ROYAL ACADEMY OF **ENGINEERING**

Annual **Review**

2017/18

Strategic priorities

Engineering matters. It underpins our daily lives, drives economic growth, plays a critical role in addressing major societal challenges and helps ensure our readiness for the future, from providing a sustainable supply of food, water and clean energy, to advancing healthcare, and keeping us safe and secure.

As the UK's national academy for engineering and technology, the Royal Academy of Engineering brings together the most talented and successful engineers – our Fellows – to advance and promote excellence in engineering for the benefit of society.

We harness their experience and expertise to provide independent advice to government, to deliver programmes that help exceptional engineering researchers and innovators realise their potential, to engage the public with engineering, and to provide leadership for the profession.

Drawn half from business and half from academia, and from all branches of engineering including areas of emerging technology, our 1,600 Fellows give their time and expertise voluntarily.

We have three strategic priorities:

- Make the UK the leading nation for engineering innovation and businesses
- Address the engineering skills and diversity challenge
- Position engineering at the heart of society

We bring together engineers, policymakers, entrepreneurs, business leaders, academics, educators and the public in pursuit of these goals.

Engineering is a global profession addressing global challenges, so we work with partners across the world to advance engineering's contribution to society on an international, as well as national scale

Front cover image courtesy of Gravity Sketch, co-founded by Enterprise Hub member, Oluwaseyi Sosanya

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www.raeng.org.uk/publications/strategy-and-finance

"I'm pleased to say that we have seen a number of positive steps taken to invest in and encourage greater research collaboration between industry and academia"

Professor Dame Ann Dowling
OM DBE FREng FRS
President

It's the Year of Engineering - what is the Academy doing to support it and what do you hope it will achieve?

We're really pleased that the government has recognised the significance of the engineering skills challenge and taken action to bring the profession together to raise the profile of engineering and the career opportunities it provides.

The Academy is working closely with government to make the most of this opportunity. In January, we launched our landmark digital campaign *This is Engineering* to encourage teenagers to think about careers in engineering by demonstrating how relevant it is to what they love. In the first three months of the campaign, the films were watched 13 million times, and initial research has indicated that among those who saw the films, consideration of engineering as a career has increased significantly. We hope to work with more companies and organisations in the profession to extend its reach further.

Of course, a year is not enough to address the skills challenge, so ensuring that the profile of engineering continues to grow and that the Year has a lasting legacy is a priority. *This is Engineering* will be a multi-year campaign and we want to lead the profession in an ongoing, coordinated effort to attract, develop and retain the required engineering workforce.

How else can the Academy better support and influence government?

In late April 2017, the Academy published a report – *Engineering an economy that works for all* – that outlined the engineering profession's response to the government's green paper on industrial strategy. It brought together the views of all 38 professional engineering organisations, representing an unprecedented level of engagement across the community. The report was well received by government and demonstrated how much potential there is to increase engineering's impact with policymakers, by speaking with one voice on issues that affect the whole profession.

This is precisely why we are establishing an Engineering Policy Centre – a bold new initiative that will provide a framework for collaboration on policy across the engineering community. The Academy will lead and coordinate the centre, which will also seek to build close relationships across government so that policy outputs can be responsive to the government's, and the profession's, needs.

Three years on from the publication of the Dowling Review, how has the engineering research landscape changed?

I'm pleased to say that we have seen a number of positive steps taken to invest in and encourage research collaboration between industry and academia.

Engineering an economy that works for all highlighted both the importance of industry-academia links, and the need for an ambitious target for investment in R&D as a proportion of GDP. When the government's industrial strategy white paper was published, I was therefore pleased to see a focus on industry-academia collaboration: such collaborations are a key part of the Industrial Strategy Challenge Fund and will be critical to meeting the Grand Challenges, and government has committed to the UK investing 2.4% of GDP in R&D by 2027.

At the Academy, we have seen the impact of this focus through an increase in research and innovation funding over the next four years. This funding has meant, for example, that we can double the number of Research and Enterprise Fellows that we support and significantly expand our flagship Chairs in Emerging Technologies programme.

The other major development that has changed the landscape for business-university research collaboration is the formation of UK Research and Innovation (UKRI). Effective collaboration between the Research Councils and Innovate UK is essential and can simplify the way that companies not already engaged in collaborative research can begin to do so. UKRI will play a vital role in ensuring that we capture value from our research excellence, and by linking business and researchers, will help to achieve the 2.4% target.

The developing *Research Excellence Framework* (REF) 2021 will bring welcome further recognition to business-university collaborations and make mobility between academia and industry easier.

What are your ambitions for the final year of your term?

My ambitions for my final year are threefold. I would like to see the Engineering Policy Centre up and running and for it to be regarded as the place to go to for engineering policy advice. Secondly, I hope that *This is Engineering* continues to be successful, but also that we will have worked with partners across engineering to simplify and unify messaging for young people who want more information about engineering careers. Finally, I hope that the UK will have secured a Brexit deal that ensures we remain a great place for engineering innovation and businesses.

"My long-term vision is that the Academy's role, relevance and contribution to society will make it an essential part of national life"

Image courtesy of *The Manufacturer*

Dr Hayaatun Sillem
Chief Executive

What do you hope to achieve in your first year as CEO?

The Academy is an incredible organisation, and I feel very privileged to serve as CEO. During my first year, I'm keen that we accelerate progress on signature initiatives such as *This is Engineering* and the Engineering Policy Centre, as well as laying the foundations needed to scale up our ambition, impact and visibility in future years.

This involves working closely with our Trustees, staff and Fellows to strengthen our operational effectiveness, including investing in our capacity to comply with modern expectations of charity best practice. In addition, I hope to bring a much sharper focus on the outcomes we are seeking to achieve and, ultimately, to improve our ability to demonstrate and articulate the difference we are making in the world.

I will also be investing in building even better relationships with partners and stakeholders across and beyond the engineering community so that we understand their needs and can inspire them to work in partnership with us to deliver societal benefit.

Where can you see room for improvement?

The Academy's charitable objects can be summarised as promoting engineering excellence for the benefit of society. Today, there are so many societal issues on which an engineering voice is important, and so many ways in which engineering can create benefit for society, that we have much more to do before we can say that we are fully realising our leadership potential.

I would pick out the longstanding shortfall in engineering skills and diversity, linked to outdated perceptions of engineering, and the importance of maximising the contribution that engineering makes to economic growth at a time of national need as challenges where there is an imperative to improve our collective impact as a profession.

My long-term vision is that the Academy's role, relevance and contribution to society will make it an essential part of national life. It's an ambitious objective, but we're heading in the right direction and I believe we have a fantastic Fellowship, staff team and partner network to help us get there.

Diversity and inclusion (D&I) are topics that have very much been in the public eye recently – how much progress is the Academy making in supporting the profession to improve D&I?

I am proud to be the Academy's D&I champion as I believe it is crucial that engineering tackles its D&I deficit: we will never be able to attract or retain the best talent until we do so. We run the D&I Leadership Programme for the profession and last year published a study – the first of its kind – of engineering workplace culture, based on a survey of around 7,000 engineers. This provided a baseline for assessing the success of efforts to improve D&I as well as informing the development of effective interventions.

We have also produced a *D&I Progression Framework* for engineering and science professional bodies. It is important that the Academy leads by example, so we have benchmarked ourselves against the framework and implemented plans to improve D&I in every area of our work. It is fantastic that we have already been recognised for our efforts: the Academy was voted among the Top 50 UK Employers in the 2017 Excellence in Diversity Awards, and also won the Best Diversity Resource award.

That said, the Academy and the profession still have a long way to go. We are currently undertaking an analysis of the gender pay gap in engineering and developing a set of recommendations based on the results, and will continue to work with partners to identify and implement best practice in increasing D&I.

The Enterprise Hub turned 5 this year, how far has it come and where do you see it going next?

I'm delighted by what the Enterprise Hub has achieved so far – both in terms of the number of high-quality jobs created in Hub member companies, and their success in attracting external funding, where we are punching considerably above our weight with more than £63 million in follow-on funding raised to date.

The Hub fills a crucial gap in the innovation ecosystem by providing sustained and bespoke support for the most talented engineering entrepreneurs and SME leaders, drawing on the expertise of our Fellows and partners, and without taking equity. It has supported the development of excellent innovations that will deliver real benefit to society.

I have high hopes for the Hub's future growth and believe it can play a really important role, as it scales, in boosting UK innovation.

Hub member Dr Katerina Spranger

Make the UK the leading nation for **ENGINEERING INNOVATION AND BUSINESSES**

The Academy supports the development of successful engineering research, innovation and business in the UK to create wealth, employment and societal benefit. This aim underpins a range of programmes, from the Enterprise Hub to support for researchers, including those that build partnerships with engineers and engineering institutions across the world.

Since its launch in 2013, the Enterprise Hub has become one of the Academy's success stories. In 2018, it celebrates five years of operation, during which time it has helped increase the number and quality of high-growth engineering and technology companies in the UK that solve some of society's most pressing challenges. To date, there are 73 Hub members who have started 57 companies, creating more than 270 jobs. With the Hub's support, the startups and spin-outs have attracted £62 million in additional funding and four have been acquired by larger, established companies.

