report in early summer of 2015 and will ensure that the Academy plays a strong and visible part in strengthening UK performance in research and innovation.

Enterprise Hub

Launched in 2013, the Hub forms an important part of the Academy’s commitment to stimulating and celebrating excellence in engineering innovation and entrepreneurship. Entrepreneurial researchers at UK universities are selected to become members following a competitive process and receive bespoke support, training and mentorships, as well as valuable access to Academy networks. Members in turn commit to supporting the Hub’s objectives by acting as role models and peer mentors.

To date, around 30 very early-stage entrepreneurs have created 19 companies that have raised over £6 million of external investment and are associated with over 60 employees. An additional 22 SMEs at later stages of development have benefitted from access to training grants and mentors. These entrepreneurs have been supported by more than 100 Academy Fellows, who have contributed their time and expertise as mentors, advisors and judges.

The Hub’s initial offering focused on support for aspiring and early-stage entrepreneurs, with members selected via the Enterprise Fellowship scheme and the ERA Foundation Entrepreneurs Award. In the course of 2014–15, the Hub team expanded the portfolio to include three new programmes.

Enterprise Hub is supported by a number of partnerships, including the Engineering and Physical Sciences Research Council (EPSRC), the Royal Academy of Engineering, the Royal Society, the Royal Academy of Medicine and the Royal Society of Edinburgh. A number of business leaders have also committed to supporting the Hub.

Awards

The Academy's awards celebrate the significant contribution of engineering to the nation's wealth, health and wellbeing and recognise engineers at all stages of their careers.

MacRobert Award

The MacRobert Award is a £50,000 prize awarded annually to a team of engineers for an exceptional UK engineering innovation that has been both commercially successful and delivered societal benefits. In 2014, the winner was a team from Oxfordshire-based SME Cobalt Light Systems for the Insight100 airport security liquid scanner.

Cobalt pioneered a technique to determine the chemical composition of materials in nonmetallic containers and behind a range of other barriers, including skin. The Insight100 system can analyse bottles of up to three litres, in order to determine if they contain anything considered a threat, without them having to be opened, providing detailed and exceptionally reliable results in just five seconds. Use of the same technique is now being investigated for other applications including real-time diagnostic tools for cancer and bone disease.

Silver Medals

The Academy’s Silver Medals are awarded to outstanding individuals in recognition of their personal contributions to UK engineering. The award recognises individuals’ success in creating and bringing a particular innovation to market. In 2014, the Silver Medalists were:

Professor Dino Distefano is the co-Founder and CEO of Monoidics, Software Engineer at Facebook, and Professor of Software Verification at Queen Mary University of London. A former Academy Research Fellow, he is one of the world’s leading experts in the process of automatically finding errors in software systems. His ideas are being applied to industrial software systems of over a million lines of code.

Chris Young played an important role in developing the world’s most efficient large aircraft engine, the Rolls-Royce Trent XWB, which will power the new Airbus A350 XWB aircraft. More than 6,000 of the Trent XWB engines are already on order to power civil airliners for 40 customers, making it the fastest selling civil large engine ever.

Professor Máire O’Neill, one of Europe’s leading digital security experts and a former Academy Research Fellow, is Queen’s University Belfast’s professor of Information Security at the Centre for Secure Information Technologies (CSIT). The Trent XWB security silicon on chips that she developed as a PhD student are now incorporated in over 100 million television set-top boxes alongside ARM technology.

Peter Brewin and Will Crawford are the founders of Concrete Canvas. While at university, they invented a rapid-setting fabric that is impregnated with concrete and activated with water, and established their business to commercialise the innovation. The canvas allows many construction projects to be completed faster, more efficiently, and with a lower environmental impact than conventional concrete. It is already used in over 40 countries worldwide.

Engineering-related sectors contribute an estimated 20% of the UK’s Gross Value Added and 48% of the total value of exports
At a glance

Technologies that shape the future: seven Academy Fellowships awarded

Dr Emmanuel Benetos
Queen Mary University of London
Aim: to produce a multipurpose software tool capable of analysing music recordings and complex acoustic scenarios.

Dr Ben Britton
Imperial College London
Aim: to improve the design, manufacture and management of materials to increase both the safety and lifespan of nuclear power plants.

Dr Soraia Pimenta
Imperial College London
Aim: to develop mathematical models to understand and optimise the mechanical properties of a new family of composites.

Dr Alex Dickinson
University of Manchester
Aim: to create a new programming language specifically designed to fully exploit the power of processors and computer architectures.

University of Southampton
Aim: to create a new programming language specifically designed to fully exploit the power of processors and computer architectures.

Aim: to develop mathematical models to understand and optimise the mechanical properties of a new family of composites.

Research

The Research Fellowship scheme provides outstanding early-career researchers with five years' funding and mentorship to enable them to establish themselves as future research leaders. The scheme is highly competitive and only a small number of new appointments are made each year, with one supported by the Lloyd's Register Foundation; a further 58 were supported across 22 universities.

The Leverhulme Senior Research Fellowships scheme, funded by The Leverhulme Trust, enables academics with a proven track record in research to be relieved of their teaching and administrative duties so that they can focus full time on research for up to 12 months.

The Academy’s Research Chairs and Senior Research Fellowships are jointly funded with industry partners to create and enhance world-leading research collaborations. Over 40 research partnerships are currently supported, ranging from pharmaceutical processing to integrating mechanistic design.

The Industrial Secondment scheme supports early- to mid-career academics wishing to undertake a collaborative research project in an industrial environment, which in turn helps to improve the quality and industrial relevance of their teaching. Seven new awards were made in February 2015.

