PROVIDING AUDIO DESIGN FOR PUBLIC ARTWORKS – COLLABORATING WITH ARTISTS AND THE CHANGING PUBLIC PERCEPTIONS OF THE AURAL ENVIRONMENT

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1 INTRODUCTION

For many years, artworks have been used to help define the quality of the public spaces they reside in and, to some extent, help create. This now includes the aural urban environment, with the emergence and maturation of 'sound art' as a form of Installation Art, along with a growing awareness of the aesthetic environment in our daily lives. Acoustic designers who are passionate about the aural aesthetics they would create can benefit from the public profile that the right artwork can bring to the issue, and the artists can benefit creatively from tapping into sensitivities and allied skills of acoustic and audio designers.

This paper attempts to illustrate what can be achieved collectively in collaborative teamwork between an artistic vision, a technological ambition and enough empathic overlap to achieve a valued outcome. Furthermore, when experiences can be offered that obviate the need for explanations, the clarity of communication achieved cannot be surpassed; if we see it, hear it, feel it, we will know it. To this end, there are collaborative methods that bring the projected aural experience into the artist's studio, or into another space for creativity.

1.1 Historical Perspective on Art in Public Places

The traditions of art in public spaces are as old as civilisation itself. Historically, the type of works that instantly comes to mind might be categorised as jubilant depictions of triumphant or noble figures, including glorified leaders or lauded contributors, such as soldiers or workers. If art has a purpose, it might be seen that this includes the inspiration of a large number of people to credit certain desirable and beneficial elements of their own lives to the works of the individuals depicted, perhaps also to inspire a smaller number of people to aspire to similar levels of noteworthy achievement. At very least the works serve to stave the temptation to take the fruits of the labours recounted by the works for granted.

During the 20th century, public art has included a growing proportion of pieces and installations intended to inspire in a broader sense, appealing to intangible aesthetic values more than factual recollection, aiming to raise enlightenment and self-awareness as much as respect and gratitude. From Henry Moore's well located and proportioned pieces to Anthony Gormley's the Angel of the North, the significant majority of works have remained in the recognisable form of physical sculpture.

However, with the growth of areas labelled as Installation Art and Intermedia Art, technology has been explored and exploited to stimulate senses beyond the static visual and tactile, to introduce time-variance, to respond to interaction, and to generally deliver an experience directly through the senses, rather than through the representation of events or figures specific.

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The work reported occurred while Paul Malpas was at Arup Acoustics, Cambridge.

1.2 The Urban Aural Environment

Modern cities with the proliferation of car engines and HVAC systems are suffering from an increase of noise pollution. This is having a direct negative impact on people's health as pointed out by numerous health studies on the subject, leading to noise regulations such as the Guidelines for Community Noise from the World Health Organization. This had lead over the last 20 years to an increase in number of commissions to promote sound art installations in our cities as escapes to our noise polluted urban landscapes. With the same goal in mind to create more pleasant aural environment, it was not long before acousticians started to work with sound artists to create better living spaces.

1.3 Symbiosis – an Alignment of Goals

Like all new technologies, especially when they are applied to art, early adopters are susceptible to the temptations of employing very unsubtle means of making the technology's presence felt, such as in early stereo recordings, and again when surround sound formats became popularised. There is also the prejudicial but not entirely inaccurate perception that the proclivities that generate great artists do not sit comfortable with those that lead to a talent for the adoption and extending new technologies. Creatively harnessing a field of technicalities to form an elegant expression of the human condition is not an equation that will balance out well very often!

For our part, audio and acoustic consultants have an interest in raising awareness of the 'products' of their work – ie aural experiences and environments. Audio art potentially plays a valuable service to this end, by providing a public and positive platform for exploring aural aesthetic experiences within the pieces. Visual aspects of architecture can be represented in images, and have been in print for some centuries. Aural environments simply need to be experienced to be understood and, hopefully, valued. The artists provide a lively platform for the abstraction and delivery of aural experiences to what should be a receptive audience. In the simplest terms of promotional activity, artistic collaborations would seem to make good sense for those promoting the quality of the aural environment to participate in.