Hub members' innovations span sectors including healthcare and medicine, robotics and AI, and clean energy.

Over 150 Academy Fellows act as mentors to Enterprise Hub members, volunteering

more than

1,500

expert hours each year

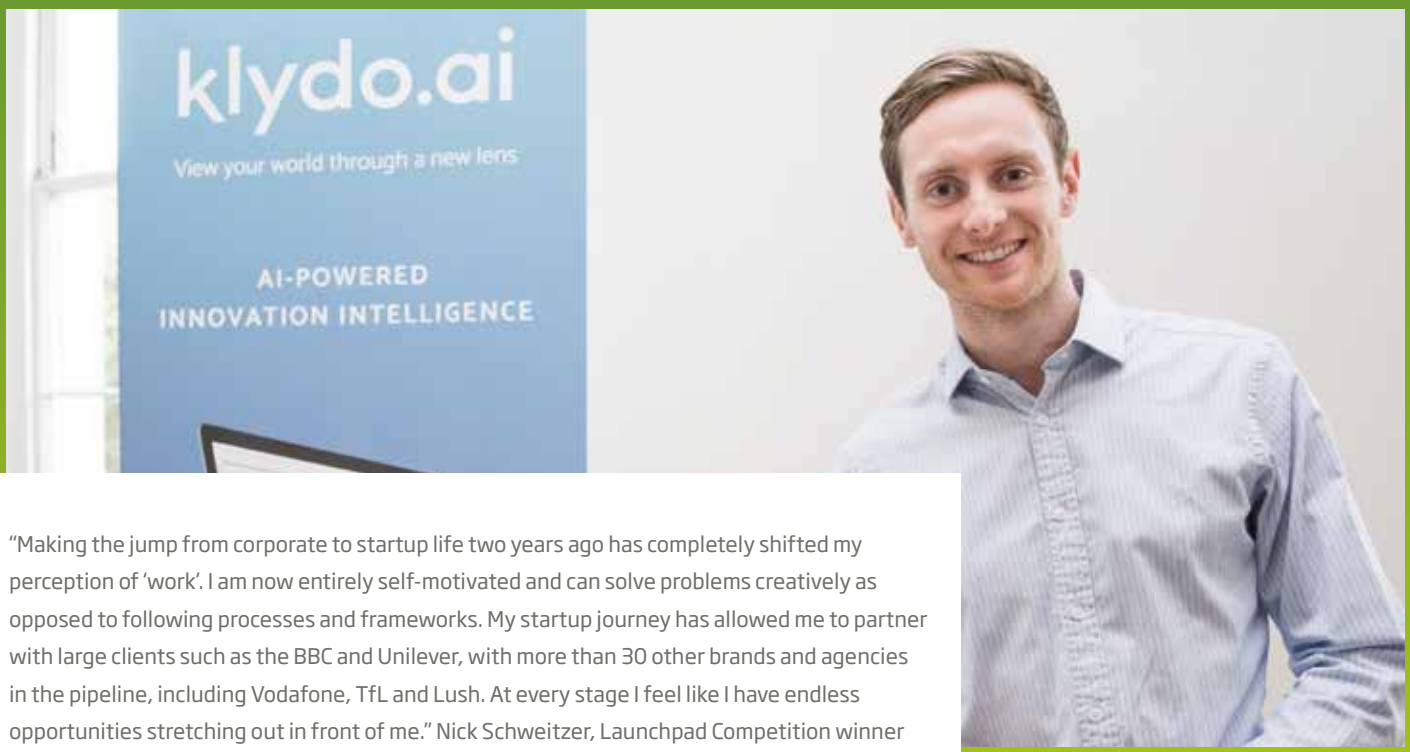
Empowering **EXCEPTIONAL ENGINEERS**

In 2017, the Enterprise Hub welcomed 12 engineering startup founders as new members. Among these was Dr Katerina Spranger, Founder of Oxford Heartbeat. She has developed a medical device that uses computational modelling to provide accurate representations of both a patient's brain and the medical devices used during surgery, to enhance the information available when planning a procedure. It achieves high levels of accuracy, which enables surgeons to better analyse individual patients and various stents, and improves their ability to choose the correct stent for each patient. This aims to reduce surgery times, improve patient outcomes and provide cost savings for hospitals. With an ageing population that increasingly requires minimally invasive cardiovascular procedures, Dr Spranger saw a growing market for the technology and has taken advantage of the seed funding, mentoring and business support that the Enterprise Hub provides.

She says: "During my time as a Hub member, we have grown from a team of one to five people and have received a number of awards for our innovative technology, including an NHS Innovation award in 2017 from Health Enterprise East. Oxford Heartbeat was also named as *WIRED*'s healthcare startup of 2018."

The Hub supports promising high-growth engineering SMEs through the SME Leaders programme, which aims to develop leadership skills through training courses, workshops and mentoring. It also encourages budding young engineering entrepreneurs aged 18 to 25 to enter its annual Launchpad Competition, and supports the winner to commercialise their engineering innovation.

In 2017, 25-year-old Nick Schweitzer, Founder of machine-learning tool Klydo, won the Launchpad Competition. Nick has invented an intelligent research assistant that reads millions of company websites and news articles to help brands answer strategic questions such as "what's the future of health and wellness?". It uses advanced machine learning to deliver unique and personalised insights in real-time.



"Making the jump from corporate to startup life two years ago has completely shifted my perception of 'work'. I am now entirely self-motivated and can solve problems creatively as opposed to following processes and frameworks. My startup journey has allowed me to partner with large clients such as the BBC and Unilever, with more than 30 other brands and agencies in the pipeline, including Vodafone, TfL and Lush. At every stage I feel like I have endless opportunities stretching out in front of me." Nick Schweitzer, Launchpad Competition winner

As well as investing in entrepreneurs, the Academy supports innovation by helping excellent researchers develop their careers. Over the past year, the Academy benefited from the government's Investment in Research Talent funding, which has allowed it to support an additional 43 awards beginning in 2017/18.

The funding is also supporting 10 new Chairs in Emerging Technologies, which began in early 2018 and will last for 10 years. This brings the total number of researchers supported by the Academy through this programme to 12, with another eight to be awarded in 2019 and seven in 2020.

This long-term support enables the Chairs to lead on developing emerging technology areas that have high potential to deliver economic and social benefit to the UK.

For every £1 that the Academy invested in Research Chairs,

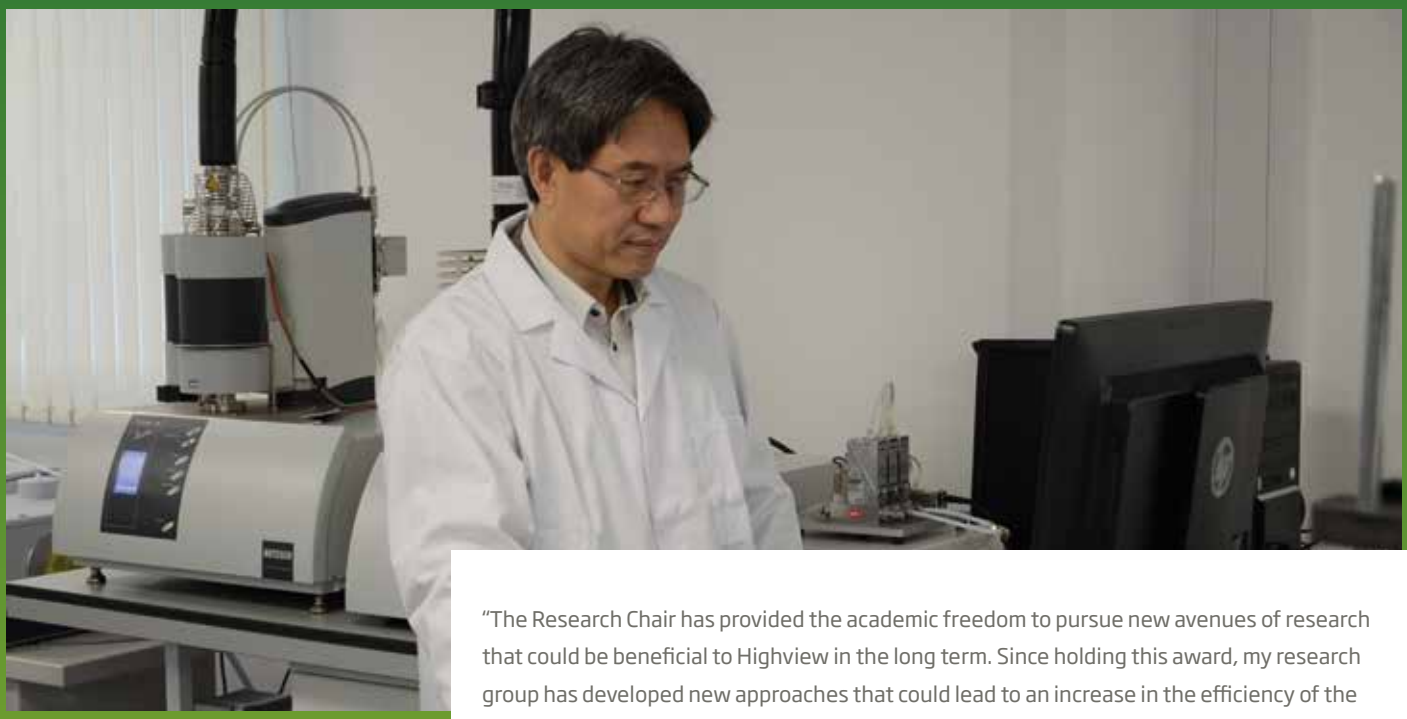
over

£17

was attracted in support from other sources

In September, 28 Academy-supported researchers were invited to Prince Philip House to present their work at the annual Research Forum, sharing projects including a robot developed to inspect city infrastructure, monitoring water quality in sand dams and the design of new prosthetics.