The Academy’s annual Research Forum brings together Academy Fellows and benefactors, engineering researchers, industry partners, research funders and government representatives. This year, the event was hosted by Professor Ric Parker CBE FREng, with guest speaker Professor Sir John O'Reilly FREng, Director General of Knowledge and Innovation at the Department for Business, Innovation and Skills, who gave an insight into the structure and future of the funding landscape. Two of the industry sponsors, Dr Mark Taylor of McLaren Racing and Professor Martin Dawson of Fraunhofer UK, spoke on why and how they support Academy Research Chairs, and what they hope to achieve from the joint venture.

The SET for Britain event is a nationwide competition to encourage early-career researchers in engineering, science, technology and maths. It is run by the Parliamentary and Scientific Committee in partnership with the Academy and others. For the 2015 event, 60 participants presented their research in the engineering category. Dr Nasrin Al Nasir, a postdoctoral research associate at Imperial College London, won the gold medal and £3,000 prize for her research that aims to develop a low-cost environmental barrier coating to protect ceramic matrix composites in the jet engine environment.

International activities

The Academy is a delivery partner for the Newton Research Collaboration Programme and the Newton Hub programme, which supports the funding of innovative UK-China research collaborations to catalyse productive partnerships. This year, 47 Distinguished Visiting Fellowships were awarded.

The Distinguished Visiting Fellowship scheme provides funding to enable a UK university to host a senior academic from an overseas centre of excellence for up to a year between researchers in the UK and their counterparts in six Newton Fund Partner Countries: China, Brazil, Mexico, Vietnam, South Africa and Turkey. In the first round of the scheme, the Academy made 47 awards.

Dr Jamie Mitchell
Professor of Nuclear Engineering
University of Manchester
Aim: to work with partners in the UK and overseas to improve the safety and efficiency of the operation of nuclear power plants.

Dr Mark Britton
Assistant Professor in Nuclear Engineering
University of Manchester
Aim: to develop methods to predict fuel behaviour in severe reactor accidents.

Dr Alex Dickinson
University of Manchester
Aim: to create a new programming language specifically designed to fully exploit the power of processors and computer architectures.

The next phase of Hub development is now underway and this includes plans to redeploy the lower ground floor of Prince Philip House to create a physical base for Hub activities.

The Launchpad Competition supports exceptionally promising engineering entrepreneurs between the ages of 16 and 25. The 2014 winners were Dr Niall Kent and Dr Alessia D’Onofrio with their new material for dental implants, Aerograft.

Pathways to Growth grants provide up to £20,000 in funding towards training for staff in engineering and technology SMEs. The leadership teams from the companies selected for these grants were also invited to mentoring and networking events at the Academy.

The Blavatnik Family Foundation Alumni Awards celebrate progress made by Enterprise Fellows during and after their Fellowships. The 2015 winners were Dr Susannah Clarke, Professor Janice Kirby, Dr Adar Polah and Dr Stephen Smith. All were recognised for their efforts to turn their innovative technologies into viable businesses.

In May 2014, the first Hub Showcase was held with elevator pitches from Hub members, followed by a discussion in which Dr Hermann Hauser KBE FREng FRS and Sir Robin Saxby FREng shared their personal insights into the founding of ARM. The Hub was also selected for these grants were also invited to mentoring and networking events at the Academy.

The anechoic chamber at the Institute of Sound and Vibration Research, University of Southampton

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Foster better education and skills

To succeed in the global economy, the UK needs to be a leader in innovation, seizing the opportunities presented by technological change. This requires a highly skilled workforce of creative engineers and technicians across many disciplines. However, engineering companies are reporting difficulties filling current vacancies and are concerned about meeting future skills needs. Thousands of qualified engineers and technicians are needed to replace an ageing workforce and meet future expansion.

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Programmes in sub-Saharan Africa

Two pilot programmes have been developed to address the chronic engineering skills shortages and skills gaps that exist across sub-Saharan Africa. These programmes seek to support and improve engineering teaching at higher education level, in addition to fostering entrepreneurship skills in talented engineering innovators.

The Enriching Engineering Education Programme – supported by the Anglo American Group Foundation – was established to help address the engineering skills shortages in sub-Saharan Africa and to showcase the role of engineering in driving economic growth in the region. A structured partnership between universities and industry is achieved through bilateral staff exchange placements and knowledge-sharing workshops. The beneficiaries of this programme comprise 14 universities from Botswana, Kenya, Mozambique, Namibia, Uganda, Tanzania and Zimbabwe.

The Africa Prize for Engineering Innovation encourages ambitious and talented engineers from sub-Saharan Africa from all disciplines to apply their skills to develop solutions to local challenges. Crucial commercialisation support is awarded to a shortlist of 12 successful applicants, through a six-month period of training and mentoring. Following this period of mentorship, finalists are invited to present at an event held in Africa where a winner is selected to receive £25,000 and two runners-up receive £10,000 each. A high-profile judging panel has ensured that the Africa Prize has benefited from some excellent international publicity, including the BBC World Service and key national broadcast and print outlets. The Africa Prize is supported by the Shell Centenary Scholarship Fund, Consolidated Contractors Company, ConocoPhillips and the Mo Ibrahim Foundation.

The beneficiaries of this programme comprise 11 universities from Botswana, Kenya, Mozambique, Namibia, Uganda, Tanzania and Zimbabwe.

The Barrow Engineering Project (BEP) is a major part of the Academy’s effort to provide opportunities for STEM engagement to students in disadvantaged areas of the UK. Following the success of the BEP, the Academy launched the Stoke Engineering Talent Project in 2013. The project provides funding to enhance and enrich the STEM curriculum in 10 primary schools, six secondary schools, and two further education colleges in the area. Ten CPD sessions have been held for teachers in primary schools, leading to the promotion of postgraduate engineering programmes.

The Academy’s flagship Connecting STEM Teachers programme works to enhance teaching and learning in schools across the UK. The programme supports its network of 278 STEM Teacher Coordinators with training, teaching and learning resources and funding for collaborative projects within their regional network schools. Within the 427 secondary schools that are involved, 472 teachers have benefited from training and 46,278 students have taken part in STEM learning opportunities since the programme was launched in 2011. Renewed Industry support will see this programme continuing until July 2017.

