



2015 Ingenious awardees

Jodrell Bank, University of Manchester

Engaging with the Engineering of the Square Kilometre Array

Amount awarded £26,890

The Square Kilometre Array (SKA) is one of the most awe-inspiring and audacious engineering projects of the 21st Century. It brings together partners from 11 countries to address huge engineering challenges in order to construct the largest telescope ever known (see www.skatelescope.org).

In March 2014, the Rt. Hon David Willetts MP announced that the UK will invest £100million in the project, citing that, after the ISS and the Large Hadron Collider, the SKA will be the world's next great science and engineering project.

The SKA International HQ is located at Jodrell Bank. From here, the whole project is being planned and coordinated. The UK also has its own 'components' of the project – with teams across UK Universities and industry working on data transport, timing, high performance computing and array design.

Jodrell Bank is also home to a Discovery Centre (JBDC), which receives over 135,000 visitors each year, including 16,000 for school Education visits.

This project brings together the Public Engagement and Education expertise of the JBDC team with the UK-based engineers of the SKA project to develop public engagement activities to captivate the imagination of both the general public and the engineers of the future.

UCL

Engineering Exchange

Amount awarded £29,602

The Engineering Exchange (EngEx) aims to facilitate community engaged engineering research, teaching and practice. Community engagement is a two-way process, with communities benefiting from access to leading-edge technical expertise, and engineers benefiting from community knowledge and problem identification. The EngEx will:

- 1) make engineering expertise more accessible to local community groups;
- 2) support engineers to better align their work with local community needs.

Ingenious Award funding will be used to develop the research and skills programmes of the EngEx. This project will; develop and deliver a community engagement training programme for engineers, with materials available with open access; publish an open access handbook of community engagement for engineers; run three community forums in London to identify community needs for engineering expertise; support engineers to work on three small engineering

projects arising from the community forums. The EngEx will be launched in October 2014. The activities supported by the award funding will build capacity and networks for the EngEx to deliver the outcomes needed to ensure long term success. The EngEx will become a beacon for community engaged engineering in the UK, providing training, leadership and management systems that can be replicated in other centres.

UCL

3D Printing and Engineering Simulations to Communicate with Teenagers with Congenital Heart Disease

Amount awarded £25,000

On-going research at the Centre for Cardiovascular Imaging (UCL Institute of Cardiovascular Science) and at Great Ormond Street Hospital for Children in London is looking into the potential of using physical and virtual 3-dimensional patient-specific models of congenital heart diseases in clinical practice. The physical models are physically produced with a technique known as "rapid prototyping" (3D printing), whereby an object is manufactured layer by layer. The input for this printing process is gathered from medical imaging data, typically magnetic resonance imaging or computed tomography, and the 3D volume resulting from the process can also be used for simulations in the computer (virtual models). During a clinical consultation, such models can help parents and patients to gain a better understanding of the complex anatomy of congenital heart defects, i.e. "where things are" before and/or after repair, as well as better identifying and describing the problem that has been corrected or needs to be addressed. In this way, parents and children are more and more engaged in the research activity, as we believe that patients and public involvement (PPI) will, in turn, lead to better research design. Long-term benefits in terms of improved understanding are also, importantly, expected.

The SKYLAB

Scotland to the skies @ the SKYLAB

Amount awarded £25,900

The aerospace industry is vital for the UK economy and urgently needs young people to enter the field. Our project will guide young people towards these careers and provide engineers with the opportunity to learn new skills to share their knowledge and experience with schools and the public at two distinct events which link engineer led activities on the ground to a jet display in the sky. One event will be for schools at the National Museum of Flight where engineer designed and led workshops will allow pupils to understand the engineering principles of flight learning by experiment. These will allow engineers to develop communication skills and exchange knowledge to link to the curriculum for excellence. The event will culminate with a jet display illustrating what they have learned for real. The second event will be held at the Scottish Airshow 2015. It will enable engineers to develop communication skills with all cross sections of the general public using engineering based education packs which will be given away free ending up in the home environment of young people. It will

culminate with the first ever engineering lesson using a jet display to over 50,000 people.

