

# 50 YEARS OF ENGINEERING INNOVATION



ROYAL ACADEMY OF ENGINEERING  
MACROBERT AWARD  
50th ANNIVERSARY

Since 1969, the MacRobert Award has honoured the engineers behind the UK's most exciting engineering innovations. It is awarded annually for an outstanding example of engineering that has achieved commercial success and is of benefit to society, and seeks to demonstrate the importance of engineering and the contribution of engineers and scientists to national prosperity and international prestige. As the award celebrates its 50<sup>th</sup> anniversary, *Ingenia* looks back at some of the winners.



*"For the last 50 years the MacRobert Award has celebrated groundbreaking engineering innovations that have established the UK as a global leader. Leading the judges for the MacRobert Award over the past five years, I have been privileged to see at first hand the engineering behind products that are changing our lives for the better." Dr Dame Sue Ion DBE FREng FRS, Chair of the judging panel*

The MacRobert Award has recognised engineering achievements across the breadth of British engineering in the 50 years since it was first presented to Rolls-Royce for its Pegasus engine and to Freeman, Fox and Partners for the Severn Bridge.

The variety of the award's recipients reads like a 'who's who' of UK engineering expertise. The roll of honour has also proved to be an indicator of innovative advances in engineering. It all started in 1969 with a civil engineering achievement that heralded a new era of bridge building and the world's first short take-off and vertical landing aircraft. Rolls-Royce won a gold medal and its share of the prize for the Pegasus engine that powered the Harrier Jump Jet while Freeman, Fox and Partners picked up its share for the aerodynamic design of the Severn Bridge's deck.

Since then, the sheer diversity of the winning innovations has revealed how hard it can be to judge entries that range from sampling breath to diagnose diseases (last year's winner, Owlstone Medical) through

superconducting magnets, catalytic converters, to a credit-card-sized computer that has revolutionised education, taking in wind power, robotic limbs and fibre optics along the way.

Originally founded by the MacRobert Trust, the award is now presented and run by the Royal Academy of Engineering, with support from the Worshipful Company of Engineers. An important task for the Academy is choosing judges for the award. At any one time, as laid down in the original 'Rules and Conditions', there are up to 10 judges, most of them fellows of the Academy. The current Chair is Dr Dame Sue Ion DBE FREng FRS – the first woman judge and chair.

The key to the award's success lies in the criteria that these judges apply when assessing entries. These criteria have changed over the years. The original remit was to reward "an outstanding contribution" made "by way of innovation in the fields of engineering or the other physical technologies or in the application of the physical sciences, which has enhanced or will enhance the national prestige and prosperity of the

## THE JUDGING PROCESS

The process begins with an invitation to companies to submit entries, by the end of January, that address the three key criteria: innovation; commercial success and benefit to society. The judging panel then selects a shortlist of six to eight candidates.

During March, two members of the judging panel visit each of the shortlisted organisations, with one member chosen for their expertise in the field. Guided by the visiting judges, the panel chooses the finalists. In May, the whole judging panel then visits all the finalists in turn, before choosing a winner.

The announcement of the winner of the MacRobert Award 2019 will be made at the Royal Academy of Engineering Annual Awards Dinner on Thursday 11 July 2019.

United Kingdom of Great Britain and Northern Ireland".

The original remit left the door open to entries that looked innovative in the first place, but then proved to be short-lived when it came to the marketplace. The first rule change was to include commercial success as a criterion. To reflect the way in which the Academy sees its own remit, the rules for judging entries for the MacRobert Award now hinge on three key issues: innovation, commercial success and benefit to society.

The MacRobert Award has grown to become the UK's leading prize for innovation in engineering. It has benefited

from the beginning from the support and involvement of HRH Prince Philip, Duke of Edinburgh – the Academy's Senior Fellow. The award is now so well established that, to mark the 50th anniversary, the Royal Mail included three previous winners in a series of stamps that celebrate some of the achievements of British engineering from the past 50 years (see page 6). The Academy is also holding a reception at St James's Palace in July for past and present winners, finalists, judges and supporters. Later this year a photography exhibition will show the winners' innovations in a different light.



## A BRIEF HISTORY OF MACROBERT AWARD WINNERS

### British Petroleum (BP)

#### Techniques enabling accurate surveying through permafrost in Alaska

Three BP geologists, led by Dr Peter Kent FRS, won the second MacRobert Award in 1970 for their role in driving BP's exploration of Northern Alaska, which enabled the discovery of the North Slope oil fields. This was the first MacRobert Award for BP, which is just one of two companies to have won three times. The second company is Rolls-Royce.



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### Oxford Instruments Group

#### Superconducting magnet systems for medical diagnostics

Oxford Instruments collected the 18<sup>th</sup> MacRobert Award for its research and commercialisation of superconducting magnet technology. The company developed a new generation of superconducting magnets that delivered a field strength and uniformity never achieved before. The technology gave the company an international lead in providing healthcare and research using nuclear magnetic resonance (NMR), a technology that continues to underpin the commercial activities of Oxford Instruments.



