

## **Round 5 (2011): *Ingenious* Final project summaries**

### **SHARON BISHOP, Cheltenham Festivals Limited**

#### **Engaging Engineering II – activity based public engagement training and development**

Engaging Engineering II was a five-day intensive public engagement training course for 12 engineers, which took place during The Times Cheltenham Science Festival 2011. Engaging Engineering ran for the first time in 2010, when it was heavily oversubscribed. The 2011 course was intended to build on the observed demand and achievements of the programme in 2010 and took account of areas identified for improvement.

The target group for Engaging Engineering was qualified engineers working in academic, private and public sector organisations. Twelve engineers were chosen to participate. Of these twelve, six were from universities (Southampton, Loughborough, Edinburgh, Bristol, Birmingham), four from industry (GE Aviation, Halcrow, Energist Ltd, Carillion) and two from public sector organisations (Technology Strategy Board, National Nuclear Laboratory).

During the six days of the training course, they received structured training, observed public engagement events delivered by others and planned and delivered public engagement activities of their own, including informal individual activities and two formal events. From feedback on last year's programme it was intended that the group would split into two groups, presenting one formal event each. However the whole group wanted to work together on both events, which left less time for the individual activities.

The two formal events ('Sci-Fi Engineering' and 'Engineering a Home for the Future') appeared in the festival brochure, were popular with audiences and received good feedback. The engineers took part in a 'Meet the Engineers' session and also tried out some 'Guerilla Busking' in the gardens.

All of the engineers were very positive about the training course and all agreed that their knowledge of public engagement had increased through taking part and that their skills for communicating with the public had improved. Some of the engineers mentioned that the programme could have been better organised and this will be considered in great detail if the project continues.

One important learning for the festival is the large differences in the level of support that the engineers received from their employers: whilst some employers saw the value in the training as part of the engineers' professional development and allowed them to attend on work time, others had very little or no support from their employer and were forced to take holiday and attend in their own time. This clearly shows that many engineering organisations (and academics) do not realise the potential of public engagement for their field and engineering in general.

**OLYMPIA BROWN, Royal Institution of Great Britain**

**Engineering extracts: Short films on RiTV to promote and excite about all things engineering**

The Ri worked with six engineers across the UK to develop their communication and presenting skills on camera through the production of 10 high-quality films showcasing engineers and engineering to the general public.

Produced in partnership with two independent production companies the final films were published together on the Ri's video website ([www.richannel.org](http://www.richannel.org)) alongside a range of additional learning resources.

To kick-start the project we created a [call-out video](#) inviting engineers to film themselves explaining a specific task and submit a short audition film on YouTube. Out of 31 applicants, six engineers were selected displaying enthusiasm and passion for their subject, a certain level of natural presenting ability and representing a wide-range of engineering fields, career stages, work environments and research practices.

The selected engineers were:

- Prof Martyn Pavier (University of Bristol)
- Prof Donal McNally (University of Nottingham)
- Dr Hannah Petto (Caterpillar UK)
- Hilary Costello (Cambridge University)
- Dr Jon du Bois (University of Bristol)
- Dr Andrew Robertson (Queen Mary University).

After initial brain-storming meetings, we worked closely with the six engineers to develop scripts that showcased key stories from their day-to-day work. We wanted the collection of films to provide a picture of the range of tasks, ideas and work environments that make up a career in engineering as well as producing stand-alone films that would interest the general public.

Shot on location, all of the films were presenter-led with the engineers using real phenomena and hands-on demonstrations to explain their work. Based on our experience this is the best way to develop communication and presentation skills as well as making the most engaging films possible.

By engaging with professional filmmakers and Ri staff through a full production process the engineers gained an insight into high quality filmmaking and the skills needed to successfully communicate complex ideas on camera. Some engineers found this process difficult at first, even those with wide experience of science communication in other formats. Throughout we sought to offer guidance and tips to allow them present in a more natural style. Working with engineers based in both the academic and corporate environments also presented unique challenges, including issues with both access and final sign-off.

The final 10 films will be published on the Ri Channel in a separate section of the website alongside a range of supporting material including: searchable transcripts and captions for accessibility, personal profiles, image galleries and additional online resources allowing users to explore ideas in greater depth during video playback. In addition, blog posts were published providing an insight into the filmmaking process. The films will also be published on YouTube and Vimeo to increase reach to different audience groups.

The project encouraged engineers to gain confidence and skills in communicating their work through video and, as the videos gain increasing numbers of views, to improve the public perception of what engineering-in-practice looks like, and ultimately to inspire people to pursue careers in engineering.

### **SUSAN BRUMPTON, Medical Engineering Resource Unit (MERU)**

#### **Using photography and words to engage with engineering**

This project was to train the MERU engineers in taking effective, emotive photographs of our young disabled clients and the custom-made equipment we design and engineer for them, and to develop their skills in describing their work – and then to produce a MERU publication and on-line record which explores the impact our engineering work has on our clients and the communities they are part of.

Stage one was to buy two cameras. On the advice of several professional photographers we chose the Fujifilm FinePix JX200, which is semi automated, allowing engineers to simply 'point and click' but also to blur out the background, which is very important when taking photographs of the equipment in children's homes where the background can be very cluttered.

Once the cameras had been purchased we arranged for training by a photography tutor from Croydon College. This was the most successful part of the project, with excellent feedback from the engineers.

"I think I will be able to use the composition examples to good use and not feel that I have to keep back from the subject of the photo"

“When the equipment is being photographed with the client in an un-ideal environment we can now blur backgrounds and make the pictures more focused.”

These images are uploaded onto MERU’s Facebook profile on a monthly basis, and there is a noticeable improvement in the quality of the photographs from most of the engineers. In particular there are now often several usable shots, whereas previously the PR team would have to search through several different projects to find one suitable image.