UCL

UCell Public Engagement Events, 2015

Amount awarded £3,500

UCell are a team of PhD students, lecturers and industrial partners who provide renewable power and public engagement opportunities to a range of events across the country. Over the past three years UCell has actively promoted a programme designed to heighten public awareness in renewable energy with a particular focus on hydrogen fuel cells. A fuel cell is a device that converts chemical energy stored in the form of hydrogen into electricity without the need for combustion. The UCell stack is twice as energy efficient as a conventional diesel engine and its only by-product is water vapour. The team have attended events including Glastonbury Festival and Green Man Festival with the aim of showcasing and utilising an operational fuel cell stack to power mobile phone recharging and a stage respectively. In addition, UCell has spent time at local schools to educate students about the merits of electrochemical energy using demonstration materials which showcase water splitting, fuel cell, solar, wind, and battery technology.

At-Bristol

On Shaky Ground?: Earthquakes, Fracking, Engineering and Risk

Amount awarded £25,344

Engineers from Mott MacDonald and scientists from The University of Bristol will work closely with At-Bristol science communicators to develop and deliver an authentic civil engineering experience in the form of a special theme day for GCSE students: 'On Shaky Ground? Earthquakes, fracking, engineering and risk'. Integral to the content development process will be provision of training and skills-enhancement in public engagement, which will be applied publicly when the engineers take on the role of mentor for small teams of student engineers. Students will investigate the causes of seismic activity on global and local levels. They will work alongside engineers and scientists to understand the causes and human impact of Earth's natural seismic activity and will apply a range of design principles to build and test their own earthquake-proof buildings. From a local perspective students will focus on the topic of fracking, using scientific evidence to objectively investigate the viability of fracking activity in their local communities. Civil engineers will communicate the passion, motivation and creativity that underpins the scientific rigour of their job, which will in turn develop students' understanding of the role of civil engineering in everyday human experience and community life.

Ignite Imaginations Before Now

Amount awarded £20,220

What is made, created and invented in Sheffield today? What goes on behind those huge industrial doors? What does it sound and feel like to work as an engineer and is it the same as it was in the past? An intergenerational project will explore these questions in the heart of our industrial communities (Brightside, Attercliffe and Tinsley). Working with a professional artist a number of local groups (from young children to people over 65 years) will use archived film, photos and recollections to explore the key changes in engineering in Sheffield over the past 150 years bringing them into the advanced engineering of today. Retired local engineers, current employees and students will support the participant's journey of discovery and development of their own artworks. Visits to different sectors of engineering (academia, industry, charity, social enterprise) will support the participants to record what it feels, sounds and looks like to work in engineering today. The story of engineering will be represented through film, sound recordings, drawings and photographs and will be in situ along an "engineering arts walk", exploring the heritage and modern day activities of engineering. A final exhibition/celebration will be held at the end of the walk.

University of Central Lancashire
3D Future

Amount awarded £18,350

We will run workshops in which different publics can get hands-on with 3D-printing and engage with how engineering is shaping the future of manufacturing. The workshops will be delivered at the University of Central Lancashire (UCLan) to school, girl-guide and family groups. They will also be taken out into the wider community in venues such as cafes, bars and museums. The events held outside of UCLan will be accompanied either by a talk from Dr. Hadley Brooks, who researches additive manufacturing or a 'Talk to an engineer' activity in which engineers speak with participants about their work. Engineers from across the region will be recruited to take part in the project and we will make short, professionally-filmed case studies capturing their passion for engineering and include small engineering challenges for viewers. These videos will be incorporated into our workshops and also be used to create an online interactive resource. We will create a social media campaign #3DFutures that will document the project in real time and create interactivity. We will encourage readers to send pictures and videos of their engineering challenges as well as CAD designs to be 3D-printed and featured on the blog.

Space, Science & Engineering Foundation
UK Space Design Competition

Amount awarded £30,000

The UK Space Design Competition (UKSDC) provides school students with the opportunity to take part in a design simulation that exposes them to the joys and challenges of working in a large industrial team (~40 students). Students

develop a space-based infrastructure that requires challenging and imaginative thinking whilst increasing their interest in and awareness of science and engineering. By using the excitement of space exploration in a real-future world context, UKSDC aims to inspire the next generation of scientists and engineers. The simulated companies have one day to design a space settlement for up to 10,000 inhabitants, taking several factors into account, from structural engineering and communications to entertainment, food production, construction timelines and cost. The companies present their design proposals to a panel of expert judges including local teachers, scientists, engineers and business specialists.