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Activities for schools

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At a glance

Connecting STEM Teachers programme

28 STEM teacher coordinators working nationwide

472 STEM teachers from 427 schools engaged

Over 300 peer-to-peer network meetings/CPD sessions held

Nearly 2,000 STEM resource boxes and associated training disseminated to network schools

Academy developed STEM resources being used in curriculum time

Provided funding for schools to introduce mobile robotics

Facilitated an online engineering challenge and mentoring programme for post-16 students from across the UK

46,000 students benefited during Phase 1 (Sept 11 – July 14)

158,000 people visited the Engineer the Future exhibition between its opening in December 2014 and March 2015

A secondary school student demonstrates a hovercraft built as part of the Bosch All Around You Roadshow

Further and higher education

In its third and final recruitment year, the Aerospace MSc Bursary Scheme is set to hit its target of up to 500 bursaries for new entrants to UK aerospace and for up-skilling people. The scheme promotes in-sector employment through a LinkedIn group, the Talent Retention Scheme recruitment portal and events such as the networking lunch held in 2014 at the Farnborough International Air Show. Bursary holders are already graduating and finding employment, so adding to the sector’s talent pool.

The project has received high-profile endorsement from the Prime Minister and the Deputy Prime Minister the Rt Hon Nick Clegg MP. The scheme has been awarded the endorsement from the Prime Minister and government’s Your Life campaign in May 2014. Internally, the Academy is strengthening its approach to diversity, including an emphasis on attracting a higher proportion of female applicants to its grant schemes.

Diversity initiatives

The Academy diversity programme continues to lead and coordinate activity across the profession. The Engineering Diversity Concordat now has 39 signatories, including 31 of the 36 Professional Engineering Institutions (PEIs). The Academy has now started to focus on specific action areas, including data monitoring and support given during career breaks. Three new PEI-led projects have been supported to explore unconscious bias in the professional body environment, diversity and inclusion support for corporate partners and embedding diversity focus.

The Diversity Leadership Group (DLG) engages with 50 engineering companies and sector skills councils and is chaired by Allan Cook CBE FREng. The DLG has active subgroups that are developing guidance for diversifying engineering work experience, case studies of good practice in inclusion, guidance for using procurement levers to encourage diversity through the supply chain and benchmarking of the DLG participant organisations.

The DLG has worked with the WISE campaign to develop and launch an industry-led 10-step plan for sustaining and progressing women in engineering and technology careers. The initiative was launched in September 2014 with 20 signatories, with support from the Prime Minister and from government.

The Academy also has worked with WISE to produce a guidance document to assist University Technical Colleges in engaging and technology careers. The initiative was launched in September 2014 with 20 signatories, with support from the Prime Minister and from government.

The Diversity Leadership Group (DLG) brings 40 engineering companies and sector skills councils together

The Academy sponsored the WISE Advisor Award in 2014. The winner, Tony Thompson, of Incommunities Group was recognised for his outstanding work encouraging female apprentices in construction. He is pictured here with Bola Fatimilehin on his right and Allan Cook CBE FREng and Jenny Young on his left.

The Academy’s work with further education has seen it work closely with the Gatsby Charitable Foundation to compile guidance on the equipment needed by FE colleges to provide a broad engineering education along with common engineering qualifications for technician and higher levels.

The Diversity Leadership Group (DLG) brings 40 engineering companies and sector skills councils together

Deputy Prime Minister the Rt Hon Nick Clegg MP meets with Aerospace MSc bursary holders at the 2014 Farnborough Air Show

Foster better education and skills

Chris Mairs CBE FREng is Chair of the UK Forum for Computing Education, which is supported by the Academy to improve 5–19 computing education across the UK.

The Academy also has worked with WISE to produce a guidance document to assist University Technical Colleges in engaging and progressing women in engineering careers. The initiative was launched in September 2014 with 20 signatories, with support from the Prime Minister and from government.

The Diversity Leadership Group (DLG) brings 40 engineering companies and sector skills councils together
**Visiting Professors**

The Academy’s Visiting Professors (VP) scheme is a highly valued industry-academia initiative that aims to enhance student learning in UK universities as well as the employability and skills of engineering graduates. VPs bring fresh ideas about teaching methods into an academic environment. Respondents to an external evaluation survey said that VPs had introduced modifications to existing courses and in some cases became responsible for the development and implementation of entirely new undergraduate courses. Some VPs have been involved in developing courses that are cross-disciplinary, involving numerous departments over a number of years, and are now embedded into the course structure.

**Bursaries and professional development**

The Academy’s Engineering Leadership Advanced Awards programme, now in its 20th year, identifies and supports outstanding engineering undergraduates. Those selected are seen to have the potential to be future leaders in industry and an appetite to act as role models for the next generation of engineers. Over the past year, 35 award holders each received £5,000 funding to undertake an accelerated personal development programme, overseen by mentors. Engineering Leadership Standard Awards also enabled promising engineering undergraduates to take up over 200 places on a range of bespoke personal and professional development courses.

For the sixth year running, five prestigious Petrofac/Royal Academy of Engineering Fellowships were awarded in September 2014. Awarded a £9,000 bursary towards an eligible full-time master’s level course at a UK university. Additional learning and development opportunities are provided by Petrofac, including a company-sourced major project, a mentor and a work placement.

Five new Panasonic Trust and associated fellowships were awarded to graduate engineers in 2014. This scheme supports and facilitates the professional development and technical up-skilling of UK-based engineers by providing funding for the pursuit of full-time master’s degree courses in the following fields: environmental technology, energy, sustainable development, natural resources, materials, and the built environment.

