

# mmW @ Cheltenham Science Festival 2007

## Evaluation report

### 1 Introduction

Millimetre-Waves: The vision for the future is a partnership between the Department of Physics at the University of St Andrews and FifeX. It is funded through the EPSRC's Partnerships for Public Engagement (PPE) awards scheme.

Cheltenham Festival of Science 2007 ran from 6-10 June 2007. The Festival included a large number of talks and debates and an interactive 'Discover Zone'. The Festival usually attracts around 20,000 visitors each year, both adults and children.

The mmW stand had a space in the Discover Zone, and a member of the project team was a panellist in the 'Surveillance Britain' debate event. This was the first time the stand had been exhibited and several changes were made during the course of the five days.

### 2 Evaluation methods

An evaluator was present on four of the five days to observe visitors' interactions with the stand and conduct informal interviews. Fifty two interviews involving 90 visitors were conducted. Visitors were also encouraged to leave feedback on questionnaires and to write comments or questions on cards for the scientists to respond to. In total 55 questionnaire/comment cards were collected.

An evaluator also attended the 'Surveillance Britain' event to observe and distribute audience questionnaires. Nineteen questionnaires were collected.

### 3 The stand

#### 3.1 Stand setup

The stand comprised several elements that aimed to explain mmW technologies in an accessible and interactive way. These elements were:

- 8 display boards with text and images about science and technology related to mmW.
- 2 screens showing videos about mmW including mmW images.
- A PC monitor showing information about AVTIS.
- The AVTIS scanner.
- An infra-red camera and display screen plus various props including a balloon and water spray bottle.

- The transmission wheel: and interactive that showed how well light, IR and mmW could 'see' through different materials such as fabric, glass and wood.
- A scalextric track with two cars and speed guns to measure their speed and demonstrate an application of radar.
- Two pixel boards that demonstrated high and low resolution images.
- Areas where the visitors comment cards were displayed along with scientists' responses.

Three scientists from the mmW research group and one member of the FifeX team were present to talk to visitors and facilitate use of the interactives.

### ***3.2 Changes to the stand***

Several changes were made to the stand throughout the course of the Festival based on what was working well and less well.

On the first day, the infra red camera was located on the outside of the stand adjacent to the walkway. It attracted a lot of people to stop but did not encourage them to enter the stand. The panels explaining AVTIS were the least visible, being on the sides of the 'pod' placed in the corner against a wall. Also on the first day, visitors were allowed to control the scalextric cars, which encouraged lots of racing and crashing and almost no engagement with the science.

On the second day the infra red camera was moved into the centre of the stand, which attracted visitors to 'enter' and also caused less blockage to the adjacent walkway. The panel explaining the use of mm-waves in airport security, which relates to the infra red camera, was now furthest from the camera. Visitor control was removed from the scalextric resulting in better links between that exhibit and the science.

On the third day, the panel explaining airport security was moved opposite the infra red camera, which made it easier for the scientists to explain this application and the relevance of the camera. The panel explaining AVTIS was moved directly opposite the AVTIS scanner, which also made that story easier to explain.

Balloons and water sprayers were introduced after day one, which added a further interactive dimension to the infra red camera and also attracted people to the stand. From day two scans of the exhibition room were being shown on the PC monitor, which allowed visitors to see the technology working in real time.

No changes were made for day four, as it was generally felt that the best layout had been achieved in terms of attracting people into the main body of the stand and allowing ease of explanation of the various applications.

### **3.3 Observations about the stand**

A number of observations were made about the final layout of the stand. They are summarised here:

- The IR camera appeared to be the initial draw for most visitors. The demonstrations with the spray bottle are very engaging.
- The AVTIS scanner also attracted visitors, who wanted to know what it was and how it was built. Several commented that it was good to see science that was not on a computer screen.
- Visitors spent any length of time from a couple of minutes to over an hour at the stand. Longer visits usually involved discussions with one of the scientists.
- Many visitors stopped to watch the video playing on the screen that faced outwards from the stand area.
- The scalextric didn't really work as part of the exhibit: visitors weren't making the connection with radar and mm-waves. This was exacerbated by the fact that it was separated from the rest of the exhibits by a walkway.
- The panels on each side of the IR camera screen were difficult to access and read. This was a shame because they explained the basics of the science behind the technology.
- The transmission wheel did not work well 'unmanned' – few visitors were observed to engage with it unless they were with an explainer. Many visitors were observed to look at the wheel, walk up to it, touch it then walk away. It is not the most intuitive exhibit. It was also in a bit of an awkward corner that meant it was hard to approach it if the adjacent stand was crowded.
- The display is a great way of facilitating discussions between the scientists and visitors.
- The impact of the exhibits is greatly increased when the scientists are there to facilitate. Lots of visitors were looking only briefly then walking off while the scientists took their lunch breaks.
- Several visitors read the handwritten comments and replies. This was despite them having to be located low down on the panels.