Research
WITH IMPACT



"The Research Chair has provided the academic freedom to pursue new avenues of research that could be beneficial to Highview in the long term. Since holding this award, my research group has developed new approaches that could lead to an increase in the efficiency of the technology." Professor Yulong Ding, Research Chair

Many of the Academy's research activities aim to strengthen links between industry and academia. The Industrial Fellowship scheme allows early- to mid-career academics to undertake a collaborative research project in an industrial environment, while the Research Chairs and Senior Research Fellowships are co-funded by industry to support academics in UK universities to undertake user-inspired research that meets the needs of industrial partners.

Professor Yulong Ding is a Research Chair in Cyrogenic Energy Storage at the University of Birmingham. The position is co-funded by Highview Power, which develops large-scale energy storage (LAES) solutions for utility and distributed power systems. Professor Ding played a key role in developing the company's technology, which harnesses cryogenic energy storage so that the LAES system can improve the development of renewable energy sources such as wind and solar power. The Research Chairs scheme has enabled Highview to move its pilot Cryogenic Energy Storage plant to Birmingham, which has allowed Professor Ding to show potential customers the hardware and demonstrate the technology in action. As the first and only of its kind in the world, the centre is also leading further developments in liquid air storage. The research centre has attracted local and global interest. Students at the University of Birmingham have benefited from having access to this facility and exposure to working with industry. The collaborators have also hosted visits to the centre from government officials, academics and international delegations. This has raised its profile and supported an international network in engaging with this emerging technology.

"Our aim now is to maintain the competitiveness of the technology," says Highview Power CEO Gareth Brett. "One way to achieve this is to strengthen our partnerships with key academic partners, and the Royal Academy of Engineering is helping us to do that."

As a national academy with a global outlook, the Academy also supports researchers and innovators from across the world. In July, the Academy jointly hosted the Global Grand Challenges Summit in Washington with the US National Academy of Engineering and the Chinese Academy of Engineering. The event focused on the grand challenges facing the world that engineers can help to address and included presentations from Dr Rajiv Shah, President of the Rockefeller Foundation; Past Academy President Lord Alec Broers FREng FRS, a member of the original Global Grand Challenges committee; Professor Dame Sally Davies DBE FRS, the UK's Chief Medical Officer; and Baroness Martha Lane Fox CBE, Founder of lastminute.com. The speakers were joined at the summit by over 500 student leaders, some of whom took part in a student business competition to pitch design solutions to tackle one of the grand challenges for engineering.

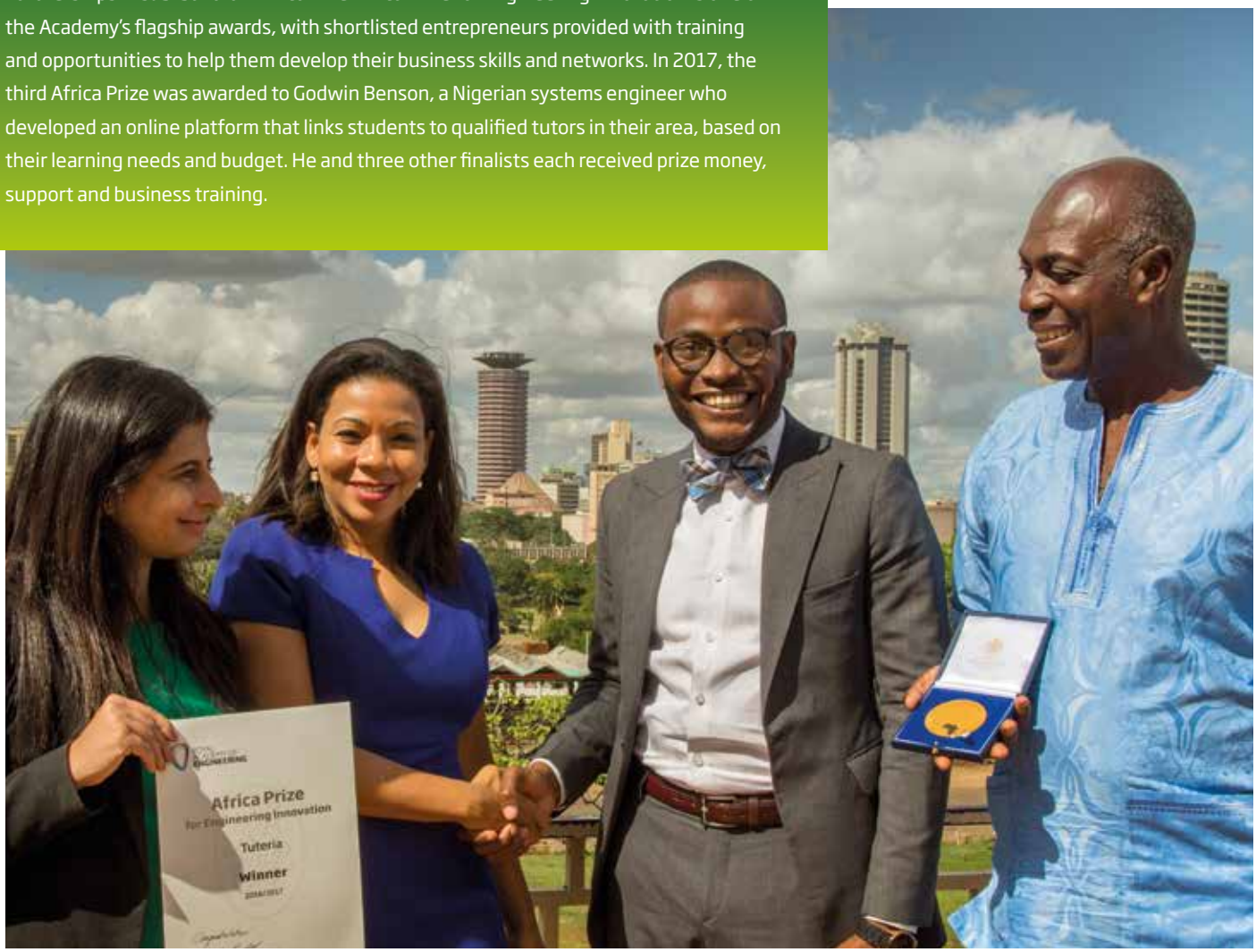
This year,

210

researchers

from 15 emerging economies who are looking to commercialise their work were trained under the Leaders in Innovation Fellowships scheme

The Academy continues to strengthen its links with African engineers, innovators and future leaders through initiatives such as Africa Catalyst and Higher Education Partnerships in sub-Saharan Africa. The Africa Prize for Engineering Innovation is one of the Academy's flagship awards, with shortlisted entrepreneurs provided with training and opportunities to help them develop their business skills and networks. In 2017, the third Africa Prize was awarded to Godwin Benson, a Nigerian systems engineer who developed an online platform that links students to qualified tutors in their area, based on their learning needs and budget. He and three other finalists each received prize money, support and business training.



2017 Africa Prize winner Godwin Benson (second from right) with judges (L–R) Sheena Raikundalia, Rebecca Enonchong and Dr Moses Musaazi

Supporting **GLOBAL INNOVATORS**

Emily Shinzato (second from right) with the Treevia team at Expoforest 2018 in Brazil

Through the Leaders in Innovation Fellowships (LIF) programme, the Academy works to support entrepreneurial researchers from a select number of partner countries, including Columbia, Egypt, Thailand and the Philippines, to commercialise their innovations and, more broadly, create international networks of innovators and technology entrepreneurs. The researchers benefit from a focused period of training in the UK, access to expert mentors and networking to help develop a commercialisation plan.

Emily Shinzato, an engineer from FAPESP, The São Paulo Research Foundation in Brazil, took part in the LIF programme to help commercialise Treevia, a technology-based system that uses artificial intelligence and data to remotely monitor and measure forest assets, to aid automation and contribute to a sustainable future for forests.

"Throughout the programme, my mentor provided advice that guided how we should present and position the smart-forest solution," she says. "I then received follow-on support for the next six months, which helped us reach several startup goals, and with support from FAPESP as well, we were able to launch the platform as a minimum viable product (MVP) at Expoforest 2018, an international forestry fair in Brazil."

The programme helped Emily and her team develop and validate the technology with feedback from other entrepreneurs, business and technology experts, and startups. The team has grown from 6 to 11 people and has received further funding from FAPESP to continue developing and improving the technology.