The Academy has long championed the importance of developing industrial leaders who will drive UK growth in the future. With a grant from the Gatsby Charitable Foundation, and the personal support of Lord Sainsbury, the Academy has enabled more than 300 exceptional engineering graduates to attend the world’s most prestigious business schools over the past 30 years. Eleven new awards were made in 2014/15 with a substantial portion of their fees covered by the Sainsbury’s Management Fellowship (SMF) award; following the completion of their MBA they will be supported by an extensive network of SMF alumni, now managed by the SMF Charity. SMF alumni also play a key role in supporting the Academy’s Engineering Leadership Advanced Awards by providing mentoring and participating in selection activities.

**Visitors to the Academy’s Thinking like an Engineer stand at the Big Bang Fair using a 3D-printed Gear Cube**

**Habits of mind**

The Academy’s awards celebrate the significant contribution of engineering to the nation’s wealth, health and wellbeing and recognise engineers at all stages of their careers. In 2014, the Academy published the report Thinking Like An Engineer: implications for the education system. Authored by the Centre for Real World learning, it highlighted the importance of ‘engineering habits of mind’ such as problem-finding, visualising, and systems-thinking. The study also examined the different ways in which such thought processes and approaches might be taught more effectively.

The report looked at all stages of learning, from primary to higher education, including vocational learning pedagogy. It concluded with defined recommendations for the Academy, for the engineering teaching and learning community, for schools and colleges, and for employers and the wider public.

The Academy supported a new exhibition at the Science Museum in London that took the engineering habits of mind identified in the report and used them as the basis for the interactive elements and content of the exhibition. Engineer Your Future aims to excite young people about engineering and challenge their existing perceptions about engineering careers.

The exhibition, which opened in December 2014 and runs for three years, takes a look at engineering through large-scale high quality interactive games and digital experiences. These enable visitors to experience the skills that engineers use every day, as well as real artefacts and stories from people working across the engineering sector.

Engineer Your Future is supported by the Academy, ABB, BT, EDF Energy, IBM, Mott MacDonald, National Grid, Network Rail and BIS. The exhibition is part of the Your Life campaign, which aims to increase the number of young people studying maths and physics and considering STEM careers.
Lead the profession

The Academy conducts policy work in the fields of international, education and research. It also has a specific role to advise government in policy areas that have an engineering dimension to delivery and aims to engage more widely with the profession and public on the value of engineering to society. The aim of the Academy’s policy work is to support national capacity and contribute to government policymaking.

Priority areas for engineering policy include energy and the environment, manufacturing and industry, infrastructure, the digital economy and biomedical engineering.

A number of policy projects have strengthened links with government, especially the departments for Business, Innovation and Skills, Energy and Climate Change, and with the Government Office for Science through the Government Chief Scientific Adviser, Sir Mark Walport FRS.

Systems thinking is becoming ever more important as society relies on increasingly complex and interdependent systems. This can be seen in traditional engineering areas such as energy, infrastructure but also in areas such as health and social care that may not be associated with engineering by policymakers. Dealing with systems requires a multidisciplinary approach that the Academy is particularly well-suited to support, with Fellows in all engineering disciplines, and close links to other disciplines such as social science and economics through sister institutions and academies. Providing a neutral space to convene groups of experts has proved to be one of the Academy’s most fruitful policy activities and of considerable value to government. Clear, unbiased, independent advice is also valued highly by government. This is core to the Academy’s policy work and is provided through responses to government inquiries, proactive policy reports on a range of subjects or workshops and meetings to address specific issues. The wealth of knowledge within the Fellowship is an invaluable resource that is having an increasing impact on national policy through the Academy.

Infrastructure and transport

Connecting dots, a joint project between the Academy and the Institution of Engineering and Technology (IET), began in November 2014. The project explores the future potential of big data, data analytics and connectivity across engineering sectors, with a view to identifying how engineering sectors can extract economic value from data. Sector-specific workshops have been held on transport, health, built environment, energy, manufacturing and defence and aerospace sectors. The project is due to report in Autumn 2015.

In January, 24 representatives from the aerospace community gathered for a roundtable and dinner to discuss the recent UK Space Innovation and Growth Strategy, and how best to realise its potential. The meeting was hosted by the President, Dame Ann Dowling DBE FREng FRS, and chaired by Professor Sir Martin Sweeting DBE FREng, FRS. Sir Mark Walport FRS, the government’s Chief Scientific Adviser, also attended the dinner.

Discussion focused on positive new developments, including the creation of the UK Space Agency, investment in the European Space Agency, and the creation of the Satellite Applications Catapult. Attendees discussed ways of maintaining momentum to achieve the target of capturing 10% of the global space market by 2030.

Manufacturing and industry

In May, the engineering profession’s action forum Engineering the Future launched a report entitled An insight into modern manufacturing. The publication was produced jointly between the Academy, the IET and the Institution of Mechanical Engineers. Based on a report entitled An insight into modern manufacturing, the report outlined the findings of a survey of members of the three institutions. The survey, which was conducted in collaboration with the UK Government’s Department for Business, Innovation and Skills, revealed that 63% of respondents believed that the UK’s manufacturing sector was still competitive, despite facing significant challenges.

Energy policy

Energy continues to be a major area of concern for the Academy, whose work has addressed the scale of the challenge ahead in decarbonising the economy in line with national and European targets. The need to address this challenge in terms of the whole energy system remains a key message for the Academy.

In April 2014, the Academy published a major policy study, Wind energy: implications of large-scale deployment on the GB electricity system. This report identified the engineering challenges associated with the deployment of wind energy and the implications of deployment at greater scale from the perspective of the energy ‘trilemma’ – security, cost and decarbonisation. It concluded that wind energy can make a significant contribution to low carbon electricity generation.

By the time wind energy is expected to reach 30% penetration of the electricity supply early in the 2020s, the system is expected to remain secure – using the balancing mechanisms already in place. The technical issues arising, such as those relating to system inertia and frequency control, will be manageable, the study reported. Looking further ahead, to when the electricity system will be largely decarbonised and heat and transport may be largely electrified, system issues will become much more serious, it concludes.