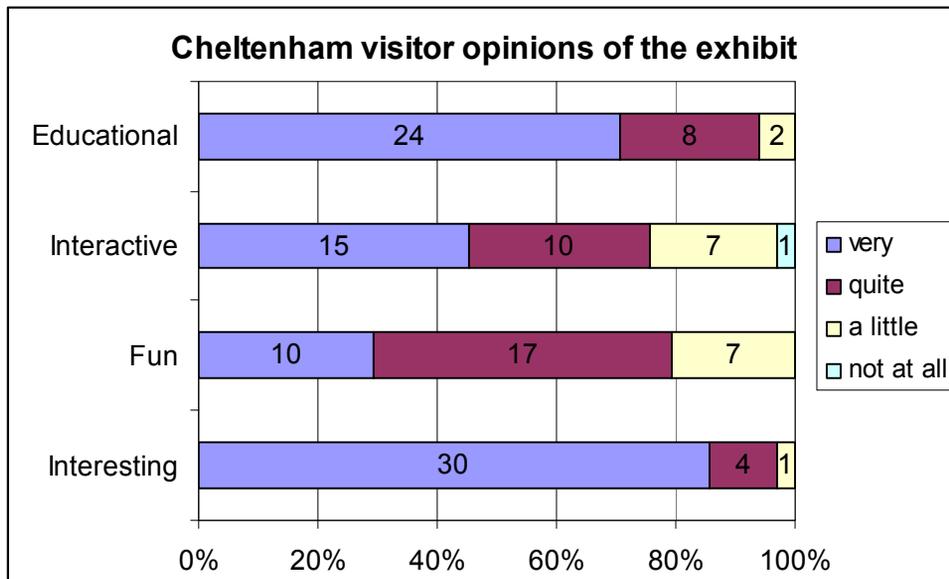
A number of observations were also made about individual elements of the stand:

- **8 display boards.** The text was in block capitals which is not necessarily the easiest format to read. There was a lot of text on each panel and images were relatively small, perhaps as a consequence of the amount of text. There was no obvious flow or story, which made it difficult for visitors to read the panels without interpretation from the scientists.
- **2 video screens.** These invited visitors to stop when sited on the outside of the stand. There were several comments that they were too high for children to see easily.

- **PC monitor.** This was useful for showing information about AVTIS and realtime scans of the exhibition room. It required explanation by the scientists. Some visitors were confused by the fact that they could see the same information on the laptop .
- **AVTIS scanner.** Important as a piece of ‘real’ technology which attracted comment. However did not look as ‘tidy’ as the rest of the stand. A label could have been useful to explain what it was when the scientists were busy.
- **Infra-red camera.** This was the main ‘attention grabber’ for visitors of all ages. It was particularly effective when used with the water and balloon props. For several visitors it was the only part of stand that engaged them.
- **Transmission wheel.** This was not intuitive, but was liked by several children once it had been explained to them. They appeared to enjoy the opportunity to do something ‘hands-on’. Some labelling instructions could have encouraged more visitors to have a go.
- **Scalextric track.** Although this worked better when visitor control had been removed, it was still difficult to relate it to the rest of the stand.
- **2 pixel boards.** These were simple and effective in terms of demonstrating resolution but they were heavy for smaller children to lift and hold.
- **Visitors comment cards and scientists’ responses.** When asked visitors were happy to submit a question. Unfortunately there was insufficient room to display them prominently. Despite this several visitors were observed reading them.

### 3.4 Visitor experiences

#### 3.4.1 Overall opinions of the stand



Most visitors that completed questionnaires felt that the stand was very interesting and very educational. Respondents were less certain about whether the exhibit was fun or interactive, although the results are positive overall.

Lots of interviewees described the stand as 'good' or 'informative'. One young person said it was 'amazing'. Visitor comments about the stand included:

*"Really good to hear about applying technology for good reasons e.g. runway debris clearance" (adult female)*

*"Staff very easy to talk to, v. personable and don't talk above your head" (adult male)*

*"There was a lot to do and the staff were great" (child female)*

*"My children couldn't wait to have a go and stand in front of the camera" (adult female)*

*"It was good to see real hardware [AVTIS scanner] and not just computer screens" (adult female)*

*"There is a lot of information here. A handout would be good to help me and my pupils remember it" (adult male)*

*"The volcanoes were the most interesting thing because I am doing them at school. The people on the stand were happy to answer my questions about them" (child female)*

*"it was good for families because there is something for everyone" (adult male)*

*"I liked the fact that there was some controversial science included." (female adult)*

### **3.4.2 Favourite and least favourite parts of the stand**

From the questionnaire data, the most popular part of the stand appeared to be the IR camera (cited 14 times). This was also the most popular exhibit with interviewees, especially children. Questionnaire respondents also cited the videos (5 mentions) as popular. From the interviews, it was clear that different aspects of the stand appealed to different visitors. The transmission wheel, volcanoes, plane landing and pixel boards were all described as the most popular aspects by different visitors (or as least favourite – although most visitors said they ‘liked everything’). Several visitors (all adults) said they would have liked more information about the medical applications as these ‘could benefit everyone’.

