Vol 36 No 2 MARCH/APRIL 2011

ACOUSTICS BULLETIN

in this issue... **RS2010 Conference Report**

plus... **Review of trailing edge noise generation**

Recent developments in aircraft noise annoyance

Noise Policy Statement for England: Significance, application and implications

Institute of Acoustics

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Contents

Front cover photograph: This issue of Acoustics Bulletin includes an interesting review of the current state of knowledge on the noise generated by aerofoils at low Reynolds numbers. Such aerofoils - the Australian spelling has been retained in the article - are seen in a multiplicity of applications from cooling fans through compressors and unmanned 'drone' aircraft to micro wind turbines. The cover photograph shows a typical micro turbine in a rural area (although mechanical noise propagation from the support tower can be a more urgent problem with such installations) on which a more thorough understanding of aerodynamic noise generation would be warmly welcomed.

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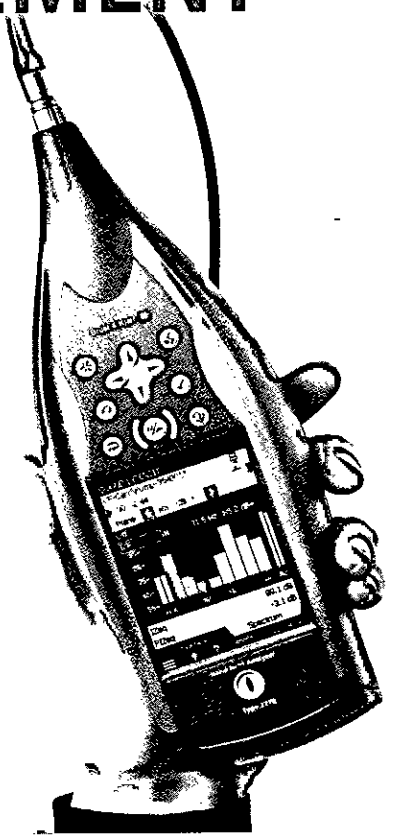

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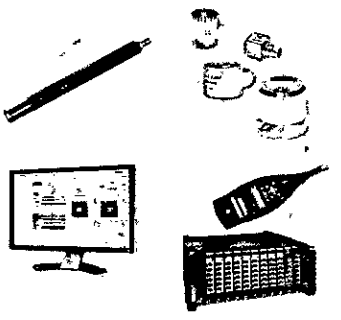

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Dear Members

I never realised being President would become so political. This is nothing to do with the internal workings of the Institute, but 'political' with a big 'P', involving Ministers, MPs and Governments. Radical changes to acoustical regulations and legislation are likely to happen and the Institute is trying to influence the political decisions. I would be very interested to hear your views on this influencing work, whether positive or not, because this is a first for the Institute. Members of the Building Acoustics and Environmental Noise groups have been doing excellent work.

Elsewhere in this issue of Acoustics Bulletin you will see a copy of the letter sent to the Minister responsible for the Building Regulations revision. Similar letters were also sent to the Department of Education because the key issue is school acoustics. You should have received an email suggesting you raise the issue with your local MP. The Institute's line is that there is a need for statutory control but we remain open about what form that might take. We have working with friends in the Association of Noise Consultants (ANC), National Deaf Children's Society (NDCS), Noise Abatement Society and Environmental Protection-UK on this issue. The ANC and IOA are also currently working to formulate guidance to be issued if the revised Building Bulletin covering schools is not published by the Government.

The situation with Environmental Noise and PPG24 is also unclear as Acoustics Bulletin goes to press. There are parallels with the discussions around the Building Regulations. If the Government removes PPG24, should the Institute be developing and publishing guidance for industry? Is this what the 'big society' and localism are all about - Government no longer paying for guidance but expecting us to fund it?

Changes in universities, especially the increase in tuition fees, have attracted a great deal of media attention, and understandably, people have been asking me about this. What has gained less attention than the radical changes to student funding is the other cuts in research and government funds that are happening. To gain research funding there is increasing emphasis on impact, demonstrating how a piece of academic work will end up being used. Universities will increasingly need support from industrial members if they are to unlock government money.

With tuition fees, we are currently in the lull before the storm as the drop in funding for the next academic year is not so large. But when increased fees start in 2012, many universities will be put into severe financial difficulty, resulting in redundancies and possibly even mergers. Will niche courses in subjects such as acoustics survive in such commercial markets? It is very hard to predict.

I will try and keep you posted on developments via ***twitter.com/ioa_president*** *when information can be published publicly. For those who do not follow my twitter feed, this is what you are missing.*

13 December 2010: Geoff Kerry to become Vice-president, Groups and Branches in July 2011 (at AGM)

22 December 2010: Noise Action Week 2011 will be on 23 to 27 May: for ways of getting involved see http://www.noiseactionweek.org.uk/: there is some emphasis on schools

7 January 2011: Government thinks a few trees prevent noise: High-speed rail route to get 2m trees for shelter, see http://t.co/N1HsD

29 February 2011: PR company claims Facebook time is costing companies a fortune. Don't they have twitter?

Trevor

Trevor Cox

PRESIDENT

Reproduced Sound 2010

Paul Malpas. Conference Report

Reproduced Sound is the annual conference organised by the Electroacoustics group of the IOA, and is now in its twenty-seventh year. In November 2010, 'RS', as it is known to those familiar, took itself to the Wales Millennium Centre in Cardiff, where the welcome was warm and architecture impressive.