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Additional tools for demand reduction and management, flexible generation, interconnection, and storage will be needed.

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In social terms, the study found no recent examples of blackouts leading to significant social unrest. A nationwide outage lasting for longer than 48 hours could have a severe impact on society, but this type of scenario would be very unlikely. Research to determine economic value found to be highly uncertain and in the need for further study was identified.

The Academy published Counting the Cost, which considered the economic and social costs of electricity shortages in the UK. This study had been commissioned by the Prime Minister’s Council for Science and Technology and followed on from a previous report on the electricity capacity margin in the UK. The study highlighted that any significant interruption to electricity supply in the UK would have severe economic consequences due to increasing dependence on electricity and communication networks.

The UK has the world’s greatest amount of installed offshore wind generating capacity.

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on a set of interviews with UK manufacturers – large, small and niche – it gives a business view of the factors that affect performance.

Later in the year, Sir John Parker GBE FREng, the then President of the Academy at the time, hosted Innovation in Aerospace, which showcased some of the most recent advances in the sector. There were talks on innovative operating systems for improving air traffic control and the regulatory barriers to flying civil unmanned aircraft. The event highlighted recent commitments by the Aerospace Growth Partnership to foster growth in the sector. In March 2015, the Academy hosted an event for the Department for Business, Innovation and Skills (BIS) aimed at informing the future of the UK’s Industrial Strategy. Martin Donnelly CMG, the Permanent Secretary at BIS, addressed Fellows on the development and impact of the strategy to date. Chaired by the President, the discussion with Fellows focused on how future governments can learn from and build on successes to date, and ensure the right opportunities are targeted and drive increased ambitions for the UK’s industrial strategy.

At a glance

List of consultation responses

May 2014
Response to the House of Commons Business, Innovation and Skills Committee’s inquiry on business-university collaboration.

July 2014
Response to the Department for Business, Innovation and Skills on the Science and Innovation Strategy. Joint response with the Academy of Medical Sciences, the British Academy and the Royal Society.

Further, individual Academy response also submitted.

October 2014
Response to the House of Commons Transport Committee’s Motioning of the Future inquiry. Submitted as part of Engineering the Future.

Response to the Department for Culture, Media and Sport on the Digital Communications Infrastructure Strategy.

November 2014
Response to the Government Office for Science on emerging technologies and their impact on and use by government departments.

January 2015
Response to the National Institute for Health and Care Excellence (NICE) and the Medicines and Healthcare products Regulatory Agency on their Triennial Review.

Response to the House of Commons Environmental Audit Committee inquiry into the environmental risks of hydraulic fracturing. Joint response with the Royal Society.

March 2015
Response to the Office for Nuclear Development, Department of Energy and Climate Change on the Triennial Review of the Committee on Radioactive Waste Management 2015.

Biomedical engineering

The Academy’s Panel for Biomedical Engineering held several meetings during the year. In June, a one-day conference brought together engineers and clinicians to examine how engineering contributes to the safety of patients undergoing surgery. It was the first time an event had been jointly organised between the Royal College of Anaesthetists, the Royal College of Surgeons, the Institute of Physics and Engineering and Medicine and the Academy.

The University of Leeds hosted a three-day conference on orthopaedic engineering, bringing together 25 early-career researchers from 10 universities. The conference was designed to help the career development of postdoctoral researchers, to showcase their work, improve their networking skills and offer guidance from leading experts.

Lawyers, regulators, clinicians, app developers and engineers came together to discuss the current and evolving legal landscape for medical apps and how it might be shaped in the future.

The Academy's medical technologies community of practice (CoP) held two meetings. The group provided evidence and case studies for an upcoming Engineering the Future report on engineering in healthcare. The CoP also discussed the emerging findings from the CoD Science Foresight Future of an Ageing Population project.

The recent and ongoing expansion of health apps constitutes an emerging grey area for regulation with unresolved issues for regulators, developers and users. In November 2014, the Academy held a joint meeting with the Academy of Medical Sciences on health apps, their regulation and control. Attendees included representatives from Apple and the creators of the first two healthcare apps to be approved by the Medicines and Healthcare Regulatory Agency and the US Food and Drug Administration.

The Academy further strengthened its links with the Chinese Academy of Engineering over the course of a joint China-UK Advanced Manufacturing Symposium held in Beijing in March 2015. The first session focused on the process and rationale for the manufacturing strategy work both countries have recently completed, followed by discussions on the findings of these reports and the policy implications for both countries. This was followed by short presentations and talks from both countries on a range of manufacturing themes, including intelligent manufacturing, 3D printing, low carbon green manufacturing and manufacturing as a driver for growth in poorer areas.

The purpose of the symposium was to bring together engineers from disparate fields and challenge them to think about developments and problems at the frontiers of areas beyond their specialisation.

International activities

In July, an Indian National Academy of Engineering delegation visited the Academy for a UK-India workshop on distributed manufacturing. This was followed by two days of site visits to Cambridge and high tech manufacturing centres in the West Midlands. Professor Sir Mike Gregory FREng co-chaired the event, with support from the Engineering and Physical Sciences Research Council and the UK’s Science and Innovation Network in India. Experts from academia and industry from both countries debated the skills and educational challenges that would be created by distributed manufacturing, and the intellectual property and governance issues that would ensue from widespread adoption of this model.

In August, the Academy co-hosted a joint conference on Distributed Manufacturing with the Royal Academy of Engineering in Cambridge, which explored the potential for the technology to drive increased ambitions for the UK’s industrial strategy.

The purpose of the symposium was to bring together engineers from disparate fields and challenge them to think about developments and problems at the frontiers of areas beyond their specialisation.