1.4 A Soundartist's Studio

When experiences can be offered that obviate the need for explanations, the clarity of communication achieved cannot be surpassed; if we see it, hear it, feel it, we will know it. If this state can be reached in the artwork, the artist can perhaps feel satisfied with knowing that the set of intangible values relevant to the piece have passed from the mind of the artist to the mind of the 'viewer' with as little interpretation error as possible. To check the progress of the piece on its route to achieving this state it is clearly important to be able to hear the piece as it evolves, but it is probably as important to hear it in its intended aural context, with appropriate acoustic responses and background noise conditions.

Over the last 20-30 years aesthetic rendering technologies, as associated with the term 'virtual reality', have emerged and rapidly matured in some aspects. Visualization rendering has exploded with the market of the game industry and movie special effects; sound reproduction has moved from mono to stereo and on to multi-channel, such as 5.1 or 10.2, or to 3D sound such as binaural, ambisonic or Wave Field Synthesis. The rapid increase of computer speed has made these technologies easier to implement and make accessible; in the past they were only confined to laboratory environments.

Acoustic simulation programs such as CATT Acoustics or Odeon now provide us with impulse responses in any kind of sound reproduction format. Real time sound processing programs, such as Max-MSP or Spat from IRCAM, allow us to manipulate a sound environment in real time. These advances have facilitated acousticians' work by providing better auralization techniques to assist in their prediction work.

Acousticians have now the ability to recreate accurately the aural landscape of a future building or urban development in lab, such as the ArupSoundLab, allowing Acousticians, Artists and, even, Planners to make decisions about the aural experience as well as the artistic endeavour, prior to installation. Recently completed auralization studies at Arup included, for example, the development study for the World Trade Center Memorial Museum consisting of creating an aural experience as people transit from the noisy street level, to the main WTC plaza, to the inside of the memorial such that the transitions of sound environments gradually reinforces the spirituality of the site. At the city level, current work is also been completed in order to decide of the aural landscape of new cities built entirely from the beginning, such as Dongtan in China. For this city, electric cars will be the main motion of locomotion, and with a significantly reduced traffic noise level, acousticians are able to make key decisions at the city planning stage to compose the aural landscape of the city by deciding on the locations and adjacencies of sound making area such as residences, activity centres, manufactures, based on sound quality as much as functionality. An entirely new field of work and perspectives for acousticians are now open allowing acousticians to have an active role in the aural experience of cities and correct the mistakes of the past.

2 EXAMPLE COLABORATIONS

As a representative trend to the active role of acousticians and sound artists in our modern urban environment, the following projects/pieces are described, to illustrate how acousticians at Arup and sound artists have worked together by combining acoustic design tools with artist's visions.

2.1 *The Smallest Of Wings* at Broadgate Arena, Stephen Vitiello, May 2007

The sound artist Stephen Vitiello was commissioned by United Technology (UTC) to compose a sound art piece for a temporary installation at the site of Broadgate Arena in the City of London, during May 2007. The UTC commission was in the context of their marketing strategy to promote their corporate sustainability approach. The artist recommended Arup to the client in order to engineer a wooden structure to hold the installation and also to collaborate in creating 3D audio spatialization effects of natural sounds that he had previously recorded in the Brazilian Amazon Forest. Coincidently, many of the buildings around Broadgate were architecturally designed and engineered by Arup in the 80s. They consist of offices, mostly banks and finance companies, built in a circular layout with a circular arena in the centre as a theatrical effect but also serving as a cohesive and dynamic architectural layout. The circular arena surrounded by the outer circulations offers a very appropriate set up for a multi-media installation, which is precisely what UTC spotted for their latest commission.