The next stage of the project was for our PR team to work with the engineers on their descriptions of each project. The engineers are required to write a short description each month for inclusion in MERU’s Internal Progress Report and on Facebook. The changes necessary were often subtle and difficult to quantify, but the impact can be seen in the following ‘before’ and ‘after’ examples.

Before: A modification to a portable toilet seat: a PVC handle was added to a commercially available potty training insert for a young lady to stabilize herself.

After: This modification was for a six year old girl with restricted growth whose parents wanted something that would allow her to use the toilet whilst feeling safe and secure. We modified an ordinary potty trainer by adding a plastic grab bar and made a few modifications to the underside allowing the seat to sit further forward so she could maintain the desired seated position.

The final stage of the project is to collate a year’s worth of project information into a publication aimed at the public. This work is still underway. All the information has been collated, but we have been offered 2 days of volunteer support by a graphic designer from Reed Business Solutions. They will be visiting MERU on 23<sup>rd</sup> & 24<sup>th</sup> October 2012 to help lay out the document in In-Design which will lead to a much more professional publication. Once complete this publication will be available to download from our website.

### **LOUIS BUCKLEY, Guerrilla Science**

#### **Guerrilla Science 2011: taking engineering to music festivals**

Guerrilla Science is an organisation that specialises in running science-based events at music festivals for an adult audience. Our *Ingenious* Award enabled us to work with 15 engineers to develop a series of 10 events that ran at four different music festivals and two London venues in 2011 and 2012, reaching an audience of almost one thousand people.

Participating engineers gained experience of working in close collaboration with science communication professionals, and of communicating their work to an unusual non-specialist audience using innovative formats. An

independent evaluation report showed that the engineers gained a better understanding of how to foster interest in their work among non-specialists, and almost all gained confidence in presenting their work to a diverse audience and in novel and unusual settings. Some engineers specifically noted that contributing towards Guerilla Science improved their attitudes towards public engagement from being something they wouldn't want to contribute to and wouldn't enjoy to something that they feel may be fun and interesting. Festival audiences (people aged predominantly 16-25) at the Secret Garden Party (July 2011 & 2012), Bestival (September 2011), Shambala (August 2012) and Wilderness (August 2012) were given the opportunity to meet engineers and discover cutting-edge engineering projects through an experimental, entertaining and thought-provoking series of events on topics ranging from synthetic biology and robotic fish to wearable electronics and building catapults. Evaluation shows that these events were dialogue-rich and informative, and that there is evidence for them making audiences think about how science and engineering feature in their lives and leading to an increased interest in science and engineering in some audience members.

Guerilla Science were able to establish lasting partnerships with a number of professional engineers, which they intend to continue to draw on for future public engagement activities.

**DR HELEN FEATHERSTONE, Science Communication Unit, University of West England**

**Continuous Loop Project: adventures in wool n' engineering**

The Continuous Loop Project was a creative engineering and craft project using knitting as a device for stimulating conversation about structural engineering. Over 800 people (children, parents and grandparents) worked together to create a tensile canopy structure. Nine engineers took part in three events successfully discussing engineering principles with the visitors. Engineers felt they had improved their engagement skills and confidence in engaging the wider public. Public participants enjoyed the hands-on nature of the craft, were surprised to see craft at a science festival and easily engaged in conversation about engineering as they took part in the activity. Older participants were particularly drawn to the knitting Nancies as they reminded them of fond childhood memories. The project was successful in engaging adults and children with structural engineering through craft. However, it was less successful at engaging the engineering community with fewer than anticipated numbers of engineers taking part.

The initial plans for creating an immersive PE experience incorporating development of an activity, skills development, practice and evaluation was envisaged. This was supported by senior staff in Buro Happold and Arup, however, this turned out to not be appealing to engineers on the ground for two interplaying reasons:

- Perception that Public Engagement was only necessary with children to raise awareness of engineering as a career choice.

- Time commitment was too great, considering the target audience were adults.

We hadn't anticipated this so didn't communicate with engineers about the benefits of talking with adults as gatekeepers for children's career decisions.

In response to this, and in consultation with RAEng, we revised the project to take it to science festivals in cities. This would allow engineers easier physical access as they could pop out of the office for a couple of hours to join in, and the target audience was kids and their families. The Continuous Loop Project attended three events: Bath Taps into Science (2.5 days), M Shed Immersive Week (2 days) and a Family Fun Day at the Royal Institution (1 day). Nine engineers, external to the project team, contributed to the events with ~825 children and adults contributing to the activity and discussing structural engineering whilst communally making a knitted tent. Another four engineers committed to taking part but could not attend the events. In addition to the drop-in activity, Fiona and Helen also developed an interactive talk for the Family Fun Day which they delivered three times during the day with approximately 150 people attending the talk throughout the day.

The project evaluation changed in response to the changing project. It was also scaled down to make it more appropriate to the reduced commitment of the engineers.

**JAMIE GALLAGHER, University of Glasgow**

**How big can we go, how small can we go**

The project developed and delivered an engineering show aimed at a family audience. The presenters and developers were early stage researchers with a keen and established interest in public engagement. The principle applicant was currently studying for a PhD in electrical engineering. Other participants came from academia and industry.

The show titled "How big can we go? How small can we go?" was a guided tour of the dimensions. Shrinking the audience down showing how amazingly precise engineering allows us to 'see' atoms while telescopes have been developed over hundreds of years to allow us to see the largest stars in the sky.

The show was aimed at a family audience and aimed to set a positive image of engineers and engineering as a subject. The show was presented 10 times and was seen by around 600 people at venues including: Cheltenham Science Festival, The British Science Festival and Glasgow Science Centre. It demonstrated in a very visual and interactive way the ability for engineering to allow us to expand our horizons and see objects that lie outside normal human perception. It highlighted the fact that many things that we take for granted have impressive engineering underpinning them.

The show had the additional aim of raising the profile of engineering at the UK's leading science festivals. Engineering is becoming a leading

theme at the festivals and this show added to the impact by introducing it to a family audience.