"When I was selected to participate in LIF, I focused entirely on the Treevia business, its solution and myself as an entrepreneur. I allowed myself to have a wonderful experience of immersion and improvement in different spheres, and to understand how it could improve both me as an entrepreneur and my company. I believe that in this short time I learned a lot, and that from this experience, I could add a lot of value to my startup. From a conceptual prototype, we gained our first customer and reached the MVP phase of our solution. It was just fantastic how things happened so fast!

"In addition, I noticed how important the Academy's role is globally, in terms of truly enhancing the international innovation and engineering network, and reinforcing important questions regarding global goals for sustainability, wellbeing and social integration."

The Academy delivers the LIF programme as part of the UK Newton Fund, which supports the economic development and social welfare of developing countries through a variety of science and innovation activities.

The launch of the Welsh Valleys Engineering Project in March © Rosa Fay

Address the **ENGINEERING SKILLS AND DIVERSITY CHALLENGE**

Engineering matters. It underpins our daily lives, drives economic growth and plays a critical role in addressing some major global challenges, such as access to clean water, reducing the increased amount of plastic waste, and meeting the needs of an expanding global population. However, in the UK there is still a shortfall of engineers in the talent pipeline; figures from EngineeringUK show that there is an annual demand for at least 124,000 engineers and technicians with core engineering skills, and an additional 79,000 roles that require engineering knowledge and skills alongside other skill sets.

Through its education engagement and diversity and inclusion (D&I) activities, the Academy aims to develop an education and skills system that inspires people from all backgrounds and promotes UK engineering excellence, and to engage the next generation in the opportunities presented by a career in engineering, to increase the number of people joining the profession.

In early 2018, the Academy launched its fourth regional engineering education programme in the Welsh Valleys. The programme is building on the region's engineering heritage, enabling students in the area to develop skills that will support many of the engineering companies that are investing in South Wales. As well as providing STEM enhancement and enrichment opportunities for students, the project enables continued professional development for teachers. Upon its launch in March, the project was already changing the perceptions of students and teachers, with one saying: "Today has not only inspired the children, but the staff as well. A colleague and I have decided to run a STEM after-school club for children in years 5 and 6. The activities were amazing and, as well as STEM skills, helped develop soft skills such as collaborative working and perseverance."

Funded by The Panasonic Trust, the programme will reach eight secondary schools and five primary schools across five years. The Academy's other engineering education projects in Barrow-in-Furness, Stoke-on-Trent and Lowestoft have provided over 100,000 STEM learning opportunities since their launch.

Embedding **STEM IN THE CURRICULUM**

The Connecting STEM Teachers programme works to enhance the teaching and learning of STEM in schools across the UK through a network of regional teacher coordinators who support nearly 700 schools, and receive training, free teaching and learning resources, and funding for collaborative programmes.

Since January 2016, Tracey O'Connor has been a teacher coordinator receiving regular training from the Academy, which she has then been able to pass on to primary and secondary colleagues in her region and share best practice.

"This training has developed my confidence in areas of the design and technology curriculum, such as systems, electronics and robotics," she explains. "I feel that I can successfully deliver these areas of the curriculum to my students and have the support of my teacher coordinator colleagues to share ideas and questions."

Over the past academic year, Tracey has facilitated collaboration between schools on engineering projects that have allowed young people from all backgrounds, ethnicities and genders to engage with engineering resources, as well as with industry professionals who have demonstrated the broad and diverse range of roles within the profession. She says that this has challenged the misconceptions that students may have about a career in the profession not being for "people like them".

"The Academy's support in helping me develop a strong and collaborative network has positively impacted the active and growing STEM offering in the West Midlands," she adds. "By responding to the Academy's aim of engaging schools in areas of high deprivation, we have been able to bring engineering opportunities to students who would be unlikely to have such access by any other means.

"With a large primary network, we have also been able to support a wide variety of non-specialist teachers in the area with their own professional development at a time when financial constraints may have hindered uptake."

Over
1,500
free engineering teaching resource boxes
have been given out to schools, including the most recent one, *Aiming for Awesome*, which was developed with the Royal Air Force

"The opportunity to 'connect' with a much greater audience of students and teachers than might be possible when working within the constraints of your own classroom or school site cannot be underestimated. I would, without hesitation, encourage anyone interested in working with the Connecting STEM Teachers programme to get involved at the earliest opportunity." Tracey O'Connor, Teacher Coordinator

Identifying **FUTURE LEADERS**

"I owe my entire post-graduation career to the Royal Academy of Engineering."
Arnaud Doko, Engineering Leaders Scholarships alumnus

Each year, the Academy selects 35 of the UK's brightest engineering undergraduates for the Engineering Leaders Scholarships (ELS) scheme, a three-year programme of career development activities, annual networking weekends, and access to advice and mentorship from Academy Fellows, Sainsbury Management Fellows and ELS alumni.

In 2017, project engineer Arnaud Doko completed his three-year programme, during which time the ELS funds allowed him to invest in specific learning opportunities that he would not have pursued otherwise, including a project management course and an engineering conference in Beijing.

Upon receiving his award, he searched the Academy's database for a mentor and was connected to Chris Shelley, an entrepreneurial Sainsbury Management Fellow who had started his own engineering business, Dymag Group Ltd.

"He was very generous with his time and I learned a lot. I interned for Dymag one summer, which I enjoyed immensely, so Chris offered me a graduate role with the company and I started work the day after graduation. It's a small, but growing, company and has provided me with many different opportunities for personal development."

Since completing the programme, Arnaud has been encouraging other engineering students to apply and has been doing STEM outreach with Bristol Grammar School.

"The Academy is committed to helping engineers develop themselves, network with each other, and better engage greater society. It's a logical choice for all those interested in engineering, regardless of their career stage. The scholarship funds were useful, but I ended up valuing the opportunity to meet and befriend the other awardees (all impressive, high-quality people) the most. I remain in contact with several of them, and it's a great network to be a part of."

Improving
DIVERSITY AND INCLUSION

The Academy is committed to increasing D&I across engineering, not only to attract more underrepresented groups into the profession to address the skills gap, but to harness the positive impact it has – on individual engineers, company bottom lines, innovation and creativity.

In September, the Academy launched *Creating cultures where all engineers thrive*, a unique study of culture and inclusion across the engineering profession based on the responses of 7,000 engineers. The research confirmed that there is a strong business case for inclusion across the profession. Of the respondents to the survey who said they felt included, 80% said they felt more motivated, 68% said they performed better and 52% said it increased their commitment to the organisation. The responses showed that the more included engineers feel in an organisation, the more likely they are to understand business priorities, see a future for themselves in the profession and be confident about speaking up about improvements, mistakes or safety concerns.

Academy analysis of graduate diversity data revealed that while 27% of UK engineering graduates are from ethnic minority backgrounds, only 7.8% of them are in engineering employment. Women are also significantly underrepresented in the profession, with women making up only 16% of engineering graduates in 2016 and just 9.3% women engineers employed in industry.

In response to this, the Academy delivered a pilot engagement programme in collaboration with employers between 2015 and 2018 to encourage more ethnic minority and female graduates from newer universities to transition into engineering employment. During the pilot, 468 undergraduates and recent graduates engaged with 14 engineering employers, and of the 287 students who took part in years one and two of the programme, 91 have already secured engineering employment-related opportunities.

Engineering graduates attend a workshop as part of the pilot programme

Natasha Mudhar, a chemical engineering graduate from the University of Birmingham, took part in the programme to gain further insight into the graduate recruitment process, as well as experience of the assessments used, such as group interviews and technical exercises.

"Providing opportunities for young engineers through these events helps those that are more than capable of careers as engineers but may not necessarily know certain corporate etiquette and are at risk of unwittingly making a faux pas during the recruitment process," Natasha explains. "I would highly recommend applying to the programme to anyone wanting advice on the placement or graduate application process and for a rare opportunity to network with people within the industry. I believe the value of exposure to the professional world of work and those with successful careers cannot be underestimated."

The programme has also received positive feedback from employers. "I absolutely encourage employers to get involved," says Graham Hopkins, Non-Executive Director at Network Rail. "As part of the scheme, we were able to offer a pilot opportunity to take on five students to join the organisation. It's a fabulous opportunity to not only meet lots of really great potential talent, but also to network with other organisations, learn from those organisations and understand what they're doing."

Because of the success of the pilot and the positive impact on students and employers, the Academy is launching a longer-term Graduate Engineering Engagement Programme and is seeking more employers to take part.

Transforming **ATTITUDES TO ENGINEERING**

In January, the Academy launched *This is Engineering*, a multi-year perception-change campaign aimed at rebranding engineering for young people and their influencers and encouraging them to take up careers in engineering. The first phase of the campaign used social media advertising to promote films of five young engineers who had followed their passions, such as sport, design and fashion, into engineering. The films direct their teenage audiences to an online hub where they can learn more about the engineers and access practical information about how to pursue a career in engineering.

In the first 15 weeks following launch, the campaign films were viewed 13 million times. The campaign also gained coverage in *The Times*, on Sky News, BBC Radio 4 and Radio 5 Live, among other media titles.