The source material consisted of stereo sound recordings (intensity and time-of-arrival stereophony) of the Amazon Forest and American Forests conducted by Stephen Vitiello. Arup's collaboration with the artist involved the use of the ArupSoundLab as a workspace in which to compose the piece, allowing the artist to audition the sound sources in simulated 3D space, sound using ambisonic technology (3rd order). The spatialization was conducted with custom software developed at Arup, based on Max-MSP, along with Spat from IRCAM and objects for Max from ICST (Institute for Computer Music and Sound Technology of Zurich University) and Gerzonic. The composition included the localised and animated sounds of flying birds, insects and moths, along with the sounds of beating wings, in order to create a fully immersive environment. All the spatialization was conducted in the Lab and each rendered to one channel per loudspeaker, for simple playback at the Broadgate Arena. The 22 loudspeakers were on a geodesic configuration and laid out to create smooth flying effects across the entire arena. Loudspeakers were gratefully lent to the project by JBL.

The composition lasts 15 minutes, running on a continuous loop, and the installation was in place for a week, attracting half a million visitors. The result was a highly realistic, immersive effect, convincingly carrying the imaginative listener to a forest environment thousands of miles away from the city site of the work. The visual sensation of been in the city while been aurally transposed into a realistic, deep forest environment offered a true escape and reflection about our modern urban

environment. Workers and businessmen sat at their lunch break in the centre of the installation for a quick moment of escape, poetry and relaxation. The piece not only attracted humans but also birds from the city that would gather in the centre of the sound installation.

Figure 1: The Smallest of Wings in place at Broadgate Arena, London

Links:
www.stephenvitiello.com
www.utc.com/press/releases/2007-06-03.htm

2.2 Harmonic Bridge – Bill Fontana, Tate Modern London, 2006

Bill Fontana is a sound artist who has made himself famous for recreating the sound of one area of a city into another part of the same city, in real time, creating an interesting effect of space folding on itself.

While visiting the new Tate Modern and crossing the Millennium Bridge in front of it, he was inspired to translate the movements and vibrations of the bridge into a soundscape within the gallery. The piece consisted of the bridge vibrations which were captured using accelerometers located on the metal cables which were transmitted then reproduced in real time with loudspeakers located inside the Turbine Hall.

Arup worked with the artist to collect sample vibration signals from the Bridge using accelerometers normally used for building isolation studies. A computer simulation was created of the acoustics of the Turbine Hall and used to play back the vibration recordings in the ArupSoundLab. This allowed the group to listen to how the piece would sound like inside the Turbine Hall, helping the artist to organize and optimize his composition. The piece was then evaluated by the Tate curator and 'sold' in the SoundLab piror to its installation. The sound system was designed and specified by Arup.

The piece in its context was ‘archived’ using Soundfield recordings linked to a simultaneous video camera recording. This was part of the initiative at the Tate lead by Arup to organize an archiving procedure of multimedia installations which suffer from been only temporary and not having a storage and reproduction procedure in a similar fashion to painting or other art forms. The intent is to collect video and Bformat sound recordings of installation so that they could be virtually recreated using a 3D sound and visual reproduction playback system.

The piece had a great impact and received great reviews. “The sound is alive: rising and falling, always different, at once strange and familiar, mysterious and evocative, hypnotic and sensual.” – Alan Riding, NY times.