Cambridge Hands-On Science
Cambridge Hands-On Science (CHaOS) Summer Science Roadshows
2015 and 2016

Amount awarded £8,000

The CHaOS Roadshow aims to bring fun, interactive experiments to children around the country. Our experiments are demonstrated by enthusiastic engineering and science students from the University of Cambridge, who want to help spread the excitement of science and technology to a wider audience. We define science in a broad sense, to include engineering, mathematics, computer science and medicine, as well as biology, chemistry and physics; this broad definition fits our key aim of showing how science is relevant to the real world. We run a large public event in Cambridge that is open to the public as part of the Cambridge Science Festival, but are able to reach people from much further afield with our Summer Roadshow. This is a month long tour of schools and public venues such as town halls, leisure centres and county shows. CHaOS is successful because we are able to make science and technology directly applicable to the children we meet – who are able to see the fascinating effects our experiments demonstrate. In kind, our volunteers quickly learn invaluable communication skills and a real delight in teaching their subjects.

Guerilla Science
Fire Organ: Seeing sound

Amount awarded £29,500

Fire Organ: Seeing Sound is a collaboration between renegade experience producers Guerilla Science, musicians and construction and acoustic engineers. Together we will design, prototype and build a Fire Organ: a precision engineered, multi-pipe version of the Ruben's Tube (a century-old teaching tool commonly used in physics demonstrations). This project incorporates engineering expertise and adheres to modern fire safety standards to create a unique tool with which to engage public audiences with music, motion and engineering principles. A 'how to' guide will be produced and shared freely online to enable others to safely replicate this equipment. A new musical composition will be created especially for the Fire Organ in collaboration with musicians, and performed at UK music festivals during summer 2015. Engineers will be involved in the set up and delivery of these festival performances. The Fire Organ will also

form the centrepiece of a participatory workshop for young people, exploring harmonic waves and their significance for our world and built environment, to be delivered by engineers through STEMnet and Guerilla Science's pre-existing links with underserved young audiences.

TROPE

Chain Reaction - Creating an installation at Kirkaldy Testing Museum

Amount awarded £25,240

The art partnership, Trope are the inventors of The D-Scope®, a new medium of concrete animation. They create interactive art installations that seamlessly marry technology, design, sound and visionary aesthetics. Trope will create an interactive kinetic artwork '*Chain Reaction*' with students and practicing engineers inspired by and located at the Kirkaldy Testing Museum in Bankside. The artwork will be on public display and run during *Merge*, an annual festival which exhibits site-specific art that draws on the rich heritage and contemporary culture of Bankside to the public. Engineers will be engaged in the development and delivery of the project, backed up by away days and workshops in applied creativity, narrative and audience interaction. They will also develop skills, knowledge and experience in public engagement as volunteers at the museum. The project will offer further workshops on methods of qualitative research such as designing and using evaluation questionnaires, and learning filming techniques to enable them to document experiments in slow-motion and how to conduct interviews with the public that can be used as texts for documentation, qualitative assessment and publicity. Trope provides a strategic framework within which the volunteers can operate, giving learning opportunities for them to develop systems and procedures for engaging with the public through combining art with science.

Gallomanor Ltd

I'm an Engineer, Get Me Out of Here!

Amount awarded £24,905

I'm an Engineer, Get me out of here! is an engineering enrichment and engagement activity where Maths, D&T and Science school students talk to engineers for 2 weeks, online at imanengineer.org.uk. It's an X Factor-style competition for UK engineers, where school students are the judges. Students read engineers' profiles online, ASK the engineers questions, have live text CHATs with them and VOTE for one engineer to win £500 to spend on further engagement work. The event is split into zones - groups of 5 engineers and 330 students. Zones are themed by topic rather than by discipline, to show students the range of disciplines and opportunities involved in engineering projects. Engineers develop their communication skills, gain a fresh perspective on their work, and find out what young people think about engineering and the role of engineers. Students discover what engineering is actually about, see that engineers are normal people, and explore the wide range of careers that engineering has to offer. As one engineer says "this has been the most

rewarding outreach event I have been part of and would thoroughly recommend it to both engineers and teachers – it was a great pleasure to be part of"

University of Strathclyde

Space for Art: Making Mechanical Engineering in Space Visible

Amount awarded £29,560

Strathclyde Space Institute deals with a number of experimental concepts with a view to protecting the Earth's long term future. Science Fiction is rapidly becoming Science Fact and the achievements and goals of researchers in today's space industry would astound a lot of people. As human-kind's grasp catches up to its reach we are seeing the following boundary pushing concepts given life: from techniques for Asteroid Deflection and Manipulation to Space Debris capture and control with the *Stardust* Marie Curie ITN Network and also Future Air-Space Transportation Technology, Solar Sails, Computational Intelligence (A.I.) and Swarm Intelligence. The 'Space for Art' project will train researchers to translate their work into stories which will be inspiring and accessible to a wide audience out-with the engineering sciences. Glasgow School of Art's Digital Design Studio will provide a series of visually captivating and innovative displays to accompany the researchers' work and engage the public. These displays will then be collated into an exhibition which will tour Science Centres throughout the UK and the Engineers will speak to public audiences about their research using their new public engagement skills surrounded by the exhibits. This project aims to bring engineering concepts to the public through art.