Impact was monitored by feedback from audience members and facilitating venue staff. It was clear that there was a very positive response and that the children had picked up on many areas that had excited and interested them. Parents also left having had a positive and enjoyable experience. Several hundred comment cards were filled in and where available many families chose to stay on after the show to further explore the themes that arose and in particular to get hands on experience with the props used.

### **PHILIP GARSED, Cambridge Hands-on science (CHaOS)**

#### **Summer Roadshow 2011**

Cambridge Hands-On Science, more fondly known as CHaOS, is a not-for-profit voluntary student group based at Cambridge University. CHaOS believes that that science in all forms (including engineering) is fun and relevant to everyone. In July and August 2011 the CHaOS Science Roadshow spent nearly 5 weeks visiting schools, town halls and festivals all over the country, hosting around 5,000 people at our events. There were 62 volunteers from Cambridge University who staffed the 2011 Roadshow, who all gave up their free time to share their passion for their subjects.

CHaOS events are built around hands-on experiments that are designed for children of all ages, each of which is staffed by a lively and knowledgeable student demonstrator. Small groups of children are guided through each experiment, whilst the demonstrator explains the science behind it in an interesting way and at an appropriate level. At some events we also run short talks, enabling us to show off some of our more explosive experiments.

Our events were well received by both schools and families. Some comments from teachers included: *"The school was buzzing with enthusiasm."* *"All pupils saw how science can be fun and became engaged. Higher ability pupils enjoyed being able to ask more probing questions."* *"All experiments were relevant and well delivered."* *"[Demonstrators were] very enthusiastic and delivered the demonstrations in language that our students could understand."* *"You have given me some great ideas for practicals..."*

At family events we collected 232 questionnaires, representing views from more than 700 people. Highlights of our analysis were that >99% would come to another CHaOS event, that >80% of people said that the level of difficulty was "about right", and that most people said that they'd learnt something! This was one of our favourite comments: *"Many thanks for the science roadshow in Thetford last Wednesday, July 27th. I and, more importantly, my six-year old granddaughter enjoyed it immensely. The outdoor rocket was her particular favourite but the polarisation of light impressed very much too".*

The CHaOS Roadshow is often our volunteers' first experience of communicating technical concepts to the general public. We hope that their experience with CHaOS will help to give them the skills and confidence they need to enable them to share their passion for their subject after they leave Cambridge! One of our engineers said "demonstrating with CHaOS really improved my science communication skills and confidence in talking to (sometimes large!) groups of people...this has been useful when giving talks and presentations as part of my PhD". Two of the engineers who came on the 2011 Roadshow are now on the committee, and are helping to plan the 2012 Roadshow!

### **TARA GIBSON, Glasgow Science Centre**

#### **Build It**

Build It brought the public, from pre-school children to adults, together with engineers to explore how construction impacts on our daily lives. The aim was to bring together expertise in a range of areas, wider than construction alone. Illustrating the breadth of professions involved in major engineering works long before and after construction. Exploring the impact of these works we involved archaeologists, biodiversity experts, geographers, artist performers and the main core of engineers.

#### **Highlights**

- We trained 30 engineers in public engagement skills for Build It. Of these trainees 21 returned to deliver a public engagement experience.
- We attracted a total of 82 engineering experts to take part in our events.
- Build It week in October 2011 saw an unprecedented 16,000 visitors, the busiest week ever in 10 years of Glasgow Science Centre.
- The Build It schools event ran 25<sup>th</sup>-27<sup>th</sup> January and attracted 1847 pupils. We ran both bookable workshops and drop in activities suitable for P4-S2 pupils.
- Our 'Who Wants to be a Scientist?' show was reworked to enhance the engineering demonstrations. The show ran for the first 2 weeks in February to coincide with pupils making their subject choices for Standard Grade and was delivered to 686 pupils.
- Public feedback on meeting with engineers was 100% positive. Similarly the Engineers rated the experience as Excellent, 89% or Good, 11%.
- Build It provided an ideal opportunity to refresh and add to our online resources and enabled us to add three new activities to our Science Bites section.

#### **Legacy**

The Build It project opened up opportunities for us to work with local and national engineering experts from a variety of disciplines. We trained 30 engineers in public engagement skills and hope to work with them in future to deliver engineering experiences to schools and the public. The success of the public Build It event has encouraged us to run an engineering event again this year. We had a fabulous response from

organisations that wished to take part in the event and many have already committed to returning in October 2012.

**DONNIE HOUSER/LOUISE ORMESHER, Bristol Museums**  
**Bristol - Engineering city. Connecting the city's engineering communities, past, present and future**

25 engineers attended the initial core-team planning and training session. 47 more engineers were engaged in the delivery of the public engagement programme. The engineers came from a very wide range of engineering practices and levels of experience.

A specialist trainer provided communications training and coaching.

Four schools and one community youth-agency were recruited to the core team and each was supported by a group of engineers. 17 schools attended events and workshops produced by the programme –

Engineering fairs/family days at M Shed ,

- 403 Key Stage 2 schools pupils
- 155 Key Stage 3
- 24 Key stage 4
- 26 post 16
- c. 3, 820 visitors over 4 family days many with children under seven.
- 450 students/young people were booked into hour workshop with engineers at the M Shed Museum

Workshops and outreach learning events. -

- 15 Key stage 4 students, building rockets and landing systems
- 30 Key Stage 4 students, using centre lathes
- c. 300 Key Stage 2 pupils, building sail boats
- c. 200 Key Stage 3 students, flight
- 15, 16-19 year olds design and build an Olympic skate-ramp

Outreach projects involved c2500 hours of engineers' time (excluding planning time). Some joined half-day workshops and others led projects dedicating up to four days of their time.

Three films were made for use on-line and within the museum displays. Two resources were developed as prototypes for the M Shed Museum displays and tools for learning.