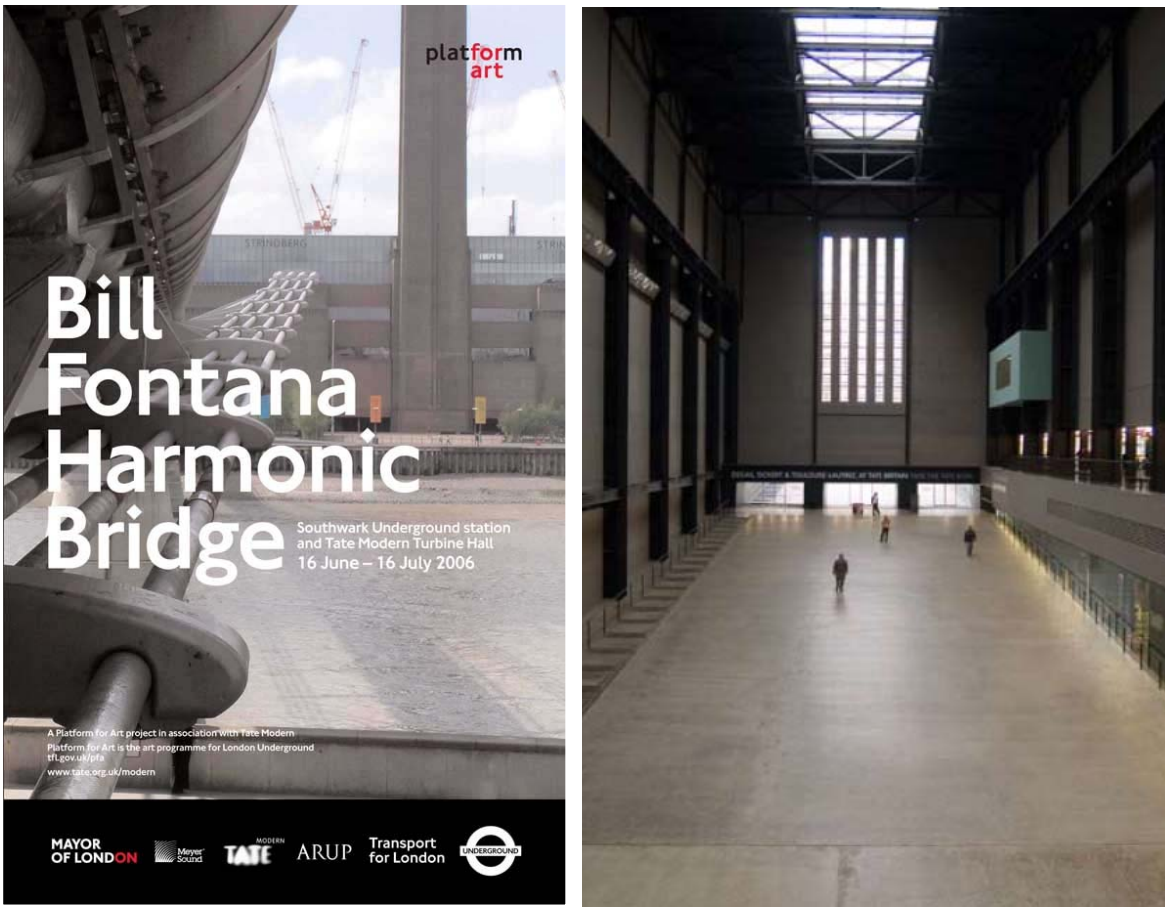

Figure 2: Images of Harmonic Bridge at the Tate Bankside

http://www.tate.org.uk/modern/exhibitions/fontana/
www.resoudings.org

2.3 Dark Aches - Anders Peter Kuhn, Leeds, 2007

Sounds composed to work in concert with real life ‘found’ soundscape.
Improvements made to background soundscape.

Neville Street in Leeds, UK, forms one of the main routes into the city centre from the M62 and M1. It happens to pass under railway lines as they fan out into Leeds City Railway Station, and so the route feels more like a long tunnel or underpass. Traffic levels through the tunnel had increased to levels that dominated what had become a dark and aurally aggressive space. Despite this, a number of retail units, including boutiques, cafes, a bakery, an exhibition space and a 1,000 capacity events venue have established themselves within ‘The Arches’.

As part of a drive to deliver a pedestrian-friendly city environment, Leeds City Council commissioned work by the sound artist Anders Peter Kuhn, as well as lighting features to illuminate and enliven the space.

Three-dimensional visualisations of the proposed lighting schemes were produced, as is now common in the planning of public architecture, and Arup Acoustics were approached to provide the aural equivalent of the sound art compositions that Anders Peter Kuhn was preparing.

It was immediately clear that any aural assessment of the proposed compositions would need to be set against the existing aural environment, in order to be valid. In preparing this, it then became clear that, whereas the pieces played would serve to partly mask and partly intersperse with the existing environment, there was some scope for 'cleaning up' the aural basis that was found in the tunnel.

A scheme was proposed, involving porous asphalt, to subdue tyre-road surface interaction noise, and panels to provide low frequency absorption of the resonant 'rumble'. Just as any other change to a public space, and also to secure a responsible level of public funding were subject to the normal planning process, including the resurfacing, panelling, lighting and audio systems. As part of that planning process Arup generated aural renderings, firstly to judge the benefits of the proposed remedial works, and then to superimpose Anders Peter Kuhn's composition-in-progress. This allowed the piece to be auditioned in the context of the projected aural environment.