Queens University, Belfast

Creative bridges: Ingenious Design in Civil Engineering

Amount awarded £21,208

Creative Bridges aims to introduce young people in Northern Ireland to creative problem solving in civil engineering design. We will use bridges, because they are highly visible, serve functional and aesthetic purposes, and require specialised design. The main activity will be the creation of "let's design a little bridge" kits for practical workshops aimed at 14 and 15 year old secondary school pupils. The construction materials for the workshop will be based on the Plastruct model making structural sections, complemented by bespoke 3D-printer connector pieces to permit bolted construction and reuse. The shape files for these 3D-printer connectors will be made freely available to schools. These workshops will be run by ten recent graduates in civil engineering, who will register as STEM ambassadors and receive public engagement training. We will also create a set of vox-pop videos in which three significant Northern Ireland bridges are described by members of the public and by three recently graduated civil engineers, who will receive media training, for the purpose of contrasting an engineer's interpretation of the form, function and structure of these important pieces of infrastructure with that of the wider public. These will be the starting point for debate in the workshops.

University of Birmingham

Why is aerodynamics important? - A Wind Engineering View of the World!

Amount awarded £22,245

Civil Engineering is an exciting and broad discipline. However, many people are unaware of the breadth of the discipline and typically associate Civil Engineers with building the 'big stuff'. When people are asked to describe aerodynamics, images of planes and sleek sports cars spring to mind with little, if any, reference ever made to the infrastructure that surrounds them. Such infrastructure forms the veins and arteries that enable our cities (and civilizations) to function. However, building aerodynamics is fundamental to the functioning of not only buildings but cities as a whole. This is one of the small areas that Wind Engineering (a sub-discipline of Civil Engineering) occupies. This project will introduce children and the public to this exciting and challenging discipline through a series of hands-on experiments using a novel and portable wind tunnel (5m long, 0.4m² cross-section). The wind tunnel will be used to analyse a variety of shapes to highlight the challenges faced by wind engineers - designing infrastructure, illustrating the efficiency of natural designs and investigating the wind throw of trees/crops. The main aim of this project is to engage with a wide variety of children to introduce an unknown but fascinating area of Civil Engineering.

Brunel University

Robo-Code – up-skilling Engineers' communication skills, enabling them to stimulate young people through engagement with Engineering

Amount awarded £29,625

Robo-Code builds on Brunel University London's well-established STEM outreach activities to produce a replicable, scalable, cost-effective model. This pilot will include robotics programming and will be delivered in schools by postgraduate engineering students and professional engineers. Offering an almost indefinite legacy period through a "train the trainer" model, it addresses problems associated with many children being disenchanted with science early on in their school careers. Ingenious funding will be used to train and equip a cohort of 40 HEFCE-funded Women in Engineering MSc scholarship holders with creative public engagement and communication skills as well as specialist equipment and tools to be used in engagement sessions. The initial cohort will engage with the public (in this case school pupils) and also with fellow engineers, ensuring Robo-Code is "inherited" by other engineers (both genders) at various stages in their academic learning, ongoing professional training and careers. Robo-Code is attractive to schools as it offers a fun, stimulating, engineering-wide and gender neutral way of introducing pupils aged 11-14 to programming and "engineering thinking" as required by the National Curriculum. Brunel will make the project available via its multitude of communication channels to interested parties and will disseminate learning outcomes widely.

University of Edinburgh

Glass Whispers: Audio and Electrical Engineering meets Studio Glass for Interactive, Personal Art Experiences

Amount awarded £14,500

Through the collaboration of an Edinburgh College of Art artist, a Berklee College of Music (Valencia) composer, and engineers from the United Kingdom, this project will demonstrate how art might interact with an audience (and vice versa) via engineering and technology. It will use live audience events to alter the soundscapes of glass installation/performances, thereby creating ever-changing, personal art experiences for the viewers. The installation/performances will showcase engineering and technology juxtaposed against sound to create a dialogue with the audience about isolation, connection, and human emotions in this wired and Wi-Fi age. Participating engineers and artists will be on site during the "Glass Whispers" exhibition/performances to engage with the public, present the project, and answer questions. More formal workshops (running simultaneously with the exhibitions) will provide hands-on teaching opportunities for the engineers and artists to work with diverse public groups to introduce the interdisciplinary work and concepts behind the engineering, the art, and their collaborative merger.

