



The Royal Academy  
of Engineering

# The MacRobert Award 2012

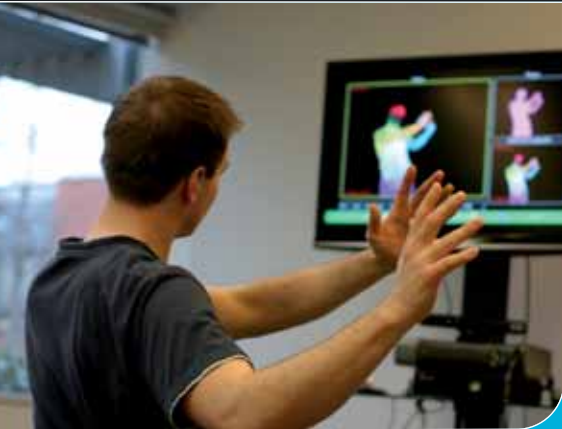
**The UK's premier award for innovation in engineering**

- £50,000 prize for winning team
- Wide acclaim and recognition for finalists and winner
- Enter now: closing date Tuesday 31 January 2012

[www.raeng.org.uk/prizes/macrobot](http://www.raeng.org.uk/prizes/macrobot)



## The winner of the MacRobert Award 2011



**Microsoft Research** won the 42nd annual Royal Academy of Engineering MacRobert Award for their machine learning work on **the Human motion-capture system in Kinect for Xbox 360**, allowing controller-free gaming and opening up a whole new future for human interaction with computers. The Kinect sensor provides a stream of 3D "depth images". This is analysed by software to give a moving interpretation of the human skeleton, at 30 frames per second. The Microsoft Research Cambridge laboratory applied machine learning techniques to build a capability to analyse depth images independently, classifying pixels in each depth image as belonging to one of 31 body parts. The classifier is trained and tested using a very large database of pre-classified images, covering varied poses and body types. It is engineered so efficiently that it uses only a fraction of the total available computing capacity - essential to the practical success of Kinect. In the two months after its launch in November 2010, Kinect sold 8 million devices, making it the fastest selling consumer electronics device in history.

[www.research.microsoft.com](http://www.research.microsoft.com)

## Other finalists of the MacRobert Award 2011



**Defence Science & Technology Laboratory (Dstl) & NP Aerospace Segmented Ceramic Armour** is a ceramic protection system, developed and patented by Dstl and exploited by NP Aerospace as CAMAC®. The armour system is being used to protect troops in a range of military vehicles from the threat of improvised explosive devices (IEDs) as well as machine gun fire. Unlike conventional ceramic tiles, the new system consists of thimble-sized hexagonal segments held together by a moulding resin, then packaged in a polymer composite with high ballistic performance. Like a ceramic chain mail, the armour performs better than a single ceramic tile, a critical component of CAMAC®. The CAMAC® armour is lightweight and modular, reducing the logistic burden of shipping entire armour kits to remote patrol bases for repair. It is in use in Afghanistan and has already saved the lives of UK troops and local people. The segmented technology is being further developed for related projects, such as the recently procured Foxhound Light Protected Patrol Vehicle (LPPV).

[www.dstl.gov.uk](http://www.dstl.gov.uk)

### Jaguar Cars

The **XJ Light Weight Vehicle concept** is a unique lightweight aluminium body for the new XJ series and is 200 kg lighter than a comparable steel-bodied model. It also gives the XJ a more environmentally friendly production process than any other car in the world. It is the first production car body to be built using aerospace cold joining techniques for the whole assembly, eliminating fusion welding from the body shop. This reduces electricity consumption by up to 90 percent and avoids using extra water to cool the weld guns. Up to half the aluminium used to make the body is also recycled. The XJ is amongst the world's safest cars, the body being a lightweight strong platform for passive and active safety systems, designed to meet all legal and consumer safety tests around the world with a single body derivative.



Lighter weight assists both steering and braking and helps to reduce the impact of any collision. Jaguar is the first vehicle manufacturer to offer a deployable bonnet across the whole vehicle range, this reduces head and upper body injuries to a pedestrian in the event of an accident.

[www.jaguar.com](http://www.jaguar.com)

### Radio Design Ltd

The **Universal Combiner Unit** is a radio frequency filter system that allows up to three mobile phone operators to combine the outputs of one 2G and two 3G base stations onto a single antenna system. The combiner has extremely low signal loss but still provides sufficient isolation between the base stations connected to it to stop them interfering with each other.



Although there are significantly fewer cell sites in the shared network it actually has better coverage and significantly higher data capacity than the original independent networks. Introducing the universal combiner has no measurable effect on the way the networks perform and no additional antenna infrastructure is required - the universal combiner is installed at ground level, eliminating the need for any mast climbing. Existing mast & antenna systems can be used to support multiple base stations from more than one operator at minimal cost. It has been estimated that phone companies can save up to £100 million a year by sharing their networks. This means they can continue to support the ever growing demand for "smart phone" data services at a competitive price for consumers.