Schools and young people acknowledged that this was something new that schools could not provide. Schools want to embed the project in their curriculum. The project on flight led by the five Academies is a possible annual event.

The museum and one of the schools is discussing setting up a young-engineers club. Rolls-Royce are negotiating with a school so that students can manufacture components for one of their learning programme resources.

Young people responded enthusiastically to interaction with the engineers. Engineers showed commitment and enjoyment of the project. Not all could meet the time commitments but the project gathered support to expand the group of volunteers and was able to meet the demand. This group of engineers will support activities when requested via M Shed or by a school that has built relationships with engineers.

School leaders were committed to the project but success was ultimately dependent on the attitude of individual teachers. School's projects exceeded expectations when the teacher saw the project as achieving aspects of school improvement plans. Projects failed to progress if the workload for the teacher was too great. As a result one of the core schools led a project for four additional schools while two others stopped at the first logistical hurdle.

As the project progressed it became easier for the museum to work with large numbers of engineers from a range of businesses and to attract a new audience from STEM subject leaders.

**ANDY JONES, Techniquest Glyndwr**  
**Switched on to Engineering**

"Switched on to Engineering" was an exciting new project to inspire young people about engineering in the North Wales area. The project brought together engineers, both from within Glyndŵr University and the wider engineering community, the general public and pupils from local schools.

The project was split into three main parts:

- Engineer training in public engagement and evaluation
- An engineering design competition for schools
- A STEM Fair Day

A fourth subsidiary aspect was later added to the project highlighting the work of Techniquest Glyndŵr's new LEGO® Education Innovation Studio.

- Free Robotic workshops for schools and the general public.

Public Engagement training for young engineers was held at Techniquest Glyndŵr on the 17<sup>th</sup> and 18<sup>th</sup> November 2011. Six young engineers took part including PhD students and lecturers from Glyndŵr University. Training was undertaken by Research and Evaluation Consultant, Dr. Sue Cavell. The two-day course covered the basic skills of presenting to the general public and the importance of evaluation. In particular, the significance of Generic Learning Outcomes (GLO's) and the skills to apply this framework to activities.

A successful STEM Fair Day was held on Monday 28<sup>th</sup> November 2011 at Glyndŵr University. Engineers from industry and the University presented a wide range of interesting talks and workshops, including: Aeronautics, Electrical Engineering, Creative Industries, PhD student presentations, Kraft Foods (Cadburys) apprentices, Jacobs Engineering and Lego® Education. The day culminated in a number of career presentations from the Airbus Apprenticeship programme, the University and REME.

**Flying High** was an **aircraft design competition** open to teams of 6 students in both GCSE and A-Level year groups. Working with Glyndŵr University's Aero-Mech Dept, the pupils were asked to design an aeroplane to transport mirror segments of the ESO European Extremely Large Telescope, being built by OpTIC Glyndŵr, in the most economical way. The aircraft needed to carry 1000 segments of the main mirror. Each hexagonal mirror segment was 1.5m across, and 0.1 m thick, and weighed 15kg each. When designing the plane pupils had to consider overall mass, wing and fuselage design, tail plane and fin, and most importantly method of propulsion. Entries were in the form of a 3 view scale drawing – showing top, side and front views. Each design was tested on the Glyndŵr University's flight simulator. The aircraft design that flew the furthest on a set amount of fuel won.

As part of the Wrexham Science Festival, Techniquet Glyndŵr offered three hands-on robotics workshops aimed at the under 12's. Using LEGO® Education's WeDo™ children and adults built a 'Roaring Lion', 'Drumming Monkey' and 'Spinning Tops'; programming their models to undertake a variety of actions. Three further interactive workshops were aimed at ages 12 and over. These used LEGO® Mindstorms® NXT robots and basic programming principals to investigate the various methods of controlling motor function, with comparison to real world robotics.

In addition, six robotics workshops were offered to Key Stage 3, 4 and 5 school groups. Some 236 pupils enjoyed hands-on, interactive sessions, including a group of "Home Educated" children.

#### **PROFESSOR PAUL JOWITT, Engineers Against Poverty**

##### **An Engineer's toolkit for a developing world - Now is the time!**

The context for this *Ingenious* Project is the role of engineering in meeting the UN Millennium Development Goals. Engineering is the key to their achievement through the delivery of effective infrastructure services dealing with issues such as safe water supply, sewerage, transport, communications and solid waste.

The Project is based on the widely acclaimed Institution of Civil Engineers President's Apprentice Scheme 2009-10 which produced a free, open access resource to assist in infrastructure delivery.

[www.ice.org.uk/toolkit](http://www.ice.org.uk/toolkit)

[www.engineers.org.uk](http://www.engineers.org.uk)

The resulting Toolkit consists of 74 structured method cards dealing with Infrastructure Delivery - from inception to operations, and covering topics such as Sustainable Infrastructure; Climate Change; Financing and Anti-Corruption; Procurement; Capacity Building.

The Toolkit was developed by 12 young engineers, drawn from 8 different countries across 4 continents, educated at 12 different universities and working for 12 different employers. The *Ingenious* Rollout events were delivered by 7 of these engineers and 2 of the Toolkit tutors.

The *Ingenious* Project funded a series of 12 Rollout workshops across the UK to audiences of engineers, engineering students, civic society, school pupils and teachers. The objective was to raise awareness of the role of engineering in international development, to encourage the application of the Toolkit and in so doing, scale up the response. The Rollout events attracted 548 attendees.

The venues for the Rollout workshops included five Universities, three Engineering Companies, Schools, the Welsh Senedd and Holyrood. The Rollout programme concluded with a 13<sup>th</sup> event at the House of Commons to a mixed audience of engineers, engineering students, members of civic society, NGOs, and politicians.