As part of a partnership between the Academy and the São Paulo Research Foundation, the Brazil UK Frontiers of Engineering Symposium was held in São Paulo in November. The symposium brought together 60 outstanding early-career engineers from industry, universities, and government labs to discuss leading-edge research and technical work across a range of engineering fields including smart grids, big data in healthcare, bioremediation, and oil and gas. The purpose of the symposium was to bring together engineers from disparate fields and challenge them to think about developments and problems at the frontiers of areas beyond their specialisation. The Academy’s delegation was led by Professor Alison Noble OBE FREng, Director of the Oxford Institute for Biomedical Engineering. Follow-up activities are now underway.
The groundbreaking work of Hybrid Air Vehicle airships was discussed at the Innovation in Aerospace event held at the Academy in June 2014.

**Engineering alliances**

One of the roles of the Academy is to provide a forum for the engineering profession to work collaboratively on matters of common interest. There are 56 professional engineering institutions recognised by the Engineering Council, and more affiliated. Enabling them to come together on policy issues in an election year was critical.

A new report, The Universe of Engineering: A call to action, shows how engineering skills are now needed in an increasingly diverse range of fields including brain imaging, airport security and materials science. The report urges the professional engineering institutions to adapt so that they better represent and develop engineers involved in such exciting and rapidly developing fields, and use this as a springboard to attract more people into the profession.

The report pointed out that the UK is facing an unprecedented skills crisis: a critical analysis by the Academy suggests that the UK will need over a million new engineers and technicians by 2020. Engineering UK research shows this will require a doubling of the number of annual engineering graduates and apprentices. This requires a step-change in the effort to attract young people into the engineering and it must start with coordinated, inspiring messages to the public that truly captures the real nature and breadth of engineering in the 21st century.

The Engineering the Future Alliance also contributed a significant set of evidence to the House of Commons Transport Select Committee inquiry into motoring of the future. Looking at a range of issues, from autonomous vehicles to planning for efficient land usage, several institutions provided insights into particular technologies, as well as legal, economic, and cultural considerations.

The Academy’s external affairs activities aim to increase the impact and influence of its activities, raise awareness of the value of engineering, and shape informed debate on the issues that are preventing engineering from making an even bigger contribution to the prosperity of the nation.

As well as enabling and supporting engineering research, innovation and entrepreneurship, the Academy celebrates and raises the profile of engineers who are excelling in these areas and are recipients of awards and prizes. Media coverage during the year included a major article on the new Enterprise Fellows in British Airways Business Life magazine and a short feature film on the BBC’s One Show of one of the Academy’s Hub entrepreneurs. These two profiles alone reached millions of people in the UK and further afield.

The Academy has increased its efforts to enhance its presence in new and social media and in 2014—15 launched a new website, Facebook page, revamped its LinkedIn and YouTube platforms and built on its Twitter profile.

It is important that young people and their influencers have the chance to meet engineers face to face. The Academy’s Ingenious grants scheme continues to be the lead public engagement scheme in the profession, helping hundreds of engineers to reach tens of thousands of people in the UK every year.

There is good evidence that the Academy and its partners across industry, academia and the professional bodies are slowly but surely helping change perceptions of engineering in society.

**Engaging through the media**

The Academy increased its media presence by 8% from 2013—14, achieving over 2,500 mentions in print, online and in broadcast media.

Highlights include:

- A series of interviews with the new President, Dame Ann Dowling DBE FRS, to influential outlets including BBC Breakfast, the Independent and Times Higher Education.
- Increased profile of the Academy’s diversity activities including a blog by the President for BBC News online on the importance of engineering research and the challenge of the skills gap. Dame Sue Ion FRS produced a blog for The Huffington Post on why girls should choose engineering as a career and Diversity Leadership Group chair Allan Cook FRS was interviewed by The Times.
- Widespread coverage, including in The Daily Telegraph, was gained for Academy reports including Engineering for a successful
Medical pioneer wins biggest engineering prize

The Queen Elizabeth Prize for Engineering (QEPrize) is an international £1 million prize that rewards and celebrates the engineers responsible for a ground-breaking innovation that has been of global benefit to humanity. The inaugural winners of the QEPrize were the creators of the internet and the World Wide Web.

In February 2015, the second biennial QEPrize was awarded to Dr Robert Langer of Massachusetts Institute of Technology for his revolutionary advances and leadership in engineering at the interface between chemistry and medicine. Dr Langer was the first person to engineer polymers to control the delivery of large molecular weight drugs for the treatment of diseases such as cancer and mental illness. It is estimated that over 2 billion lives have been improved worldwide by the technologies that his lab has created.

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A key aim of Ingenious is to improve the quality of engineering outreach activities while also giving engineers skills and opportunities in public engagement.

Ingenious projects

The Ingenious public engagement grant scheme is funded by the Department for Business, Innovation and Skills. A key aim of Ingenious is to improve the quality of engineering outreach activities while also giving engineers skills and opportunities in public engagement.

Among the funded projects that ran activities during the year was **Robots vs Animals** which saw engineers collaborate with zoologists to demonstrate how humans have learned from the ingenuity of nature. Teams from Bristol Robotics Laboratory and Bristol Zoo developed interactive events that explored nature-inspired robots, and gave public audiences the opportunity to decide which performed better: the creature or the creation. Two other projects celebrated outstanding engineering, both past and present. As the UK remembered the 100th anniversary of the outbreak of World War I, the Women's Engineering Society used school workshops to highlight the achievements of female engineers working in the aviation industry. **LASTheatre** worked with engineers from UCL and the Pennine Water Group to put on an interactive theatre show that explored how water engineering affects our lives.

The Academy organised its own engagement events, including at the Cheltenham Science Festival in June, where the Academy supported an event that discussed recent flooding events. In October, the Academy funded an energy debate, **How can we keep the lights on?**, at the Battle of Ideas festival.