© Oxford Instruments Group

### ICI Klea

#### For the process and production technology for manufacturing the ozone-benign refrigerant KLEA 134a

ICI won the 25<sup>th</sup> MacRobert Award for a technology that addressed one of the key environmental issues of the day: depletion of the ozone layer caused by chlorofluorocarbons, refrigerant gases that were leaking into the atmosphere. Four engineers – including Rachel Spooner FEng, the first woman to win the MacRobert Award – led the team that developed the hydrofluorocarbon KLEA 134a and a commercial production route for the new refrigerant in just five years.



© ICI Klea

### Optos plc

#### The Optos scanning laser Panoramic 200(P200) ophthalmoscope has revolutionised eye care and the early detection of retinal defects with its ultra-wide retinal imagers

Douglas Anderson OBE FEng FRSE founded Optos in 1992 after his then five-year-old son lost sight in one eye due to late diagnosis of a retinal detachment. The P200 used low-powered lasers to create a 'virtual scanning point' inside the patient's eye. Proprietary software allowed the practitioner to capture, manipulate and enhance the image, enabling a detailed evaluation of the retina and producing a permanent clinical record of the examination.

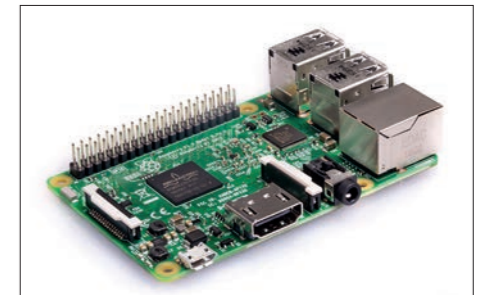


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### Raspberry Pi

#### A microcomputer the size of a credit card that set out to help increase the number of computer science applicants to the University of Cambridge

The Raspberry Pi started as an education aid but went on to create a new class of computer that has transformed how engineers design industrial control systems. As Dr Dame Sue Ion DBE FEng FRS, Chair of the MacRobert Award judging panel, said: "What sets Raspberry Pi apart is the sheer quality of the innovation, which has allowed the computer to be used far beyond its original purpose. By blending old and new technology with innovative systems engineering and circuit board design, the team has created a computer that is cheap, robust, small and flexible."



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© Post Office Telecommunications

### Post Office Telecommunications

#### Prestel Viewdata software system

The 11<sup>th</sup> winner of the MacRobert Award in 1979 was Post Office Telecommunications for Prestel – the world's first viewdata service.

In the pre-internet days, Prestel was an early two-way system, with terminals connected to the telephone network. At its height in 1987 the service had over 75,000 terminals in the UK and overseas, increasing at 1,000 sets a month. The service finally closed in 1994.

This was the first time the MacRobert Award was given to an innovation in information technology.



© BP International

### BP International

#### Advancing the application of hydraulic fracturing technology used in the exploitation of oil and gas reserves

There is no denying that hydraulic fracturing has changed the face of the energy industry. The technology won the 24<sup>th</sup> MacRobert Award despite the fact that Dr Tim Harper and Dr Paul Martins had to overcome initial scepticism within the industry when they set out to improve on existing methods of hydraulic fracturing.

Through extensive research and testing, Harper and Martins devised new approaches to fracturing and drilling, the biggest advancements in the field in 30 years, that significantly improved the flow of oil and gas and helped save oil firms hundreds of millions of pounds.



© Buro Happold

### Buro Happold

#### For the roof structure of the Millennium Dome

At the time, the Millennium Dome, erected in Greenwich to host the Millennium Experience in 2000, was the biggest fabric building in the world but so lightweight that the structure weighed less than the air it contained. Supported by 12 steel masts, the dome was built as a set of modular components held together by 70 kilometres of cables.

Now known as The O2, the structure is visible from space as one of London's landmarks.



© Microsoft Research, Cambridge

### Microsoft Research, Cambridge

#### Human motion capture in Kinect for Xbox 360

Five engineers from Microsoft Research in Cambridge won the MacRobert Award for their machine-learning work on the human motion capture in Kinect for the Xbox 360, allowing controller-free gaming.

The team applied machine learning to analyse depth images independently and to classify pixels in each image as belonging to one of 31 body parts. In the two months after its launch in November 2010, Kinect sold eight million devices, making it the fastest-selling consumer electronics device in history.

John Robinson CBE FEng, Chair of the MacRobert Award judging panel at the time, said: "Yet again, British engineers have solved a seemingly intractable problem that stumped the rest of the world – motion capture in real time has made Kinect hugely successful and what was originally developed as a game is now poised to revolutionise the way we use computers in the future."