**ANDREW LAMB, Engineers WITHOUT Borders UK and Practical Action**  
**Small is ... Festival 2011 & 2012 - family friendly events that to explore technologies that tackle global challenges**

The Small is... Festival is an event run by charities Practical Action and Engineers Without Borders UK in the first weekend of September. The festival aims to attract a broad audience to increase awareness of the role of engineering in international development and sustainability. Inspired by E.F. Schumacher's book 'Small is beautiful', the festival provides wide range of talks and discussions raising these issues.

Hands-on workshops are also run to enable participants (with or without engineering backgrounds) to gain some practical skills and actually learn about the technology by building and making. Workshops are predominantly run by volunteers who have a background in engineering or technology. This is a great opportunity for engineers to engage with each other and the general public and share their research and areas of interest. As the festival attracts people from a variety of occupations, it enables engineers to network with other professionals such as designers and architects encouraging multi-disciplinary interaction, and encouraging engineers (and other professionals) to be involved in cross-disciplinary collaboration.

In addition to the direct engagement that took place during the festival, its work is being continued, thanks to the production of workshop guides. These are produced by EWB UK volunteers in collaboration with workshop leaders and are published free on-line [www.ewb-uk.org/programmes/training/resourcearea](http://www.ewb-uk.org/programmes/training/resourcearea) . The primary audience for these is the EWB UK community. Volunteers use these guides in promoting engineering, appropriate technology and sustainable

development. The guides published after the Small is... Festival 2011 have already been accessed over 500 times since publication.

The outcomes of the festival provide benefits for a huge proportion of attendees. It provides opportunity for organisations to develop their networks. The idea of shared learning and collaboration between different organisations is apparent at the festival, and when asked, nearly all of the contributors stated that attending the festival benefits them or their organisation.

More widely the festival strives to influence and excite children and young adults in science and engineering topics. Each year we have seen an increase in the number of children, families and those from non-engineering backgrounds. We are particularly proud of this as it's a testimony to our approach having a positive impact on engaging the general public in ideas of engineering, appropriate technology and sustainability.

We have a very high return rate of contributors and attendees; collaborations have formed between people and organisations who attended the festival over the last couple of years. The experience of speaking to the general public has also been very beneficial to those in the engineering community; contributors have said that the experience of speaking at the festival has increased their confidence in speaking about engineering topics and has encouraged them to speak at other events.

**SHANE MCCRACKEN, Gallomanor Communications Limited**

**I'm an Engineer - get me out of here!**

I'm an Engineer, Get me out of here! ran from 12th-23rd March 2012 with 6 zones, 30 engineers and nearly 1,600 school students. We believe it was very successful, and the objectives were met.

Over 1,300 school students were actively engaged. They asked questions, took part in live chats and voted for the engineer they wanted to win. 30 engineers were actively engaged. On average they answered over 100 questions each and wrote over 10,000 lines of live chat between them. A further 11,000 people visited the site creating a total of 150,000 page views.

The event involved D&T, Maths and Science students from year 5 to year 13. The engineers came from a broad cross section of industry, academia and the public sector. 50% were from industry ranging from small consultancies to large multinational corporations like Thales and Jaguar/Land Rover. 40% of engineers worked in Government, Academia and the Public Sector and ranged from Royal Navy Weapons Officers to a Project Leader at the British Antarctic Survey.

Students were very interested in engineering as a career, asking all about what the job involves, what it's like to be an engineer, what the pay's like, what qualifications are needed. Over 50% of questions the students asked were about careers and the workday of an engineer. The zones were

themed, which encouraged far more on topic questions than off topic ones in each zone.

Engineers were very positive about their experience. All 15 engineers who gave feedback would recommend taking part to a colleague and want to do more public engagement. 93% are now more confident about communicating their work.

Students and teachers were very positive about their experience. All students surveyed (self-selecting) enjoyed taking part and 94% now understand what engineers do better. 62% of students used the site at home as well as at school. 89% of teachers think their students are now more aware of how their studies relate to the real work, and have a more positive view of STEM subjects.

### **TONY MONAGHAN, Bombardier Aerospace**

#### **High Flyers of the Future**

Have you ever wondered how or why things fly? Have you ever dreamt of taking to the skies or learning what it would be like to be a pilot? Have you ever wanted to know how to build your own models capable of flight? If the answer to any of the above is 'yes, yes, yes!!!' – then this is the place for you.

Using flight as an overarching theme, the High Flyers Programme is a journey of discovery and excitement.

With a wide variety of interactive challenges, pupils soon have an understanding of the art and science of flight, and we'll highlight the job opportunities available in aerospace.

The project greatly assisted teachers and pupils to have a much greater understanding and appreciation of what is involved in designing and manufacturing a modern aircraft. Through the science workshops pupils were able to see the development of scientific principals to allow aircraft to be developed from the early days with the Wright Flyer to today's new aircraft that uses the latest materials to reduce weight and save fuel.

Engineers came to appreciate how they can play a vital role in inspiring the next generation of engineers.

### **MIKE RIDLER, Energise7 Limited**

#### **EBOX - 'Engineering in a box, engineering outside of the box'**

The EBOX project was created to provide a platform for 12 engineers to experience public engagement with both a youth and an adult cohort. The project comprised of the creation of a set of table top experiments and activities which helped children investigate basic scientific and engineering principles including gravity, friction, density, up-thrust, air resistance, change of state, structural engineering in the form of key stone bridges, surface tension and floating and sinking.

The project also aimed to provide the resources, in the form of a kit or set of experiments, which could be used by teachers after the project had finished to aid them in their delivery of the science curriculum at Key Stage 2 level. The EBOX resource was designed to be easily usable by teachers, even those who did not have a particularly deep grounding in science, with a comprehensive set of instructions and explanations for each separate experiment/activity and for the resources to be reusable, robust and not to rely heavily on consumables.