An important aspect of the stand that contributed to its success was the explanations from the scientists. Combined with the wide variety of applications for mm-waves this meant that the stand was interesting to many people and accessible independent of their level of science knowledge. A good example of the successful combination of these factors was with the volcanoes application. Two couples that were interviewed were specifically interested in the volcanoes because they had visited craters in Montserrat, East Africa and Hawaii. In both cases they were pleased that the scientist they spoke to checked to see if they had scientific backgrounds – they didn’t – as it meant the explanation was given ‘in plain English’ at a level appropriate for them. This link allowed them to explore mm-waves through an application that was already of interest to them.

Interviewees ranged in age from young children to retired people. All felt that the science was explained to them in a simple yet non-patronising way. This is an extremely positive result.

As previously mentioned, few visitors said they had a ‘least favourite’ aspect of the exhibit. Some mentioned ‘too much text’ or ‘not enough space’, and a few felt there could have been more interactive or ‘hands-on’ elements.

Several teachers, and some other adult visitors, said it would have been useful to have a handout to take away. The teachers’ want their handout to link to the Curriculum.

## **3.5 Impacts on visitors**

### **3.5.1 Project messages**

From the feedback above, it is clear that visitors enjoyed talking to the scientists at the stand and interacting with the exhibits. This indicates that the concept and content of the stand is essentially sound (although some improvements are planned).

Questionnaire respondents appear to have grasped the key messages of the project. Some of their responses to the questions ‘What, if anything, did you learn from the exhibit?’ included:

*“The idea of wavelength affecting image quality” (adult male)*

*“About millimetre waves and some of the possible applications”  
(adult male)*

*“The application of science in my world” (adult female)*

*“How science, research and practical applications work together”  
(adult male)*

However, it became apparent during the interviews that the messages visitors were leaving with were not always clear. The interviews were an opportunity to explore the learning in more depth, and this threw up questions for some interviewees. These questions included:

*“What was the IR camera for? What is a mm-wave? How close is the scanner to the volcano – would it get damaged?” (adult female)*

*“What is the relationship of the uni to money making activities?”  
(adult male)*

*“What is the wheel for?” (adult female)*

*“What is the main message of this stand?” (adult female)*

*“Why are these scientists here – are they looking for funding?”  
(adult male)*

*“Why was there not more about the medical applications? (adult female)*

Some interviewees were unable to articulate what they had learned, especially younger visitors. When asked, many interviewees described what they had learned about infra-red rather than mm-waves. The IR demo was very engaging so it is important to have clear links with this and the key project messages.

### **3.5.2 Changing attitudes towards science**

Most visitors to Cheltenham Science Festival have positive attitudes towards science<sup>1</sup>. This was the reason that many gave for the exhibit not really changing how they felt about science or engineering.

### **3.5.3 Stimulating discussion**

Questionnaire respondents were asked whether they were likely to continue to discuss any of the issues raised by the exhibit. Two-thirds (67%) said yes, only one person said no and the remaining 30% were not sure.

The comment cards were an interesting addition to the stand. Many people read the cards and the scientists' responses: the handwriting provided a pleasing visual contrast to the professionally printed text of the displays.

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<sup>1</sup> Grant L (2005) Comparative evaluation of science communication activities and their impacts. University of Liverpool, chapter 6

Combining the comments cards with the questionnaires was problematic. People that left comments rarely completed the questionnaires, and if questionnaire respondents did leave comments they were often related to evaluation of the stand rather than their perspectives on the issues. Towards the end of the festival the team used the cards in one way or the other rather than attempting to combine the purposes.

## **4 The debate event**

The Surveillance Britain debate was attended by c.70 people. The approximate male/female ratio was 60/40 (for questionnaire responses this was 53% male, 47% female). 10% of the audience were estimated to be under 25, with 30% between 25 and 45 and 60% over 45. The Festival organisers confirmed that this age demographic was typical for such an event. There were no 25-45 year-olds represented in the questionnaire sample, which consisted of three under-25s and 16 over-45s.

Unfortunately one of the speakers, who would have represented a human rights watchdog on surveillance, was unable to attend. This diluted the debate aspect of the event.