Zoologists working with students on the Ingenious activity Robots vs Animals

The ERA Foundation Entrepreneurs Award is enabling Dr MacFarlane to take his advanced airborne radiation monitoring system out of the lab and into development.

**Time to take the ‘E’ out of STEM?**

The Academy’s **Engineering for Growth** campaign has continued to raise debate on engineering and the engineering skills gap.

In November 2014, the Academy held an Oxford-style debate to ask if it is time to rethink the strategy for promoting engineering. Six leaders from industry and education discussed whether ‘Engineering should be rebranded as a creative and humanitarian discipline, rather than a scientific and mathematically-driven endeavour’. In other words, should we take the ‘E’ out of ‘STEM’?

Those speaking for the motion argued that the STEM acronym camouflages the impact of engineering, when it is engineers who connect science, technology and maths with society.

The result of the final vote represented an exact 50/50 split, demonstrating the complexity of both arguments, and the challenges to promoting engineering in the future.

Engineering for Growth Campaign – key highlights to date:

- Delivered in partnership with government, engineering companies and the professional bodies
- Provides a unified voice from multiple organisations, amplifying the campaign’s effectiveness by ensuring many influential stakeholders were consistent in the messages put across
- Reached millions of people through traditional and social media, events, and ministerial engagement. Over 2,000 pieces of coverage have been secured, including national television, radio and print and key trade outlets
- A series of stakeholder events encouraged further debate addressing topics on entrepreneurship, immigration, apprenticeships and engineering education and training.

**FEATURED FELLOW**

The 2015 QEPrix judging panel was chaired by **Lord Alec Broers FREng FRS**, seen here deliberating with fellow judge **Professor Frances Arnold** (California Institute of Technology).
Building organisational capacity

Membership panels

A new system of membership panels and assessment for nominations to the Fellowship were introduced in 2014. The existing five membership selection panels were replaced by 11 new panels. These blend sectors and disciplines while providing a more discriminating evaluation of the diverse mix of nominations submitted each year. Each panel is populated by up to 15 Fellows and every new nomination is allocated to two Fellows who are charged with the responsibility of in-depth assessment and due diligence.

There are now over 100 Fellows on the new panels working on nominations assessments, many of whom have been elected in the past three years. The strategy is for the majority of new Fellows to be called on to work on a panel within the first few years of their election.

Governance review

During 2014, the Academy completed a comprehensive review of its governance structure and procedures. Following Privy Council approval of amendments to the Academy’s Charter and Statutes, the Academy adopted a new structure, recommended by the review, at its Annual General Meeting in September.

The Council of 26 trustees has been superseded by a Trustee Board of 13 elected trustees, all of whom are Fellows of the Academy. The Chair of the Trustee Board is the Academy’s President, Dame Ann Dowling DBE FREng FRS. The board has the discretion to co-opt up to two additional members, and has co-opted Professor Sir William Wakeham FREng as Vice-President to oversee the implementation of the new governance arrangements; Sir William also led the governance review.

The Trustee Board has formed five governance committees which are specifically tasked to ensure that the board fulfils the responsibilities of charity trustees: Finance Committee, Audit and Risk Committee, Membership Committee, Nominations Committee and Remuneration Committee.

Since the AGM, the Trustee Board has met on five occasions and will continue to meet every other month in the future. The Trustee Board has tasked Alan Cook CBE FREng, Vice President and trustee, to oversee a thorough review of the Academy’s operating committees. This work is in progress, and it is planned that the final report will be submitted to the board in September 2015. Richard Williams OBE FREng has been appointed by the Trustee Board as Vice President to oversee Fellowship engagement.

New website

After extensive consultation with its Fellows, staff and other users, the Academy designed and built a new website that was launched in August 2014. The old website had been in existence for eight years, was text-heavy, and visitors had reported it being difficult to navigate.

The new site has a clean, streamlined design to match the Academy’s visual identity. It can be customised to promote specific activities, and displays social media activity updates. The navigation and site structure have been simplified to increase usability, and the site design is responsive, adapting to mobiles and tablets.

The site has also been integrated with several Academy databases, so that visitors can log in and sign up for Academy events, and applicants for dozens of the Academy’s grants and awards can access the application process online. There is a dedicated secure area for Fellows to comment on calls for evidence and to make and review nominations for Fellowship; this section will be expanded in the future.

Grants management

The Grants and Awards Change Programme to modernise and strengthen the Academy’s approach to grants management and administration has progressed during the year. A new online grants management system was launched in April 2014. 34 of the Academy’s schemes and prizes have been transferred onto it to date.

The system works well for both applicants and beneficiaries, with improvements to streamline the reviewer journey underway. The implementation of the IT system has been complemented by an extensive programme of restructuring, training and development for all staff involved in grants management, ensuring a more consistent and robust approach is taken across all Academy schemes.

Development

In 2014–15, the Academy secured £3.2 million in new commitments for education, engagement, enterprise and research programmes. These contributions came from corporate organisations, charitable foundations and individuals, including Fellows. The continuing generosity of all donors and supporters is greatly valued.

The Academy’s work received a substantial boost from the Helsington Foundation, which will enable more STEM teachers and school students to benefit from educational enrichment activities. A three-year extension of BGC Group’s support for the UK-wide Programme is key to helping future generations through

Connecting STEM Teachers programme will provide STEM teachers with expert support as well as tailored STEM resources. Petrofac also provided funding for this programme, adding to its longstanding support of the Petrofac/R

MSc Fellowship programme. Petrofac also became a core supporter of the Academy’s Enterprise Hub; others now include Anglo Platinum, Atkins, BBA Foundation, Johnson Matthey and Dr Mike Lynch FREng. These contributions, combined with pro bono mentoring from Fellows, will help grow and develop the Hub’s programmes. A multi-year grant from the Blavatnik Family Foundation will provide ongoing support for exceptional Enterprise Fellowship alumni.