Figure 3: Visulaisation image of the Neville Street refurbishment, site of Dark Arches

2.4 *Suspended Sounds*, Ear to the Earth Festival at 3LD Art & Technology Center New York 2006

Ear to the Earth is an international network of musicians, sound artists, scientists, environmental activist concerned about the environment. The events take place in New York and in different cities around the world. Its first event took place at the multi media art venue 3LD Art & Technology Center located in New York.

The show consisted of eleven short sound art pieces created by several sound artists including Luc Ferrari, Joel Chadabe, David Monacchi and others, which were composed in 3D sound by Alban Bassuet in the ArupSoundLab. The event focused on natural sounds taken from all over the world using sounds from extinct animal and birds or from species in imminent danger of extinction which sound recordings still exist. The realistic reconstruction of a natural environment and its extinct species were obviously very impact full and dramatic, and its high degree of realism provided by the 3D sound immersive effects increased its drama. In addition to its environmental impact the show offered a great escape from the noisy urban environment of the city of New York.

The sounds were spatialized over 13 loudspeakers in 3rd order ambisonic using Max-MSP and the programs already mentioned above. Loudspeakers were B&W.

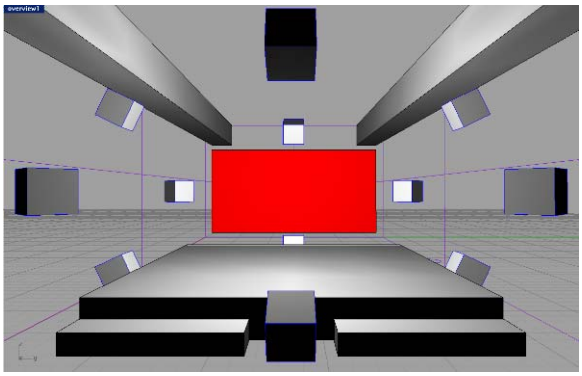

Figure 4: Visual rendering of the audio-visual installation

Figure 5: Photograph taken during the events

Links:

www.eartotheearth.org
www.eartotheearth.org/reports/0610_festival/suspendedsounds.html
www.eartotheearth.org/articles/060927_bassuet.html

2.5 Restoration Drama – Marion Kalmus, Cambridge, 2000

The 'silent' film – using sound to create a reaction.
Restoration Drama by Marion Kalmus – a silent movie of a play performance, projected in a disused theatre with the sound of a ghostly audience responding aurally to the action on the 'stage'.

The visual artist Marion Kalmus was awarded the 1998 Kettle's Yard Fellowship and was Artist in Residence at Cambridge University at the time of this work. In 2000, an installation piece from Marion was commissioned, to be located in a disused theatre in Cambridge. The commission came from Kettle's Yard, a modern art exhibition space in Cambridge (it is actually a department of the University), and Commissions East, a visual arts development agency, responsible for delivering public art in the east of England.

The theatre was of the pre-Victorian form, with a flat floor, entered at a gallery level, and with two further tiers of seating above that gallery. Figure 6 shows an image of the theatre from the 1920's. The stalls seating, and the raked floor they are on, had been removed by the time of the installation, giving the theatre a 'standing' arrangement in the stalls that was reminiscent of an Elizabethan play house. The current entrance to the auditorium is at the Gallery level, with three steps down into the stalls 'pit'. The building was at the time of the piece, and still is, used as part of the Cambridge Buddhist Centre, as a space for mediation.

Figure 6: *The theatre in the 1920's. Note the stalls seating and raked floor have since been removed.*

The theatre also contains the last surviving cyclorama in Britain, which formed the focus of Marion's piece. The auditorium was also in a state of extensive dereliction at the time, and the concept that formed was of a video projection showing images of actors appearing to move within and between the layers of peeling paint: the performances, as it were, remaining as hosts in the fabric of the building. The 12 minute video would contain a silent performance, by actors in 18th century costumes, of a short love story involving a Princess, her apparently unsuitable suitor and her protective father, the King. The confusion and concerns that ensue are dramatically but quickly resolved when it emerges that the Suitor is in fact a Prince in disguise, a fact that wins the approval of the King and Queen and the hand of the Princess.