The project consisted of the following format. The 12 engineers received a two day training session where topics such as working with children, health and safety, communication, teamwork and presentation skills were covered. The initial aims and ideas for the project were also discussed at this session. The engineers, in two separate groups then had several meetings with Energise7 (the company managing the project) where content and experiment ideas were created and discussed. Energise7 staff, the engineers and subcontractors, then manufactured a range of these ideas into prototypes and these were then field tested in a number of participating schools. The prototypes were then further refined and over the course of the project the sets of EBOX resources were manufactured and presented to each of the schools which took part in the project.

The project was delivered to 18 primary schools around the country and during a weeklong science summer camp in the summer of 2011 by the participating engineers and Energise7 staff. Over 1000 pupils came into direct contact with the project and experienced the 'hands-on' workshops delivered by the participating engineers and Energise7 staff. The project also delivered training sessions to teachers at each of the schools showing the teachers how to utilise the EBOX resources in their future teaching (over 70 teachers experienced these training sessions).

Feedback from those involved in the project has been positive with the resources having been used within schools subsequent to the initial delivery and with engineers who were involved contacting Energise7 asking if they can be informed of future outreach opportunities. The initial timescale and locational scope for the project were extremely ambitious and the most significant learning point Energise7 feel it has learnt from the project is to allow for more time in content development and manufacture in future projects. Energise7 do however hope to continue the success of the project and now include the EBOX as part of their public engagement offering.

**DAVE ROWLEY/ JONATHAN ELLIS, Bloodhound Project Limited**  
**Bloodhound SSC Ambassador programme**

Underpinning the Bloodhound Project is the need to "inspire the next generation of engineers" through increased awareness and take-up of STEM Education. It was agreed that this would be developed through the Bloodhound Education Team (BET) and through an "army" of Ambassadors. Accordingly, it was vital to ensure that Ambassadors were trained and coached to ensure that they were able to deliver a consistent

and cohesive STEM message regardless of engineering background they possessed. The training programme developed as part of the grant met the needs of both Ambassadors and schools by concentrating on ensuring that Ambassadors could communicate effectively and inspire young people to ask “why, when, how, who and what”. Once trained the Ambassadors were deployed as a. part of a corporate initiative, b. in support of public events, c. at the request of schools and colleges, d. acting independently with local schools and colleges, e. in support of BET college and county events.

Not only did the training improve delegates technical knowledge of the Project but also improved confidence and gave skills associated with working with young people and a better understanding of the UK education system and schools engagement. This enabled Ambassadors to better engage with schools and pupils at a variety of opportunities.

The Training and Ambassador Programmes have been adopted by partners and Sponsors who recognise the aims of the Project and the need for increased take-up of STEM Education (in all areas of and levels of education). It is used by some as part of their CSR Protocols and as part of Colleague development where the skills developed in training and engagement have added additional skills and confidence to Ambassadors.

Ambassadors have successfully supported the BET and Project at a variety of STEM and public events throughout the UK (and overseas in some cases) including (but not limited to), Big Bang, BETT Show, Goodwood Festival of Speed, College Events at Enfield, Southgate, Derby, Newcastle, North Lincs, Teesside, York, Newcastle, Cumbria, Wrexham, Chichester, Bristol, Glasgow and Edinburgh (to name but a few)

#### **NICOLA STACEY, Health and Safety Laboratory**

##### **Crash it, don't smash it - improving your world with engineering**

Engineers influence every part of modern life. Their work includes addressing risk and managing uncertainties. This project aimed to develop the public engagement skills of engineers at the Health and Safety Laboratory (HSL) who specialise in understanding how engineering provides solutions to reduce risk, hence enabling the benefits of technology to be realised while minimising the potential for harm. They also investigate root engineering causes of the failure of work equipment that either did, or had the potential to, kill or seriously injure people. HSL has approximately 35 degree-qualified engineers from a wide range of disciplines including mechanical, chemical, electrical, electronic, structural, metallurgy and materials, computer, control and instrumentation.

Following appropriate training in communication skills and child protection issues, including a Criminal Records Bureau check, HSL engineers, in pairs, twice visited ten local primary schools. On the first visit, they gave a presentation about their job and answered questions that the children had prepared in advance based on information provided in a child friendly CV and information on the HSL web site. On the second visit children

participated in a 'hands on' activity in which they got to step into an engineer's shoes. The activity involved using a scale model of HSL's ten tonne drop rig, originally built to test pit bottom buffers, but since used for testing offshore pipeline protectors from anchor strikes and the robustness of nuclear transportation packages. Children had to design a way of protecting an egg from cracking when set on an impact course with the ground (see figures 1 and 2). They also learnt how to conduct an experiment and record results.

The informal format of the sessions provided a forum for lively interaction between engineers, teachers and children. The overall goal was to promote an understanding and appreciation for engineering and its role in making the world of work safer and healthier.

The participating engineers were all volunteers, and represented a range of grades, ages and experience. About half were confident and experienced at giving technical presentations to their peers or the lay public as expert witnesses in court during inquests or criminal proceedings. A few had previously given presentations at schools, participated in after schools clubs, were involved with scouts or cubs and one, who provided much valuable advice and encouragement, has been a STEM ambassador for several years. The other half had more limited presentation and communication experience, a significant proportion having very little or none. A small team developed a template for the presentation and the hands-on activity including scripts and kit lists. Each pair of engineers who visited schools contained at least one experienced person who was the main point of contact for the schools and led the activities.

### **NIGEL TOWNSEND, Y Touring Theatre Company**

#### **Theatre of Debate: Tele-health**

In partnership with Cranfield University, Y Touring created, performed and published two 45 minute Theatre of Debate® scripts for intergenerational performances in schools and community settings. *Holborn, 1961* by Ben Musgrave and *Don't Be Shy* by Judith Johnson were developed and performed by young people from two schools: Capital City Academy and Sedgehill School and seniors at the Arcola Theatre. The project engaged engineers, artists, young people (14-18) and seniors in an informed debate exploring the issues raised by Telehealth/remote monitoring, increasing their awareness of the impact of engineering in society and on our lives.