[www.radiodesign.eu](http://www.radiodesign.eu)

# Submission and selection process

**The MacRobert Award is administered by the Royal Academy of Engineering and is awarded annually from a shortlist of four finalists. The Award is given for excellence in UK innovation that has reached a stage where both the level of innovation and commercial potential is clear.**

## Who can apply?

The Award is open to any individual or team from any organisation in the private, public or charitable sectors. However, no more than five individuals may be named as the key innovators behind the submission. Applications are invited for engineering innovations in any area of science, engineering, medicine or technology.

## Judging criteria

In considering applications for the MacRobert Award, the judging panel seeks to identify world-leading engineering developments which demonstrate the following three key criteria, each of which may be interpreted very broadly, reflecting the diversity of 21st century engineering:

### 1. Innovation

The claimed innovation should demonstrate either truly novel engineering techniques, or the novel application of existing techniques to the solution of challenging engineering problems. The claimed innovation should be demonstrably superior to alternative or competitive solutions to the same problem.

### 2. Commercial success

Proof of commercial success is required. Where appropriate, this may be measured in terms other than the purely financial. There must, however, be clear evidence that the users at whom the innovation is aimed have fully embraced it. Further, the scale of the success must be commensurate with the scale of the innovation and the scale of the potential target user community.

### 3. Benefit to the community

Benefits to the community can be presented to suit the individual circumstances of the entry. Examples include – but are not limited to – health and safety, national security, environmental improvement, employment, exports, spin-off activity and so on.

## How to apply

Submissions for the MacRobert Award 2012 should be made electronically via The Royal Academy of Engineering website at

**[www.raeng.org.uk/prizes/macrobot](http://www.raeng.org.uk/prizes/macrobot)**

Closing date Tuesday 31 January 2012

## Judging panel

The judging panel comprises nine Fellows of The Royal Academy of Engineering, representing a wide range of engineering disciplines and organisational backgrounds, a representative of the MacRobert Trust and a Chair.

## How the judges work

Following the closing date for submissions, the judging panel will meet to select a short-list of eight to ten candidates. Two members of the judging panel will visit each of the short-listed organisations. Where possible, one member will be chosen for their expertise in the field, the other will often be an expert in an unrelated field.

The case for each short-listed entry will be made to the full panel by the two judges who visited that organisation. As a result of this process, up to four finalists are then chosen. A second round of visits is organised which the whole judging panel attends. When all the finalists have been visited, the judges meet to decide the winner.

**Further information on the Award and guidance notes on how to submit an entry can be found on our website at [www.raeng.org.uk/prizes/macrobot](http://www.raeng.org.uk/prizes/macrobot)**

**If you have any queries, please email: [macrobert@raeng.org.uk](mailto:macrobert@raeng.org.uk)**

# Why you should enter

The MacRobert Award offers many opportunities to promote your innovation and for networking, whether you are a finalist or the ultimate winner.

## • Site visits

Most organisations find the visit process extremely helpful even if they do not go on to win the Award. They benefit from effectively free consultancy on a wide range of possible technical, business and marketing issues.

*"The site visit turned out to have many additional benefits. In particular, it has helped us improve our marketing material because we had to think in a particular way how to present our company, what it does and what the benefits are."*

Professor Nilay Shah, Director,  
Process Systems Enterprise Limited,  
MacRobert Award Winner 2007

## • The Royal Academy of Engineering Awards Dinner

The announcement of the MacRobert Award 2012 will be made at the Royal Academy of Engineering Annual Awards Dinner, held on Tuesday 26 June 2012 at the Royal Opera House in London's Covent Garden. Finalist teams will be invited to attend and will join a mix of representatives from government, heads of industry and the media.

Each of the finalist teams will be invited to mount a display of their project during the pre-dinner reception which provides networking opportunities. Video clips of each finalist will be shown during dinner illustrating the specific innovation behind their submission.

## • Ingénia

An article about all of the finalists will appear in *Ingénia*, the Academy's quarterly magazine. *Ingénia* is sent out to 11,500 people, including leaders and opinion formers both within and outside the engineering profession. Engineering students, MPs and civil servants in relevant departments and city analysts involved in engineering investments also read its thought-provoking and authoritative articles.

## • Exhibition opportunities

The MacRobert Award winner and finalists will be given the excellent opportunity to exhibit their projects at the Royal Academy of Engineering's Forum for Engineering, due to open in Spring/Summer 2012. There could also be a possibility to work with the Science Museum in London to promote their work. Previous winners have provided material for

Science Museum display, Arup Water Cube



the Science Museum's Wellcome Wing, the world's leading centre for the presentation of contemporary science and technology.

*"The MacRobert Award quite rightly deserves its prestigious reputation as the UK's leading engineering innovation award. I think it is a great thing that the Royal Academy of Engineering continues to highlight and reward the leading advances in UK Engineering. The MacRobert Award continues to highlight the extraordinary strength that the UK has in the principles and practice of engineering and this is of critical importance to the wealth and prosperity of the country in future. For us at Microsoft Research, winning the award has been a great honour, a huge encouragement to the research team, and a spur to continue to develop more advanced interfaces between man and machine. I strongly encourage UK teams that have made leading engineering advances to submit their work to the 2012 MacRobert Award competition."*

Professor Andrew Blake FREng FRS,  
Distinguished Scientist and Managing  
Director, Microsoft Research Cambridge.  
MacRobert Award Winner 2011.