Curiously for a silent production, there is a narrator, also silent, played by Dai Bradley (the young star from the film Kes). Arup Acoustics became involved when Marion approached Commissions East about commissioning the audio production and installation for this silent video! It transpired that the audio was to provide the ghost of a long departed audience, responding vocally to the drama unfolding on the cyclorama, mirroring the central theme of the actors, and now the audience, still active in the fabric of the building.

Figure 7: *View of the theatre and the cyclorama from the gallery level entrance* **© Marion Kalmus 2003**

Figure 8: *Stills from the piece Restoration Drama* **© Marion Kalmus 2003**

We visited the theatre with the Artists, and viewed the 'rushes' of the video production to date. We determined that the audience should appear to occupy the upper tiers. These were non-accessible to the public due to structural uncertainty, and would be darkened during the production. They would also form locations where, to the visitor, it would be feasible that an unseen audience might be sitting. It was decided that an array of four loudspeakers (JBL Control 1) would be located at the first tier in the front seats, located towards the four corners of the auditorium and facing across the stalls. A single bass unit was also to be used in conjunction with the Control 1's, to give the sound suitable 'body'.

The material devised and produced for the audio tracks developed through a number of attempts to build up the audience response from sound effects libraries. This proved unsuitable as the various soundbites did not sit comfortably with each other, if mixed, and sounded repetitively similar if not.

The final solution to gain the audio material was elegantly simple: a number of willing volunteers were brought into a viewing theatre where the near-complete cut of the video was playing. A pair of microphones were placed directly in front of the group and a second pair further away from them. The video was simply allowed to play and the exaggerated responses of the group were recorded in sync with the pictures. This was repeated a number of times and lastly a number of 'point' events of calls such as "bravo!", "more!" etc were recorded in isolation.

Four stereo mixes of the full length 'performances' were then taken and routed to the four loudspeakers as stereo pairs at the front, to the right side, to the rear and to the left side respectively. The right channel of the 'front' mix would appear in the loudspeaker on the audience right and close to the stage. The left channel of the 'left house' mix would appear in the same loudspeaker and so it would continue around the ring. The bass was simply tapped from the two rear loudspeakers. In addition, the four-channel audio mix included spot effect calls of "Bravo!" etc at various panned locations around the four units, giving the impression of vocal individuals at a selection of seats within the house.

The resulting effect was of a spatially distributed audience that gave an uncannily convincing impression that the room was occupied busily, even when the viewer knew with certainty that hey were the only person in the space. This included at lead-in full of audience participation and the murmured aftermath when the curtain finally dropped. The whole event was then looped and written to DVD, with the audio occupying the front stereo and rear surround channels correspondingly.

The event ran for three weeks and attracted a good number of visitors. The audio element worked surprisingly well, going further than the requirements in effecting a real sense of anticipation when passing through the theatre foyer towards the auditorium.

2.6 A Record of Fear - Louise K Wilson, Orford Ness, 2006

Disembodied Sound
Sound of events no longer active in a disused space where they once occurred.
The Aural as theatre alone.

Louise K Wilson's artwork takes the form of installations, sound pieces, live events and videos. For many years, Louise has been exploring perceptual, social and cultural aspects of science and technology, and specialises in 'disembodied' sounds transplanted into spaces where they may once have occurred, to "make audible what is absent or intangible".

Orford Ness is a spit of land of the Suffolk coast, now managed by The National Trust, but the site of strategic military testing and operations for most of the 20th century. Accessibly by foot ferry from the NT office in Orford town, or by a four hour, 10 mile off-road drive from Aldeburgh up the coast, Orford Ness is also Europe's largest vegetated shingle spit and provides a protected habitat to a number of wading birds and rare species, including an important breeding area for Little Terns.