A group of young people from each school and a group of seniors participated in an initial workshop which creatively explored the subject of Telehealth/ remote monitoring, the barriers to its uptake, the ethical issues it could raise and people's attitudes to the use of differing personal technologies and the issue of privacy with experts from Cranfield, two playwrights, and a facilitator from Y Touring. From this workshop each playwright created 2 synopses that were then presented to the young people from each school and seniors to choose from. The participants were able to discuss their opinions of the synopses on the Telehealth blog

online (<http://ytouringtelehealth.wordpress.com>) and in facilitated group workshops. As a result of this collaborative process, the young people and the seniors 'selected' one synopsis by each playwright.

Y Touring and the playwrights then led a further creative workshop with the group of young people and seniors they were working with in order to flesh out their ideas and characters. At this stage, and throughout the process, the young people, seniors and engineers had a lot of collaborative input as to how the scripts would evolve into the final plays.

The students, their teachers and seniors then rehearsed each play for performances at the Arcola Theatre on the 21<sup>st</sup> and 22<sup>nd</sup> January. Due to circumstances beyond our control, Capital City Academy pulled out of the project last minute which meant that *Don't be Shy* by Judith Johnson was performed as a rehearsed reading by students from Sedgehill School. Both performances were followed by a facilitated discussion featuring electronic handsets and experts who had participated in the project throughout the process. The audience could participate in two ways; verbally by involving themselves in the discussion and asking questions and through answering questions on the electronic handsets provided.

The project and the resulting scripts engage directly with Science, Arts and Humanities syllabuses at GCSE and A level, as well as the Engineering Diploma, providing a valuable resource for teachers and STEM communicators. The project was supported by an advisory group of researchers and professors from Cranfield University: Windo Hutabarat, Research Fellow and Project Manager, Dr Oluseun Adeogun, Researcher in Telehealth Systems, Mr Jeevan Sagoo, Researcher in Design Rationale, Prof Richard Aspinall, Professor of Translational Medicine and Head of the Translational Medicine Unit, Prof Martyn Thomas, Director and Principal Consultant, Martyn Thomas Associates, Nick Gough, Business Development Manager, School of Health, Mr James Angus, Commercial Director, Integrated Health Management Centre and Mark Istvan, Integrated Health Management Centre. Y Touring were joined by a work experience student, Rebekah Keane, from Central School of Speech and Drama who was a huge asset to the project. Rebekah was key in the organisation of the project and participated in the rehearsed reading due to the last minute drop out from one of the schools.

**PERRY WALKER, New Economics Foundation**  
**Sustained Engagement**

Sustained Engagement involved twelve highly participative events, four in each of three cities (London, Newcastle and Sheffield), on topics about engineering and sustainability. Some of the topics were shared. Every city discussed transport, with London's topic being, "What's the best way to manage personal mobility in London over the next twenty years?" Others were specific to the city concerned, such as Sheffield's "Yorkshire's Manufacturing: Our Future; Your Future! How can we transform our region into the UK Silicon Valley for manufacturing?"

The events used a method called Crowd Wise, developed by Perry Walker, which uses a mix of preference voting and discussion to identify whether there is consensus in the room, and if so where it is to be found.

Each event began with a panel of engineers presenting a range of possible answers to the starting question. Continuing with the example of transport in London, the options were: A. Cater for car use; B. Encourage public transport; C. Promote cycling; D. Promote walking; and E. Use teleworking and smartcard pricing to reduce and spread demand. An initial preference vote showed that B., C. and D. were liked more than A. and E. Small groups worked on each option, helped by the speakers. In the process, the options evolved. A. became "Manage car use with road pricing". E. became, "Promote flexible working (but accept it's not for everyone)" In addition, B. and D. merged. Towards the end of the event, a second preference vote showed that the combination of B. and D. was most preferred, but not by much over C. Given longer, it is likely that B., C. and D. would have combined, in a further move towards consensus.

In all, 59 engineers took part, ranging from professors to PhD students, from firms if not from A to Z at least from Arup to Yorkshire Water. We also had engineers from the public sector, such as from Sheffield City Council. Almost 100% said that the events were enjoyable and interesting, and that the interaction between engineers and audience was good.

324 members of the public turned up. We had a young audience overall. 34% were in the age range 20 – 29, and 25% were 30 – 39. 61% were male: 39% female. Over 70% found the events enjoyable and constructive. Anecdotally, they also liked the degree of interaction, as illustrated by this comment: "This was the most high-spirited, cooperative event on this topic I've been to – and I've been to a lot in the last two years" (Newcastle, 12th December 2011)

Our main partners were: the Great Debate in Newcastle; Action for Involvement (A4I) in Sheffield; and in London the Dana Centre, the British Science Association, the Public Engagement Unit at UCL and Mapping for Change, which is based at UCL.

**DR KLAUS-PETER ZAUNER, University of Southampton, School of Electronics and Computer Science**

**"Blood on the floor": an engineering murder-mystery trail**

The Murder Mystery project invited the public to solve a set of clues using newly-gained science and engineering knowledge and skills. The first aim of the project was to train scientists and engineers for an interesting form of public engagement activity and to foster positive attitudes towards outreach. The second aim was to encourage positive public attitudes towards science and engineering by showcasing some of the research being conducted at Southampton.

The project had to cope with substantive staff movement which led to re-scaled objectives and the unexpected bonus of a new collaboration with Solent Education and Business Partnership.

The first iteration of the project took place in the wider context of National Science and Engineering Week; the University of Southampton Science and Engineering departments have been taking part in this week for the last 10 years. The general aim of this week has been to engage both the learning communities within the University as well as the community outside the university. As part of the Science and Engineering week, these departments have held a "Science and Engineering Family Day" which has incorporated pilot versions of a "Murder mystery" event for the last 4 years.