Kings College, London

Humanitarian Demining: Questions of Engineering, Ethics, and Engagement

Amount awarded £23,328

From Kosovo to Cambodia, from Sri Lanka to Mozambique, civilian populations in former conflict regions continue to be affected by the presence of landmines long after fighting has stopped. According to the UN, an estimated 110 million landmines are scattered in 60 countries around the world, rendering vast areas of agricultural land unsafe. Every day an average of 10 people are killed by landmines, and many more are injured. Globally, the clearing of currently known minefields is estimated to take another 15 to 20 years, and to cost several tens of billions of pounds.

This project will investigate how engineers can drive technological innovation in humanitarian demining and raise awareness through public engagement around technological research. Engineers will participate in a summit with organisations who work in affected areas – bringing technology researchers and end-users in conversation to identify how demining technology can be made more reliable, cheaper and faster. They will also discuss how engineers can build engagement activities around technological research. Following the summit, the project will provide training to 8-10 early-career researchers to develop a public-engagement activity around demining technology, and take this to several science festivals and/or science exhibitions around the country.

Techniquist

Making Light Work

Amount awarded £29,780

Techniquest is a science centre in Wales with a track record of success in engaging the public and schools audiences with STEM subjects. We will work in partnership with engineers in light based technologies to:

1. Develop a Science Theatre show and schools workshop about engineering and the ways in which engineers solve real problems.
2. Provide development opportunities to engineers who will help to deliver bespoke workshops to schools about engineering. Engineers will engage with the students to inspire them with the range of interesting jobs available in the field today in Wales.

Techniquest wants to challenge perceptions of engineering which can often be associated with heavy industries and manual labour. As part of the United Nations' 2015 International Year of Light and Light-Based Technologies, we want to inspire engagement between the public and engineers to explore how light and the engineering of light plays a vital role in our daily lives in Wales today. Techniquest will work with local engineers to develop a range of engagements for visitors and schools, illuminating the potential for future careers. This will ultimately give engineers the chance to share their knowledge, passion and expertise with people across Wales.

Cranfield University

Watch it Made

Amount awarded £30,000

Watch It Made (WIM) is an educational precision engineering experience developed for 12-14 year olds. The experience is based on bringing children into special purpose Manufacturing Learning studios. Housed in these studios are a number of specially tailored precision engineering small scale computer controlled machine tools. These high technology machines are adapted and operated through special (simple) design / manufacturing CAD/CAM software which enables 12-14 year olds without training to; design, fabricate and assemble the major (high quality) components of a precision engineered watch. The WIM studio comprises: lathe, high resolution UV printer and fine engraver. Watch It Made concept and its 1st Manufacturing Learning studio was funded by the EPSRC Centre for Innovative Manufacturing in Ultra Precision. WIMs long term goal is to enable all 650 000 12 year olds in the UK to experience being "proud of producing" a high quality engineered product. And to do so prior to selecting GCSE options. In this way the special "self-creation" pride of engineering may be instilled in youngsters: stimulating their eagerness for our profession. This RAEng application will enable 500 UK school children to undertake the WIM experience taking home their own designed/produced high quality watch.

Abertay University

On the Right Track: Engineering and Education for All

Amount awarded £27,361

Using the exciting backdrop of Dundee City's £1 billion Waterfront Regeneration project, On the Right Track: Engineering and Education for All, will bring engineers from research, industry and academia together with school children, teachers and the wider community. Focussing on the rebuilding of Dundee Railway Station, the project will provide the audience with an opportunity to understand the science and technology behind engineering the build in a real life context - literally from the ground up. The programme will provide training for the professional engineers, giving them valuable experience in public communication of their work. Combined with schools outreach through a Meet the Expert event, a series of short online videos and web-blogs will be created and hosted on Abertay University Outreach and Public Engagement Network (OPEN) website. In addition, print publications in local media at key stages of the building of the Railway Station will extend the reach of the project into the heart of the city community. The importance of the STEM (science, technology, engineering and maths) subjects and the value of the knowledge and skills of the engineers in the development of the city's built environment will be brought to new and diverse audiences locally and beyond.