Militarily, Orford Ness' history started around the time of The Great War (WW I) with the early development of parachutes, as well as providing target practice for first trials of aerial bombing. RADAR was also first developed at Orford Ness, and much later the long wave 'over-the-horizon' RADAR project called Cobra Mist, intended as an early-warning system during the Cold War, was located on the spit, in a shielded building now used by the BBC World Service.

Perhaps the most sinister image associated with Orford Ness is the siting of laboratories during the 1950's and 1960's, for the stress testing of nuclear missiles. No nuclear cores were involved in the tests, only the missile shells with their initiator charges. However, these charges were themselves of significant potency, and the distinctive 'pagoda' buildings that help define the somewhat famous skyline of Orford Ness were built to contain any accidental blast that may have occurred. According to records, no such blast ever did occur, even though the missiles were tested in extremes of exposure to vibration, shock, acceleration, heat, cold, humidity and even the growth of lichens on the surface. Essentially, they were tested for conditions to simulate extended periods of storage in silos, to find assurances that they would function when required to, and then for conditions that simulated launch stresses, to find assurances that they would *not* function not required to!

Arup Acoustics were appointed by Louise to provide audio design, post-production and installation services for her one-day event at the Ness on Sunday 25 September 2005. Louise had previously

recorded performances of 15th Century Madrigals, sung by the Exmoor Singers in a number of key spaces within the decaying buildings that make up the missile research campus. Paul Malpas and Louise visited site to look for good spaces to install these and other recordings for the event, and to plan the installation logistics. Access is via a passenger ferry only and there is no electric power on the 'island'. This makes for some practical challenges when providing the audio!

Although the original approach to Arup was for advice on room acoustic responses and loudspeaker types and locations, after auditioning some of the recordings in the spaces, the Artist and Consultant began to collaborate on the audio content of two of the exhibits.

Louise also installed a new piece by composer Yannis Kiriakides, called U (after the symbol for Uranium), in one of the main testing spaces, referred to as the 'pagodas'. A 4.1 mix of the piece was played from a standard DVD player in a square arrangement of JBL Control 1's with sub-bass. The piece comprises disconnected choral singing of a significant phrase, interspersed with sine wave sweeps, which was well received by the visitors who spent considerable time in the serene environment it created.

Another installation was conceived for the old Centrifuge hall, which once housed the centrifuge test equipment that now operates at Aldermaston. The building is derelict over the main area, but has an accessible viewing space where the control room would have been on the first floor. From there, the visitors could view into the space and hear the rumble, throb and whir of the centrifuge running, with the aid of recordings made at Aldermaston and a loudspeaker rig kindly loaned by Tony Andrews of Funktion One. This comprised two Resolution 2 (powered) units located out of sight in the centrifuge area, with their stunning Infrabass in the adjacent concrete access route. The Infrabass generated everything from 80Hz downwards, as far as 10hz! The result was remarkable, with the sense of enormity and power become apparent from the building before even arriving at the door.

The Ness is a remote and atmospheric place, made more mysterious by the constant reminders of its history intertwined with secrecy and intrigue. The buildings are being looked after by National trust on the basis that nothing will be done to cause damage or accelerated decay, but neither will they be restored or even prevented from their own natural course of decay. This has left us with a poignant reminder of what the 20th century was, in terms of warfare, and what it might have become. The physical location so far from any busy traffic or industry, with just the wildlife and the North Sea as an aural backdrop further rarefied the sense of event that each of the buildings that housed the installations instilled. Overall, this was a very moving experience for many, that also raised a great deal of interest in just listening to the effects of the buildings we occupy.

3 CONCLUDING REMARKS

Artists and art audiences are broadening what they consider to be art and now comfortably encompasses abstract and invisible aesthetic experiences. A number of artists are going further and are exploring sound art as a specific and isolated medium. As consultants, we benefit from the greater awareness that this raises of the aural environment, and further for the opportunities for experimentation and discovery, with regard to abstract aural experiences. In collaboration, the artists benefit from an infusion of acoustic realisms, where it is beneficial, and the ability to anticipate the net aesthetic effects of conceived works in proposed spaces. In fact, spatial audio tools are being used to audition pieces in the acoustic conditions they are likely to encounter, allowing the artist and consultant to collaborate on a virtual reality canvas.