The Murder Mystery involves solving clues using newly-gained science and engineering knowledge and skills. Participants are given a detective casebook and shown a skit -setting the stage for the mystery that they must solve. The participants then rotate through various science and engineering activities where they are shown how to do an activity in order to gain a clue to help solve the overall Mystery. For instance, an activity based on robotics invited the participants to use robots to pick up clue-objects from areas where humans could not venture.

The set of clue-collecting activities were designed and delivered by engineering students, engineering researchers and scientists from within the University. The activities were pitched at a general audience, with a particular emphasis on families with primary-age children (i.e. the core demographic of Southampton's NSEW attendees).

This primary-age focus resulted in an invitation from Solent EBP to co-host a 'Primary Science and Engineering Fair' on the 18<sup>th</sup> of June 2012 which was constructed around the core activities designed for the Murder Mystery.

The Aims for the Engineers – were broadly to develop and deliver novel public engagement activities to an audience, and the objectives were to develop communication and demonstration skills, team working, time-management and organisation skills.

The Engineers had to develop communication and demonstrations skills during their presentations to their peers, students from other disciplines, visiting school children who critiqued the Engineers during training sessions and to the Engineers' public audiences. The Engineers refined their explanations during repeated public presentations to new visitors on two different occasions – at the Murder Mystery – and the Primary Science and Engineering Fair.

The engineers learned about time management in the context of the Public Engagement project. As the Murder Mystery activities were designed, new equipment had to be selected and ordered in a timely manner. Late arrangements by two of the teams resulted in a doubling of their work loads – the 'Telescopes' and 'Robotics' activities had to be reorganised – because students had miscalculated the amount of time equipment ordered from overseas would take to reach them. Orders of pre-assembled equipment which would have taken too long to arrive had

to be cancelled and both teams had to order equipment which could be purchased locally, but which needed assembling.

Time management for outreach and public engagement is different than for research time management. The Engineers learned how to work under pressure and how to cope with the logistics of moving their audience – in groups of up to 40 - around their areas. For the first Murder Mystery event the Engineers had ten minute time-slots which included introductions, instruction giving, activity time for their participants and conclusions.

Employability skills, such as team work and reliability, were learned and practiced. The Engineers had to be able to rely on their team members to turn up on time, be where and when they had agreed they would - in order to successfully prepare and deliver their public engagement activity.

The Learning for the Participants included the application of new knowledge and practical skills new vocabulary and new attitudes towards Engineering and Science. The participants learned about Robotics, Aero engineering, optics with telescope and fibre optics, bridge-building, mathematical skills.

The 'Engineers' who took part in the project included mechanical, aeronautical and Electro-optical engineers, and the Scientists included Chemists, Physicists, Astronomers and Pathologists. Postgraduate students, researchers, academics and staff members took part.

### **FELLOWSHIP AWARDS**

**DR JEREMY WELLS, University of York**

#### **Is Recording Engineering? Skills and knowledge in the audio industry**

The recording industry fascinates and inspires many people, perhaps because of a sense of glamour associated with the work, but probably also because of the use of sophisticated equipment, knowledge and techniques to create a musical outcome. The term 'recording engineer' is ubiquitous in the UK and elsewhere, on CD liner notes and film credits; but is what happens in recording sessions actually engineering?

Over eleven months of an Ingenious Public Engagement Fellowship I set out to answer the question Is Recording Engineering? Since recording holds such a fascination for so many people, particularly young people, it's a useful starting point for people to engage with the discipline of engineering. The fellowship was a combination of direct engagement with different publics and research into attitudes towards recording and engineering amongst three different groups: recording professionals, students in higher education who were undertaking a degree program that involved sound recording or music technology in some way and those in years 12 and 13, who would be making their future choices and had aspirations in this area.

Nine consultation events or interviews took place in total, with more than two hundred people involved. These events were recorded and transcribed and are available at the project web site. In addition to this repository of raw research materials, there have been three journal papers submitted for review in addition to contributions to three conferences/workshops this year (ISEE 2012, CoDE and SoundSoftware). The transcript of one of the interviews has been accepted for publication in the Journal on the Art of Record Production.

A variety of engagement activities was undertaken during the fellowship period ranging from public talks/lectures to magazine articles through to more hands-on demonstrations and activities. In addition two pieces of audio processing software were developed to illustrate and explore the potential use of engineering in audio processing scenarios. A blog was maintained (and is still available) throughout the Fellowship period.

To ensure sustainability of outcomes beyond the fellowship period a program of training was also undertaken. I attended courses at the Royal Society, University of West England and with the dialogue coach Jill McCullough to improve my skills in identifying and communicating with different audiences.

Overall the project has produced a wealth of new material which gives an up-to-date picture of how the recording industry, and the skill-set it requires, is viewed by those who have experience of working within it and those who are working towards that goal. It has engaged with different groups of people in many different ways about sound recording and the role that engineering has to play within it.

This fellowship looks to illuminate such questions by understanding and challenging perceptions of the work of 'recording engineers' and by communicating these findings to a wide audience so as to contribute to public and industry understandings of engineering in its broadest sense. The Fellow will become a champion of the connections between sound recording practice and engineering skills, illustrating their commonalities and explaining their differences, exploring how engineering contributes to the trans-discipline of music technology. The term recording engineer suggests an individual who records sound by applying engineering principles, but to what extent is this the case? Is 'engineer' (as used in many countries) the correct term or is 'master of sound' (Tonmeister, German) more appropriate? To what extent can the 'recording engineer', a role perceived by some as a glamorous one, illuminate the process and discipline of engineering? Can the recording engineer protect their often precarious and ad-hoc employment by a realisation of the extent to which they are an engineer (via their transferable skills, for example)? Or are they technicians, acousticians and/or musicians for whom the term 'engineer' is entirely inappropriate? To what extent should engineering feature in Music Technology syllabi?