The Lloyd’s Register Foundation continued to support Academy activities. In addition to generous support for two Research Fellowships, the Foundation funded valuable UK STEM education research and contributed towards the Academy’s work in sub-Saharan Africa.

Good progress has been made on the proposed centre for entrepreneurship. The design team, led by architects Wright & Wright, is now obtaining approvals for this and other work to complete the renovation of Prince Philip House. The Academy has received notification of a substantial legacy from a late Fellow which will be applied to support the renovation and development of the proposed centre. Petrofac also provided funding for this project.

Legacies of all sizes will be increasingly important in the future. Many engineers are keen to help future generations through

In 2014–15, the Academy secured £3.2 million in new commitments for education, engagement, enterprise and research programmes.
a gift in their will. During the year, with the help of Fellows, work was begun on how lifetime and legacy giving could be developed and promoted to help achieve the Academy’s vision.

The Development Advisory Board, chaired by Ian Barlow, once again provided valuable advice and access to potential new supporters.

Trading company

The Academy’s trading subsidiary, RAE Trading Limited (RAET), provides catering to the Academy’s events and meetings in Prince Philip House. RAET has a service agreement with Harbour & Jones, whose team provides an on-site catering service. The trading company also markets Prince Philip House as an events venue, primarily to the corporate sector. The combination of the elegant, practical space within Prince Philip House, the prestigious location in St James’s and excellent catering has proved to be highly successful. The venue has been very popular, with repeat business from corporate clients such as Waltons, IBM, National Grid, Rolls-Royce, Age UK and Prudential Ride London. In its second full financial year, RAET generated revenues of £1.4 million and will gift aid nearly £500,000 to the Academy.

Immediate Past President

Sir John Parker FREng was Academy President from July 2011 to September 2014. At the AGM, he was praised for his leadership and contributions to the national engineering debate. His input on many critical issues has created a lasting legacy both for the engineering profession and for the country.

Examples of new funding

Enterprise

Blavatnik Family Foundation

Additional support for exceptional Academy Enterprise Fellows

Research

Lloyd’s Register Foundation

Research Fellowships for outstanding early-career engineering researchers

Enterprise

ERA Foundation

Core funding for Academy Enterprise Hub

Education

BG Group plc

Renewed multi-year support for the Connecting STEM Teachers programme

Events

GE UK & Ireland and Urenco Ltd

Joined current Forum Partners in enabling the Academy to reach wider audiences

Awards

Lady MacFarlane and family

Extended their support for the Sir George MacFarlane Award which recognises the potential of younger engineers

Annual Fund

Gifts from Fellows

Allocated to three priority areas: the Enterprise Hub, training teachers and policy work

At a glance

Examples of new funding

Enterprise

Blavatnik Family Foundation

Additional support for exceptional Academy Enterprise Fellows

Research

Lloyd’s Register Foundation

Research Fellowships for outstanding early-career engineering researchers

Enterprise

ERA Foundation

Core funding for Academy Enterprise Hub

Education

BG Group plc

Renewed multi-year support for the Connecting STEM Teachers programme

Events

GE UK & Ireland and Urenco Ltd

Joined current Forum Partners in enabling the Academy to reach wider audiences

Awards

Lady MacFarlane and family

Extended their support for the Sir George MacFarlane Award which recognises the potential of younger engineers

Annual Fund

Gifts from Fellows

Allocated to three priority areas: the Enterprise Hub, training teachers and policy work

The Academy’s Fellows represent the nation’s leading engineering researchers, innovators, entrepreneurs, business and industry leaders. Election to the Academy is by invitation only; with over 50 Fellows elected each year by peer review from nominations made by existing Fellows. They are distinguished by the title Fellow of the Royal Academy of Engineering and the postnominal FREng. These were the new Fellows announced at the Academy’s AGM in September 2014 — their titles were correct at the time of their election.

New Fellows 2014

Honorary Fellow

Lord Bamford HonFREng

Chairman, J C Bamford Excavators Ltd

Fellows

Professor Andrew Amiti FREng

Professor of Orthopaedic Biomechanics, and Head of Medical Engineering Group, Department of Mechanical Engineering, University of Liverpool

Ayman Asfari FREng

Group Chief Executive, Petrofac plc

Professor Muhammed Bashir FREng

Professor of Structural Engineering, University of Leeds

Professor Robin Bloomfield FREng

Professor of System and Software Dependability, City University London

Professor Alistair Borthwick FREng

Chairman, J C Bamford Excavators Ltd

Professor Steve Bull FREng

Chairman, J C Bamford Excavators Ltd

Professor Esteban Busso FREng

Scientific Director, Materials and Structures Branch, ONERA — National Aerospace Research Centre, General Scientific Directorate (France)

Tim Chapman FREng

Director, Arup, and Leader of Arup’s Infrastructure design group London

Professor Cheng Chen FREng

Professor of Bioengineering, Director of the Strathclyde Medical Engineering Group, Department of Mechanical Engineering, University of Strathclyde

Professor Patricia Connolly FREng

Professor of Bioengineering, Director of the Strathclyde Institute of Medical Devices, University of Strathclyde, and Chief Executive Officer, Ohmedics Ltd

Professor Steven Cowley FREng

Executive Vice President for Commercial and New Business Development for Upstream International, Shell UK Ltd

Professor Ed Daniels FREng

Executive Vice President for Commercial and New Business Development for Upstream International, Shell UK Ltd

Professor Graham Dent FREng

Professor of Orthopaedic Biomechanics, Head of Department of Biomedical Engineering, Imperial College London

Amber Downett FREng

Professor of Applied Hydrodynamics, Institute of Energy Systems, The University of Edinburgh

Professor Sir Anthony Bull FREng

Professor of Musculoskeletal Mechanics, Head of Department of Biomedical Engineering, Imperial College London

Dr Steve Denton FREng

Engineering Director, Parsons Brinckerhoff Ltd, Visiting Professor, University of Bath