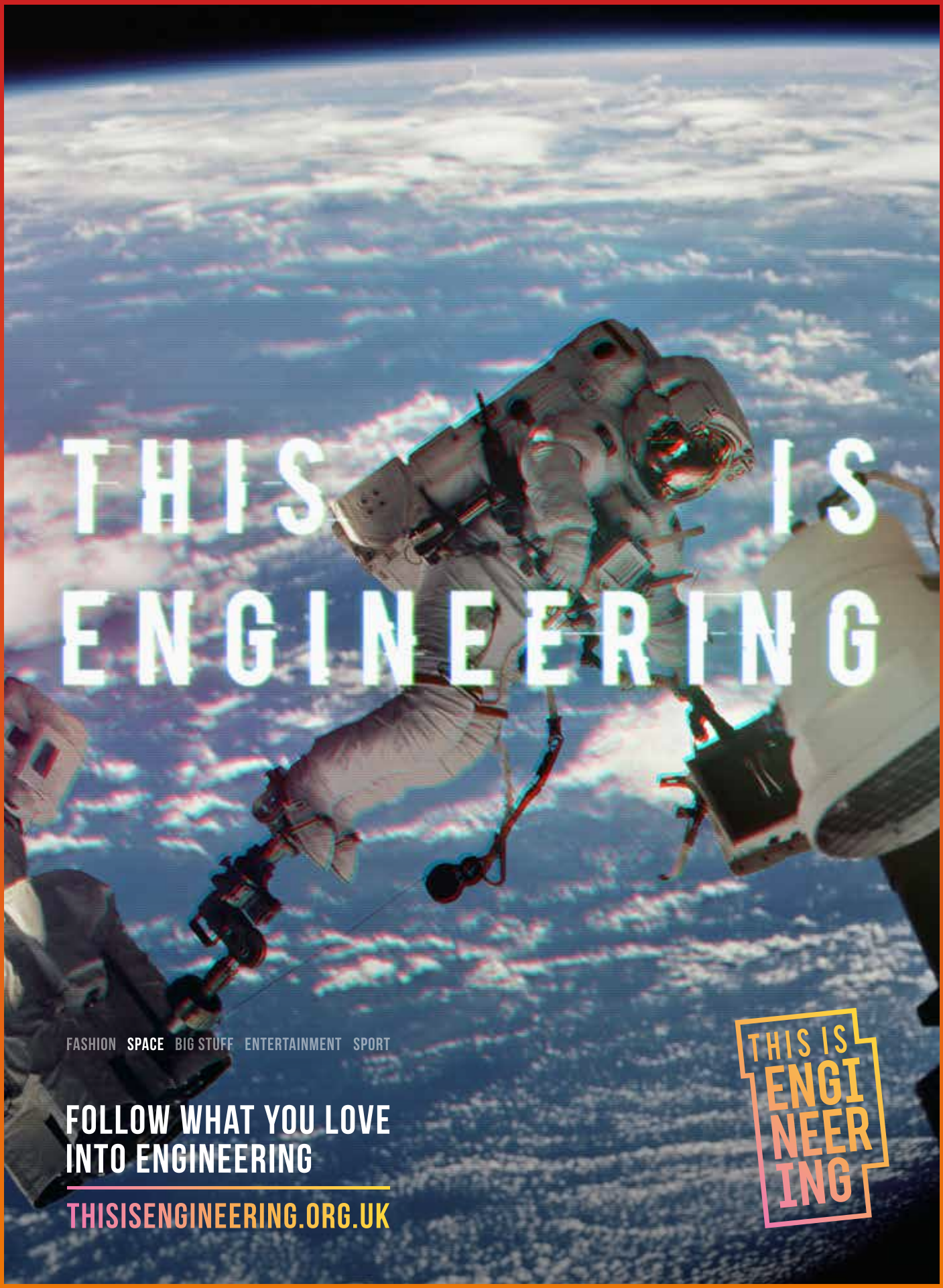
The Academy is leading the campaign in collaboration with EngineeringUK and industry partners BAE Systems, National Grid, Anglo American, BP, Centrica, Rolls-Royce, Siemens, Shell UK, and sponsors Mott MacDonald and WSP. The launch came shortly after the beginning of the government's Year of Engineering and the two are closely aligned. *This is Engineering* will provide a legacy for the Year, building on its success and delivering the sustained engagement needed.

Upon the campaign's launch, Minister for the Year of Engineering Nusrat Ghani MP said: "The Year of Engineering 2018 is all about transforming perceptions of engineering, showing young people from all backgrounds the immense creativity and opportunity of the profession. Careers in the industry are a chance for young people to shape the future and have a real impact on the lives of those around them. Role models are a vital way of showing this, and it's fantastic to see *This is Engineering* celebrating exciting and unexpected stories of modern engineers."

Among those teens who have seen the *This is Engineering* campaign, consideration of engineering as a career has increased

41%

"The stereotype of an engineer is somebody that works in a lab, might wear a lab coat and work with tools, which I think needs to change. Engineering for me is really creative. You can have an amazing impact on the world through engineering." Vinita Marwaha Madill, space operations engineer at the European Space Agency and *This is Engineering* protagonist


THIS IS ENGINEERING
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The *Ingenious*-funded MakerShack at Cheltenham Science Festival
© stillmovingmedia.co.uk

Position engineering **AT THE HEART OF SOCIETY**

Much of the work that the Academy carries out aims to improve public awareness and recognition of the crucial role of engineers both in the UK and internationally. The Academy's Fellowship is a hugely valuable network, which ensures that the voice of engineering is heard and heeded in the public domain. Fellows' expertise is harnessed to provide authoritative policy advice and enables the Academy to lead the profession in the UK and beyond.

In April, the Academy led a response, on behalf of the engineering profession, to the government's green paper on industrial strategy. The report, *Engineering an economy that works for all*, represented a collaboration of all 38 professional engineering organisations representing over 450,000 engineers, and benefited from an unprecedented level of engagement by the engineering community. It called on government to ensure that any proposals build on existing successful policies and suggested a focus on a long-term vision that harnesses the UK's international reputation for engineering excellence, presenting Britain as a top destination for inward investment and global talent.

The Academy's website attracts

25,000 users and

108,333 page views a month

Advising on **POLICY**

At the beginning of 2018, work began to establish a new Engineering Policy Centre led by the Academy, in collaboration with partners across the profession. The centre aims to increase the impact of engineering on society by informing policy and building the capacity and ability of engineers and policymakers to work productively with each other. This builds on ongoing work in the Academy's areas of policy expertise.

In July 2017, the Academy published a report on the sustainability of liquid biofuels, which was produced at the request of the Department for Business, Energy and Industrial Strategy and the Department for Transport. It attracted significant attention in the media and on social media, particularly the suggestion that fatbergs could be converted into useful fuel, with news stories from *The Times,* the *Guardian, New Scientist* and the BBC, in addition to local press, specialist websites, and mentions on national radio news. An article by Professor Raffaella Ocone FREng explained the report on *The Conversation* website following news of the proposed 2040 ban on non-electric vehicles.

At the end of September, the *Engineering better care* report explored how an engineering systems approach could be applied to health and social care. Produced with the Academy of Medical Sciences and the Royal College of Physicians (RCP), it presented a new framework to support healthcare design and improvement. The working group is currently taking forward the work in three main areas:

- Implementation – Professor John Clarkson FREng, Director of the Cambridge Engineering Design Centre, and his team and an RCP team led by Dr John Dean, from East Lancashire Hospitals NHS Trust, are in discussion with several local NHS trusts to establish projects that put the systems approach to improvement into practice to test and evaluate it.

- Training – the team is exploring potential routes to deliver training for clinicians and other healthcare professionals in delivering a systems approach in practice. As an initial step, the Academy has plans to translate the report into an interactive online resource that should form the basis for taster training courses.

- Research – Professor John Clarkson's team in Cambridge is developing a toolkit that will help practitioners put the systems approach into practice. For example, they are working on a project applying a systems approach to palliative care for the elderly, funded by Marie Curie.

In March 2018, two Academy reports discussed how government, industry, system operators and the engineering profession must act together in a coordinated way to improve cyber safety and ensure that the Internet of Things develops in a secure and trusted way. They highlighted that digital technologies have a huge variety of applications and that the integration of physical and digital systems creates many opportunities to realise economic, social and environmental benefits across business and society. However, the reports also warned that digitally connected systems need to be designed with safety and resilience in mind to minimise future risk.

Co-produced by engineers, clinicians, and health and care leaders, the *Engineering better care* framework is designed to develop systems that better meet the needs of patients, carers and NHS staff

Public promotion OF ENGINEERING

The Academy continues to increase its public engagement activities. In 2017, it sponsored two events at Cheltenham Science Festival, as well as funding the MakerShack space at the festival through the *Ingenious* programme.

For the first time, it also took part in Manchester Science Festival with an event titled *What's engineering got to do with it?*, which attracted almost 1,300 visitors who interacted with a variety of engineering activities, such as technology to extract DNA from a strawberry and an innovation that could turn their voice into a musical instrument.

At the core of the *Ingenious* scheme is the aim to inspire creative public engagement with engineering projects, and motivate and upskill engineers to share their stories and expertise with wider audiences.

In 2017, *Ingenious*-funded SMASHfestUK toured a festival that it designed with local community groups, universities, schools, and young people. The festival imagined a world that has been destroyed by a supervolcano, and participants helped rebuild that world with a series of activities that used engineering to solve problems. The challenges included using scrap material to assemble structures, creating filters to provide safe drinking water, building piping and heating systems, and making rocket stoves from bricks. A core of engineers and scientists from universities and industry supported the activities, as well as volunteers from the community.