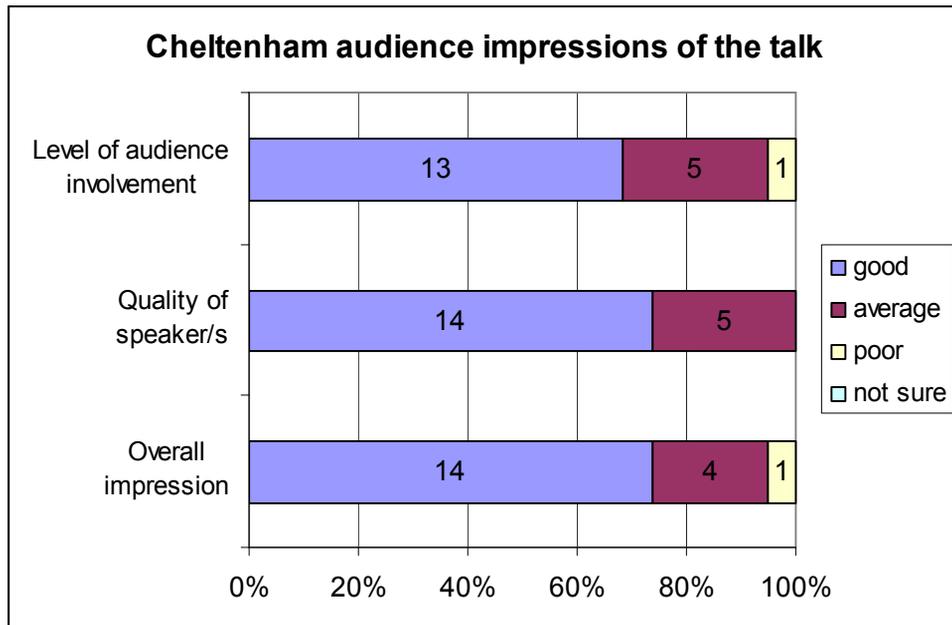
The two speakers were Bill Mawer, of Smith Detection and Dav McFarlane from the mm-wave group. They spoke for 12 and 8 minutes respectively. Dav was able to tell people about the stand during his talk.

Dav was introduced as “a scientist who would ask questions about the growth of surveillance technology”.

The audience were attentive throughout the event and only one person left before the end of the talks and three during the questions.

Several questions were asked about the ‘morality’ of surveillance. Dav was asked specific questions about the effectiveness of surveillance technologies and also raised a point about public reaction if they discovered technology had been available but not used to prevent incidents.

The event provided a good opportunity to promote the work of the group to people who would not necessarily have visited the Discover Zone, where the stand was located.



Overall, audience impressions of the debate were positive. Most respondents (89%) said they were likely to continue to discuss the issues raised at the event and two respondents were unsure whether they would. No respondents said they were unlikely to continue the discussion. These results indicate that the event was slightly more successful than the stand in stimulating discussion, possibly because it was labelled as a 'debate'.

All respondents said they felt either 'involved' or 'a little involved' in the discussion (65% and 35% respectively). No respondents said they felt 'very involved' or 'not involved'.

A majority of respondents (71%) said they had learned 'a lot' or 'some' science (24% and 47% respectively). A quarter (24%) felt they had learned 'a little' science. Only one respondent said they learned no science from the event.

All but one of the respondents said they would attend an event like this again.

*"Thought provoking" (adult male)*

*"Well-organised, succinct. Clear + informative. Lively" (adult female)*

*"A good event that was constricted by the time allowed - not a tight enough programme" (adult female)*

*"Disappointed at the non-appearance of one speaker" (adult male)*

*"Never enough time for this interesting subject" (adult female)*

## 5 Conclusions and recommendations

Cheltenham Science Festival was a very successful first outing for the stand. The debate event was a useful addition although the non-appearance of one of the speakers meant that some of the focus on mm-waves was lost.

The following recommendations are made based on the learning from Cheltenham.

1. There is a need to identify and communicate key messages for the project. Coming up with simple 'soundbites' will help visitors be clear about what they have learned.
2. Reduce the amount of text on the panels; consider starting each one with a question rather than an acronym. Images could also be larger and feature more people doing things.
3. The scientists' positions and affiliations should be made clearer, as should the fact that the applications are research rather than industry-led. This will address visitors' questions about 'who are you? What are you selling?' Also, visitors find the people inspiring, so maybe include 'day in the life of a scientist' panels?
4. The transmission wheel needs to be developed. It is an excellent way of explaining the key messages described previously but is not intuitive. However it is hands on and visitors that have used it responded positively.
5. The scalextric does not work well as part of the exhibit so could be replaced with a different interactive.
6. Asking for feedback about the stand on the video screens could provide an alternative to questionnaires. This would allow evaluation data collection to be separated from asking questions or commenting on the issues.
7. A handout for teachers or interested visitors with some links would be beneficial.
8. The group should seek to participate in workshops/debates as these provide opportunities to reach different audiences, stimulate debate and further promote their work.