Awards Dinner display, Microsoft Research



*"Submitting our entry for the MacRobert Award has, at each stage of the judging, been a superb vehicle for drawing the team together, taking the opportunity to reflect on and recognise the hard work which has got us to where we are, and has been a driver for us to articulate succinctly and clearly the achievements of the whole team. All those involved have enjoyed the experience, and indeed felt privileged to be associated with this award."*

Dr Dominic Walker, Product Development  
Director - QinetiQ Airport Technologies,  
MacRobert Award finalist 2009

# MacRobert 2012: Celebrating 43 years of engineering innovation

## 1972 Scanning success

A piece of engineering that would go on to revolutionise the medical world stood out for MacRobert judges in 1972.

EMI Limited took the award for its Computerized Transverse Axial Tomography, better known as the CT scanner.

The 'computer-aided X-ray equipment' was created by Godfrey Hounsfield, an electrical engineer working as head of the medical systems section of EMI's Central Research laboratories at Hayes in Middlesex.



The success of CT scans, which made it possible for the first time to produce accurate and detailed pictures of brain tissue, led to Godfrey Hounsfield being knighted, elected to the Royal Society and winning the Nobel Prize for Medicine in 1979.

## 1982 Fit to flare

Oil platform safety was at the heart of this year's winner, with the award going to a new and much safer gas flaring system.

Professor Denis Desty of the BP Research Centre and Kaldair Ltd invented, developed and marketed the tulip-shaped Coanda flare tip to discharge large quantities of high pressure gas.



Conventional flaring methods had provided inadequate, producing excessively dangerous smoke and heat radiation. Desty used the Coanda effect, where a fluid flow is

attracted to a curved surface, to stabilise the process – as the gas is forced over the curved surface it draws up air, diluting the gas by up to 20 times its volume.

Not only did the system reduce risk, it was also more efficient and saved money. Desty's invention is now a common sight on oil rigs across the world.

## 1992 Cracking up

BP was once again a key player in the 1992 winner, which went to two engineers for their advances of hydraulic fracturing.

Dr Tim Harper and Dr Paul Martins had to overcome scepticism within the industry as to whether improvements could be made on existing methods of hydraulic fracturing, which made cracks in rocks around a borehole in order to increase the flow of oil or gas.



Through extensive research and testing, Harper and Martins implemented wider fractures and S-shaped drilling to significantly improve flow of oil and gas.

The increases in productivity of fractured wells were not only the biggest advancements in the field in 30 years, but helped save oil firms hundreds of millions of pounds.

## 2002 Shine a light

Ground-breaking development of light-emitting polymers led to the 2002 MacRobert Award for a team of Cambridge engineers. This technology could influence the future of computer and television flatscreens.

The team from Cambridge Display Technologies - Dr David Fyfe, Professor Sir Richard Friend FREng FRS, Dr Jeremy Burroughes (now FREng), Dr Karl Heeks and Dr Carl Towns, helped advance the technology which is now used for smartphones because light emitting polymer displays have thinner, brighter and faster qualities compared to crystal screens.



Cambridge Display Technologies was the first ever spin-out company from the University of Cambridge, set up after Professor Friend and Dr Burroughes discovered they could make polymers that emitted intense light under an electric current – and that changing the polymer compositions produced different colours of light.



## History of the MacRobert Award

The Royal Academy of Engineering MacRobert Award is the UK's premier prize for engineering innovation. It is given annually for an outstanding innovation of benefit to the community.

The Award, first presented in 1969, honours the winning organisation with a gold medal and the team members with a prize of £50,000. The presentation of the Award recognises the successful development of innovative ideas in engineering. It seeks to demonstrate the importance of engineering and the role of engineers and scientists in contributing to national prosperity and international prestige. The winning organisation is given an opportunity to mount a display at the Science Museum in London.

Originally founded by the MacRobert Trusts, the Award is now presented by the Royal Academy of Engineering, a prize fund having been established with donations from the MacRobert Trusts, the Royal Academy of Engineering and British Industry.

### The MacRobert Trust

The MacRobert Trusts were established by Lady MacRobert of Dounside and Cromar, widow of Sir Alexander MacRobert Bt, Founder of the British India Corporation.

In a series of tragic events, Lady MacRobert lost her three sons, one in an accident and two on active service with the RAF in World War II. In their memory she donated a number of aircraft to the RAF and later founded the MacRobert Trusts.

The MacRobert Trusts have now been unified into a single Trust which continues to provide significant support to a range of causes including youth, services and ex-services, education, disabled, agriculture and medical care as well as science and technology. The MacRobert Award was established after Lady MacRobert's death in recognition of her long-standing interest in science and industry.

For further information on the MacRobert Trust, please visit [www.themacroberttrust.org.uk](http://www.themacroberttrust.org.uk)

### The Royal Academy of Engineering

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