SMASHfestUK ensures that its engineers represent a diverse range of ethnicities, genders and socioeconomic backgrounds, so that children and parents can meet engineers who they can identify with. A parent who attended said that it was "wonderful to see engineering really brought to life, with women engineers. Our daughter, and the girls in her class, will be inspired by this".

To understand the impact of the festival, the team measures both quantitative postcode and demographic data on attendance, as well as qualitative data about experience. In 2017, this data revealed that 62% of attendees were interested in STEM careers after attending the festival.

The team takes its festival on a tour of disadvantaged areas in the UK, with an aim of breaking down barriers to social inclusion and STEAM (science, technology, engineering, maths and the arts) engagement. In 2018, its fourth year, the festival will focus on the after-effects of a flood, the first scenario that may have affected attendees in the UK.

Ingenious has funded over

200

projects and provided opportunities for more than 5,000 engineers to take part in public engagement activities that have reached more than 2.5 million members of the public

The Academy partnered with Disney for the second time at *New Scientist Live* to present a stand demonstrating 'Engineering inspired by *Star Wars*'. A virtual reality *Star Wars* game was the stand's star attraction, and visitors could also explore state-of-the-art ultrasound technologies and thought-controlled prosthetics with a robotic arm inspired by Luke Skywalker.

Primary school pupils help out with the Robot Orchestra at the Academy

Over the past year, the Academy has received

2,150

mentions in national and regional print, and online media, averaging to 179 pieces per month. This includes 211 radio and 28 TV broadcasts

Over the past two years, the Academy has hosted a series of events with former Rooke Award winner Professor Danielle George MBE touring the UK with her Robot Orchestra. School groups and members of the public watched live demonstrations of around 50 robots built from recycled electronics and junk, while Professor George explained how household items can be adapted and transformed with robotics and coding to do extraordinary things.

In March, the tour culminated with a show at Prince Philip House, which was attended by 200 students from primary schools across London – the first time that an event specifically for children has been held at the Academy.

"It's been great to perform at the Academy and show children how creative engineering is. I hope we've shown people that tinkering with junk can be fun and result in genuine discoveries that enable us to make useful gadgets ... I want young people across the country to realise that they have the power to change the world right from their bedroom, kitchen table or garden shed, and to consider the incredible opportunities that a career in engineering could offer them." Professor Danielle George MBE, Professor of Radio Frequency Engineering, University of Manchester

Event HIGHLIGHTS

May 2017
Space missions – the what, how and why? – East Midlands Lecture by Dr Matt Perkins FREng, Chief Executive Officer, Oxford University Innovation.

July 2017
Innovation in haptics – showcase of a selection of the most recent advances in haptic technologies through presentations and live demonstrations.

September 2017
Engineering the past and shaping the future – held as part of the *Ingenia live!* series with presentations from Professor Sarah Hainsworth FREng, Pro-Vice-Chancellor and Executive Dean of the School of Engineering and Applied Science, Aston University; Professor Mark Williams, Project Evaluation Technologies Group Leader and Principal Investigator, Warwick Manufacturing Group; and David Mearns, Blue Water Recoveries.

October 2017
Building the future: what's next for engineering? – Autumn Lecture delivered by 2017 Rooke Award winner Roma Agrawal MBE, Associate Director, AECOM.

November 2017
The nature of engineering in a fast-changing world – Hinton Lecture delivered by Vincent de Rivaz CBE FREng, former CEO, EDF Energy.

March 2018
Beyond automation: the new world of work – panel discussion hosted by Alok Jha, science journalist, broadcaster and author. Speakers included: Dr Hayaatun Sillem, Academy CEO, Rebecca Enonchong, Africa Prize judge and Founder and CEO, AppsTech, and Dr John Lazar CBE FREng.

The MacRobert Award-winning Raspberry Pi team with HRH The Duke of Kent and the President

One of the highlights in the Academy's calendar is the annual Awards Dinner, which takes place every June to recognise and reward some of the very best engineers and engineering in the UK. At the 2017 event, Academy President Professor Dame Ann Dowling OM DBE FREng FRS and HRH The Duke of Kent presented the MacRobert Award, the UK's longest-running and most prestigious prize for innovation in engineering, to a team from Raspberry Pi. The low-cost, pocket-sized computer is inspiring young people in schools to learn coding and study computer science, as well as funding hundreds of outreach activities across the world through the Raspberry Pi Foundation. The tiny computer has also transformed the way that engineers design control systems in industry and has found many different applications.

Dr Dame Sue Ion DBE FREng FRS, chair of the MacRobert Award judging panel, said "Raspberry Pi has inspired multiple generations to get into coding: children are learning about coding for the first time, often alongside their parents and grandparents. Communities in the developing world are being empowered by the Raspberry Pi and its modern-day computing-on-a-budget." The prize is awarded annually for an outstanding example of innovation that has achieved commercial success and is of benefit to society. It seeks to demonstrate the importance of engineering and the contribution of engineers and scientists to national prosperity and international prestige.

Several other prizes were presented throughout the evening. The President's Medal was awarded to Ian Shott CBE FREng in recognition of his many contributions to the work of the Academy, which have culminated in the successful establishment of the Enterprise Hub. Roma Agrawal MBE, structural engineer and Associate Director at AECOM, received the Rooke Award for her contribution to the public promotion of engineering through talks and television appearances. Over the last six years, Roma has reached over 10,000 people at hundreds of events in the UK and abroad. The Major Project Award was presented to a team from Arup, for work on Glasgow's SSE Hydro Arena.

The Silver Medals, which recognise outstanding personal contributions to engineering in the early stage of awardees' careers, were presented to Billy Boyle, CEO of Owlstone Medical; Professor Constantin Coussios, Professor of Biomedical Engineering at the University of Oxford; Dr David Silver, Principal Research Scientist at DeepMind; and Rob Bishop and Dr Zehan Wang, Co-founders of Magic Pony Technology, which was acquired by Twitter in 2016.

Celebrating global
ENGINEERING INNOVATION

In December, HRH The Prince of Wales presented the winners of the 2017 Queen Elizabeth Prize for Engineering (QEPrize) with their trophies at a ceremony held at Buckingham Palace. The winners, Eric Fossum, Nobukazu Teranishi, Michael Tompsett and George Smith (who was not in attendance), were honoured for their combined contribution to the creation of digital image sensors. Their three innovations, created over three decades, have revolutionised the way that visual information is captured and shared.

The day after the prize-giving, Eric Fossum, Nobukazu Teranishi and Michael Tompsett took part in a special event at the Science Museum. While there, they discussed the story of the digital image sensor with, and answered questions from, 120 secondary school students from across the UK. They were joined on stage by Professor Alison Noble OBE FREng FRS, from the Institute of Biomedical Engineering, and Vinita Marwaha Madill, a space operations engineer at the European Space Agency, who shared how image sensors have revolutionised the way they work.

One of the key aims of the QEPrize is to inspire the next generation of engineers, so attendees at the presentation ceremony included representatives from QEPrize donor companies and leading young engineers from the QEPrize Ambassador Network. Ambassadors and high commissioners from around the world were also in attendance, including His Excellency Koji Tsuruoka, Japanese ambassador to the UK, and His Excellency Robert Wood Johnson, US ambassador.

The day also marked the release of the second *Create the Future* report, an international survey on perceptions of engineering, based on the responses of more than 10,000 people across 10 global centres of engineering, including the US, Japan, Turkey, India, and Brazil. Key findings from the 2017 report suggest that engineering is entering a new era, where technology-related innovations are seen to have the greatest impact on our way of life. The study also highlighted that engineers are seen as equally as influential as politicians in solving major world challenges. Overall, the industry is recognised as a respectable, prestigious and highly trusted career choice. However, 8 in 10 respondents agreed that there is an urgent need for more visible female role models in leadership.

The QEPrize Ambassador Network has grown significantly. The network brings together young and early-career engineers from both business and academia to act as engineering champions. They speak to teachers, parents, schoolchildren, politicians and journalists about their fascination with engineering and why it is such a rewarding profession. QEPrize ambassadors are passionate about the global impact of engineering and the difference it makes to people's lives.

HRH The Prince of Wales with (L -R) Eric Fossum, Michael Tompsett and Nobukazu Teranishi

"The QEPrize is the world's most prestigious engineering prize, awarded to a person or group of people whose innovation has made a revolutionary impact on the world. Recognising people from across the spectrum of engineering, and from around the globe, the prize shows humanity, and particularly young people, that engineering has no boundaries and has a profound effect on everyone's daily lives." Stephen Maughan, QEPrize ambassador.

New Academy CEO Dr Hayaatun Sillem, with Philip Greenish CBE and the President

Enhance the **ACADEMY'S DELIVERY CAPABILITY**

The Academy's credibility with its partners, funders and the engineering community is underpinned by its ability to deliver. To ensure that it has the Fellows, staff, partners, funding and influence to contribute substantially to the UK economy and society, it aims to:

- elect an engaged Fellowship of outstanding engineers who reflect the full diversity of society and the profession
- be an organisation that the best people want to work for
- continue increasing its numbers of partners and supporters
- raise more funding support from government and third parties
- engage more young people
- embed its values in staff, Fellows and partners, particularly relating to D&I
- ensure that programmes complement those of funders and draw on the Academy's unique capabilities
- routinely evaluate work and measure progress.

The Academy's staff team has transformed and grown significantly over the past year, with several new roles being created to accommodate its increasing activities. The number of staff has increased from 84 to 100. At the end of 2017, the Academy said goodbye to former CEO Philip Greenish CBE, who had led the organisation since 2003.

His successor, Dr Hayaatun Sillem, started in post on 1 January 2018. She has worked for the Academy since 2006 and held the post of Deputy Chief Executive Officer and Director of Strategy until her appointment as CEO. She also serves as the Academy's D&I champion.

The past year has also seen the appointment of Dr Nick Starkey as the Academy's first dedicated Director of Policy to oversee the development of the Engineering Policy Centre and Samantha Bagchi as Development Director, who has carried out a wide-ranging review of the Academy's fundraising ambitions and capabilities. Both appointments will better position the Academy to achieve its goals in the years ahead.

In the last year, the Academy secured £5.44 million in new funding for its programmes. Major new multi-year commitments were secured from Anglo American, BAE Systems, BP, Centrica, National Grid, Rolls-Royce, Shell and Siemens towards *This is Engineering*, with additional sponsorship coming from Mott MacDonald and WSP.

Shell, Petrofac, Boeing UK and the Helsington Foundation continued their support of the Connecting STEM Teachers programme. Support from the Sir John Fisher Foundation, The Ogden Trust and the Walney Extension Community Fund helped the Academy's school STEM programmes to grow and develop. A multi-year grant from The Panasonic Trust enabled the launch of a major new school STEM initiative in the Welsh Valleys.

The Motorola Solutions Foundation continued its valuable support of the Academy's work in further education with grants towards continuing professional development for lecturers and encouraging greater diversity in further education in STEM. The Gatsby Charitable Foundation supported the Academy's ongoing work to develop core curriculum content for the new T level in engineering and manufacturing. In addition, the Commercial Education Trust supported a valuable study into engineering entrepreneurship in further education.

The Academy has continued its efforts to encourage regular giving from Fellows; support from newly elected Fellows has been especially welcomed. Thanks are also due to those Fellows who have pledged to leave a legacy to the Academy.

RAE Trading Limited (www.princephiliphouse.com) is an important wholly owned subsidiary of the Academy, which partners with CH&Co, to provide room hire and catering services, including fine dining, at Prince Philip House. Profits made by RAE Trading Limited are gift-aided to the Academy, so are an important source of unrestricted funds.

The Academy's education programmes, including Connecting STEM Teachers, benefited from significant support over the past year

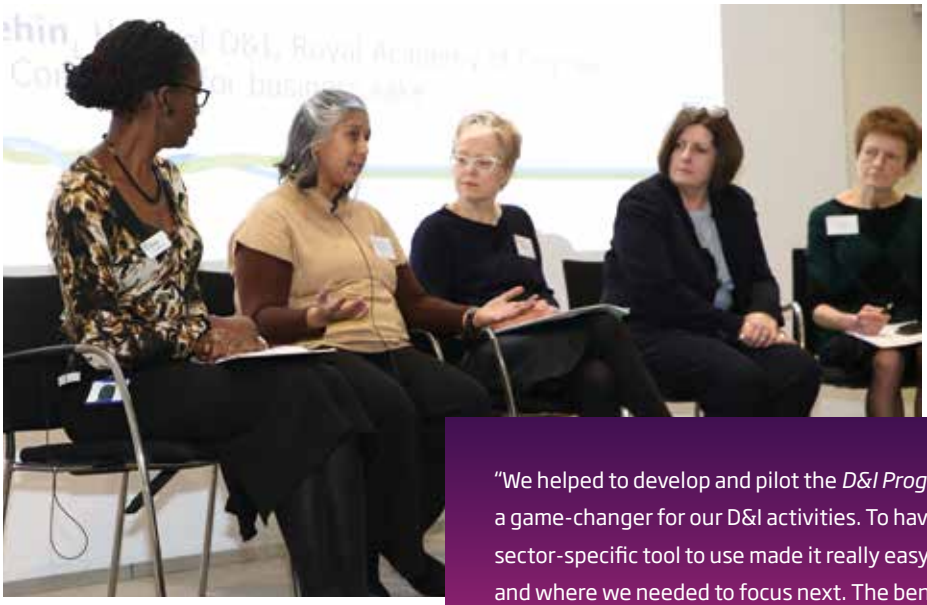
The Academy continues to invest in new technology to deliver its activities more effectively. During the year, a new laser projector and sound deck has been installed in Prince Philip House's main conference room, Al Qasimi, which has enabled high-quality presentations for lectures and conferences. The Taylor Centre provides Fellows of the Academy and Enterprise Hub members with modern meeting room facilities.

The Academy has also adopted Compleat, a cloud-based purchasing and expenses system that has improved the way the Academy interacts with its suppliers, so that it can continue to purchase goods and services at or below market price.

Changes in the way that the Academy operates have also been implemented. In preparation for introduction of the EU's General Data Protection Regulation (GDPR), new privacy notices and cookies policies were posted on the Academy's websites before the regulation was implemented on 25 May 2018 and departments within the organisation centralised their data and the way in which they communicate with Fellows and stakeholders. The Academy, along with all UK entities, continues to work towards full GDPR compliance.

On 7 February 2018, the Academy's Fellows voted unanimously at an Extraordinary General Meeting to implement the recommendations of the Governance Review, which modernised the General Regulations of the Academy. The main recommendation was to change the way Chairs of Governance Committees would be elected in the future.

Increasing D&I
WITHIN THE ACADEMY



(L-R) Bola Fatimilehin, the Academy's Head of D&I, Saraya Beg, Diversity Champion at the Operation Research Society, Sarah Bond of for business sake, Jane Banks, Business Development Manager at the Science Council, and Lynn Cooper, Chief Executive of the Institute of Water, attend the launch of the results from the benchmarking exercise

"We helped to develop and pilot the *D&I Progression Framework*, and this proved to be a game-changer for our D&I activities. To have such a straightforward, logical and sector-specific tool to use made it really easy to see where we had made good progress, and where we needed to focus next. The benchmarking exercise showed us how other professional engineering institutions are doing, and gave new impetus to our action plan. The framework is now embedded in our D&I work, as a regular check on achievements and stimulus for future actions." Rosemary Cook CBE, Chief Executive Officer, Institute of Physics and Engineering

Recent years have seen the Academy refocus its D&I activities. Following the publication of the *D&I Progression Framework* in late 2016, it put an internal action plan in place to progress and track D&I throughout the organisation. As the Academy leads external facing work to increase D&I across the engineering profession, it is essential it is seen to demonstrate good practice itself. This means having in place the structures and plans to deliver and report on progress internally – across both Fellowship and staff.

The Academy took part in a D&I benchmarking exercise across engineering and science professional bodies, which it carried out with the Science Council, to set a baseline for D&I activity across engineering and science professional bodies. Reporting on the Academy's performance against the eight areas of the framework indicates that it is making good progress, especially in its approach to integrating D&I into prizes, grants and awards; and education and training, accreditation and examinations.

To support this progress and track success, several instruments have been put in place to build on the work of the Proactive Nominations Committee (now panel). However, more needs to be done to support data collection, reporting and consistent practice.

Although organisations with fewer than 250 employees are not legally required to reveal their gender pay gap, the Academy voluntarily reported its own in March. The Academy's workforce is 62% female, and the results showed a mean hourly pay gap in favour of women at -2.19% and a median hourly pay gap of 9.19% in favour of men. While these compare well to many engineering organisations, there is some further work to be done to understand the median pay gap and the Academy will continue to look for opportunities to reduce any bias and promote inclusion and fairness throughout the organisation.

Fellowship
ENGAGEMENT

The Fellowship is at the heart of the Academy, with Fellows' broad range of expertise giving credibility and authority to its activities. Focus continues to be placed on broadening the regional footprint of Academy activity, with Fellows' lunches and dinners held across the UK, enhanced communication from the Trustee Board, a trip made by the President to the US's West Coast in January giving Fellows based in the area a chance to meet up, and regional lectures and visits.

An important aspect of this engagement is the annual Fellows' Day, which invites Fellows to Prince Philip House to learn about Academy activities and meet Trustees, other Fellows and Academy staff. Fellows' Day is a chance for Fellows to learn about how to get involved in leading and shaping Academy work.

One area where the engagement of Fellows in shaping Academy work has been evident recently is Fellows' participation in the development of the new Engineering Policy Centre. A working group has been set up, chaired by Professor Jeremy Watson CBE FREng, which is made up of Fellows, as well as colleagues from engineering institutions. The centre is a real opportunity to harness Fellows' expertise to influence and drive strategic change and foster challenging debate.

A better level of engagement with a greater number of Fellows serves to advance the Academy's aims and objectives, and helps support the UK economy in the long term.

Keith Howells FREng, Chairman of Mott MacDonald, learns about the Academy's global activities from members of the International team at the annual Fellows' Day

Trustee **BOARD**

The Trustee Board comprises 12 Trustees elected by and from the Fellowship and is chaired by the President, Professor Dame Ann Dowling.

Chair
Professor Dame Ann Dowling OM DBE FREng FRS
President

Vice Presidents
Professor Iain Gray CBE FREng FRSE
Vice-President for Committee Coordination

Professor Richard Williams OBE FREng FRSE
Vice-President for Fellowship Engagement

Members
Professor Colin Bailey FREng
Naomi Climer CBE FREng
Norman Haste OBE FREng
Dr David Hughes FREng
Dr Bob Joyce FREng
Professor Elaine Martin OBE FREng
Professor Geoffrey Maitland FREng
Dr Dame Frances Saunders DBE CB FREng
Professor Liz Tanner OBE FREng FRSE
Paul Westbury CBE FREng
Professor Stephen Young FREng

Chief Executive
Dr Hayaatun Sillem

Secretariat
Stuart Anthony FCA Flod

New
FELLOWS 2017

The Academy's Fellows represent the nation's leading engineering researchers, innovators, entrepreneurs, and business and industry leaders. Each year, 50 Fellows are elected 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 2017; their titles were correct at the time of their election.

Fellows

Professor Julian Allwood
Professor of Engineering and the Environment, University of Cambridge

Dr Don Arnone
Chief Executive Officer, TeraView Ltd

Christopher Barkey
Former Group Director, Engineering and Technology, Rolls-Royce plc

Dr Anthony Batchelor
Executive Chairman, GeoScience Ltd; Chairman, Camborne School of Mines Trust

Dr Michael Begg
Group Managing Director, Tesla Engineering Ltd (Storrington EquityCo Ltd)

Gordon Birrell
Chief Operating Officer, Production, Transformation and Carbon, BP plc

Dr Keith Bowers
Head of Tunnels, London Underground

Dr Andrew Carter
Chief Technology Officer, Oclaro Inc

Joan Cordiner
Technical and Change Manager, GBB Site; Global Risk Manager, Syngenta

Andrew Cowell
Managing Director, Mercedes AMG High Performance Powertrains Ltd

Professor David Cumming
Head, School of Engineering, and Chair of Electronic Systems, University of Glasgow

Mark Cutifani
Group Chief Executive Officer, Anglo American plc

Professor Michael Davies
Jeffrey Hamilton Collins Chair in Signal and Image Processing, University of Edinburgh

Professor Andrew Davison
Professor of Robot Vision, Department of Computing, and Director, Dyson Robotics Laboratory, Imperial College London

Professor Mischa Dohler
Chair Professor of Wireless Communications, and Director, Centre for Telecommunications Research, King's College London

Professor Alicia El Haj
Director, Institute of Science and Technology in Medicine, Keele University

Air Vice-Marshall Graham Farnell CB OBE
General Manager, NATO Eurofighter Tornado Management Agency (NETMA)

Mark Garrett
Chief Operating Officer and Executive Board Member, Ricardo plc

Dr Caroline Hargrove
Technical Director, McLaren Applied Technologies

Dr Demis Hassabis CBE
Co-founder and Chief Executive Officer, DeepMind

Eric Hawthorn
Managing Director, Radio Design Ltd

Professor Morgan Heikal
Head of the Centre for Automotive Engineering, University of Brighton

Keith Howells
Group Chairman, Mott MacDonald Group Ltd

Rachel Hurst
Group Operations Director, Domino Printing Sciences

Professor Dr Uwe Krueger
Former Chief Executive Officer, WS Atkins plc

Professor Juergen Maier
Chief Executive, Siemens UK & Ireland

Dr Graeme Malcolm OBE
Chief Executive Officer, M Squared Lasers Ltd

Professor Ursula Martin CBE
Professor of Computer Science, University of Oxford

Dr Pavel Matousek
Chief Scientific Officer, Cobalt Light Systems

Geoff McFarland
Group Head of Engineering, Renishaw

Dr Philip O'Donovan
Angel investor

Professor Sir Timothy O'Shea
Principal and Vice-Chancellor, University of Edinburgh

Dr Andrew Palmer CMG
Chief Executive Officer, Aston Martin Lagonda

Professor Sir Martyn Poliakoff CBE
Research Professor in Chemistry, University of Nottingham

Professor Simon Pollard
Pro-Vice-Chancellor, School of Water, Energy and Environment, Cranfield University

Professor Richard Prager
Professor of Engineering, University of Cambridge

Professor Tony Purnell
Head of Technology, British Cycling

Professor Graham Reed
Professor of Silicon Photonics, University of Southampton

Professor Roger Reed
Professor of Engineering Science and Materials, University of Oxford

Dr Ian Ritchey
Group Chief Engineer, Rolls-Royce plc

Professor Spencer Sherwin
Professor of Computational Fluid Mechanics, Imperial College London

Dr Dame Angela Strank DBE
Head of Downstream Technology and Chief Scientist, BP plc

Professor Eleanor Stride
Professor of Engineering Science, University of Oxford

Professor Anne Trefethen
Pro-Vice-Chancellor, University of Oxford

Dr Eben Upton CBE
Chief Executive Officer, Raspberry Pi (Trading)

Professor Paul Watson
Professor of Computer Science, Newcastle University

Professor Terry Wilkins
Professor of Nanomanufacturing Innovation, University of Leeds

Dr Sarah Williamson
Technical Director, Laing O'Rourke; Construction Technical Director, BYLOR

Professor Alexandre Yakovlev
Professor of Computer System Design, Newcastle University

Professor Antoni Ziolkowski
Professor of Petroleum Geoscience, University of Edinburgh

International Fellows

Professor John Hennessy
Director, Knight-Hennessy Scholars Program, Stanford University

Chad Holliday
Chairman, Royal Dutch Shell plc

Honorary Fellows

David Gammon
CEO and Founder, Rockspring

AWARDS

2017 MacRobert Award

The premier award for innovation in UK engineering, with a £50,000 prize, awarded annually to a team of engineers for an exceptional engineering innovation that has been both commercially successful and delivers benefits to society. The MacRobert Award is supported by the Worshipful Company of Engineers.

Awarded to: **Raspberry Pi for its low-cost, pocket-sized computer, which is inspiring young people in schools to learn coding and study computer science, as well as funding hundreds of outreach activities across the world through the Raspberry Pi Foundation**

2017 RAEng Engineers Trust Young Engineers of the Year and Sir George Macfarlane Medal

These awards recognise the potential of engineers working in the UK who have demonstrated excellence in the early stage of their career. The overall winner receives the Sir George Macfarlane Medal.

Awarded to:

Dr Ruth Misener, lecturer and Royal Academy of Engineering Research Fellow in the Department of Computing, Imperial College London: winner of the Sir George Macfarlane Medal

Frank O'Leary, Geotechnical engineer, Arup
Anna Ploszajski, Engineering doctorate candidate, UCL
Chris Shaw, Lead engineer, Sensible Object
Dr Jenni Sidey, Lecturer in combustion, University of Cambridge

2017 RAEng ERA Foundation Entrepreneurs Award

Awarded to early-career UK university researchers, who demonstrate considerable entrepreneurial promise.

Awarded to: **Oluwaseyi Sosanya, Co-Founder, Gravity Sketch**

2017 Silver Medals

For an outstanding personal contribution to UK engineering by an early- to mid-career engineer resulting in market exploitation. Up to four medals may be awarded in any one year.

Awarded to:

Rob Bishop and Dr Zehan Wang, Magic Pony Technology
Billy Boyle, CEO, Owlstone Medical
Professor Constantin Coussios, Co-Founder, OrganOx
Dr David Silver, Principal Research Scientist, DeepMind

2017 President's Medal

Awarded to an Academy Fellow who has contributed significantly to the Academy's aims and work through initiative in promoting excellence in engineering.

Awarded to: **Ian Shott CBE FREng**

2017 Sir Frank Whittle Medal

Awarded to an engineer resident in the UK whose achievements have had a profound impact upon their engineering discipline.

Awarded to: **Professor Andrew Schofield FREng FRS, Emeritus Professor, University of Cambridge**

2017 Major Project Award

The award recognises the contribution of a team of up to five UK-based engineers who have delivered a major engineering project that has had a substantial impact on society.

Awarded to: **SSE Hydro Arena in Glasgow, Arup**

2017 Rooke Award

The prize is awarded to an individual, small team or project, based in the UK, that has supported the Academy's aims and work through their initiative in promoting engineering to the public.

Awarded to: **Roma Agrawal DBE, Associate Director at AECOM**

2017 Colin Campbell Mitchell Award

For an engineer or small team of engineers who have made an outstanding contribution to the advancement of any field of UK engineering.

Awarded to: **Oxehealth**

2017 RAEng Armourers and Brasiers Company Prize

A biennial prize awarded to an individual for excellence in materials engineering, demonstrated by the successful application of novel materials science and technology in practical engineering systems. The prize is supported by the Worshipful Company of Armourers and Brasiers.

Awarded to: **Professor Mohan Edirisinghe FREng, from UCL's Department of Mechanical Engineering**

ROYAL
ACADEMY OF
ENGINEERING

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