RS has nearly always been a fully residential conference, with the undoubted value of spending quality time with other authors and delegates into the small hours having been fully understood to RS attendees long before the term 'networking' came to mean much more than preparing for a day of fishing! Unusually, RS2010 based itself in this excellent international concert hall, which not unexpectedly does not include beds for the night. It does, however, include three great performance spaces, one of which was at our disposal for the three days we were there, not to mention the design team behind the venue.

Humble beginnings

As has become customary since RS24 in 2008, RS2010 started on the Wednesday evening with a welcoming reception and a tutorial on the broad base of subjects typically covered at Reproduced Sound. Our President, Trevor Cox, kicked off the evening in his usual enthusiastic style, warming the room to the niggling questions in electroacoustics that trouble us all. Then John Taylor of d&bAudiotechnic took us back to basics with an excellent tutorial, providing great visuals to take away to explain wave motion, and an enlightening demo of multiple-source interference and directivity patterns, experienced firsthand at one tenth scale. Paul Malpas finished the session with a simulation of speech affected by simulated reverberation and background noise, coupled with a method of measuring the virtual environment directly, allowing real-life parameters to be adjusted, listened to, and the results measured. The careful user can visit all sorts of acoustic spaces, listen to a sound system in them and get reliable data from measuring them, without having to leave their seat.

That concluded the formal events of the Wednesday evening, as such they were, and delegates retired to the bar at the nearby St Davids Hotel.

In session: Thursday 18 November

The aural environment

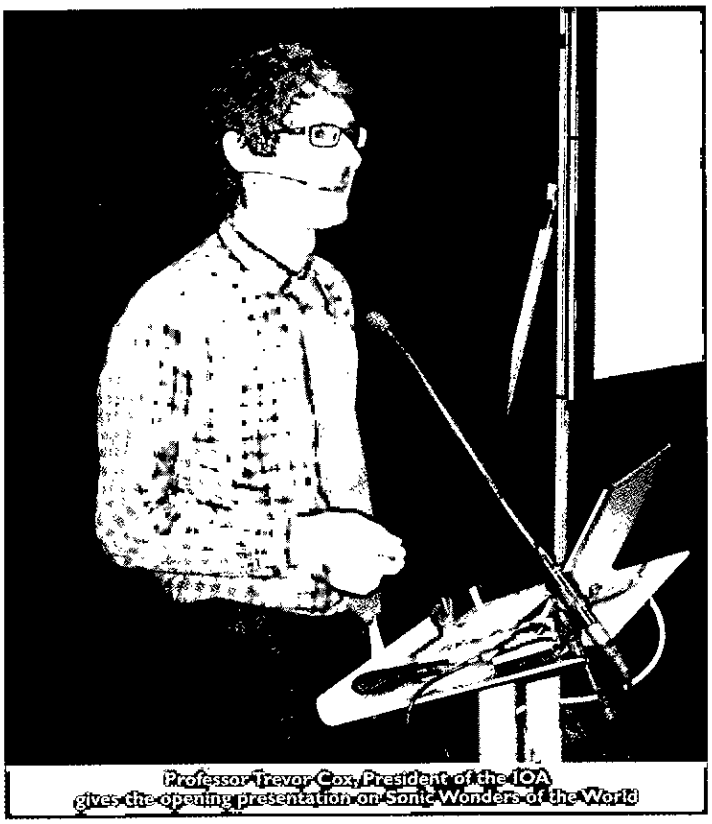
- chaired by Paul Malpas, Engineered Acoustic Designs

Thursday morning saw the start of the formal paper sessions, with Paul Malpas offering the chairman's welcome and going on to chair the first session, appropriately entitled *The aural environment* to open the full field of RS subjects. **Trevor Cox** gave the opening keynote paper, enthusing us to consider the wealth of positive acoustical phenomena in the natural environment in *Sonic wonders of the world.*

Following this, **Gareth Fry** introduced us to *The role of the sound designer in theatres.* Gareth had spent time as an acoustical consultant at AMS before pursuing a well considered career in theatre sound, so he was well qualified to bring the worlds together for us.

Physical acoustics - *chaired by Bob Walker, consultant.*

After coffee, Bob Walker chaired a session on Physical Acoustics, starting with **Glenn Leembruggen**, who presented a *Comparison of measured and predicted sound absorption properties of polyester fibre insulation using an unusual plane wave tube* in which he described impedance tube measurements using time domain windowing methods with a single microphone. By separating the forward and reflected waves in time, the frequency dependent reflection coefficient of a number of different types of materials could be determined. Using a tube of 6.6m length and 88mm internal diameter, measurements could be made over a frequency range of about 50Hz



Professor Trevor Cox, President of the IOA, gives the opening presentation on Sonic Wonders of the World

Professor Trevor Cox, President of the IOA, presents the IOA's Peter Barnett Memorial Award to Dr Leo Beranek

to 2kHz. Results were presented for a number of fibrous and perforated materials, with and without rear air gaps.

Then, **Prof Jamie Angus** presented *Approaches to single-microphone reverberation measurement.* Using a single microphone and LMS-based adaptive filtering Jamie showed how the impulse response of the room could be extracted from the existing natural sound in the room. The key to the method was the introduction of a short time offset, of about 80ms, to de-correlate the two input signals to the adaptive filter and thus allow the filter to produce a meaningful impulse response. The use of the delay was justified by the fact that reverberation responses generally do not begin until after the end of the early reflection arrivals.

Concluding the session, **Lucy Elmer** presented *Subjective perception of room mode control methods based on multiple sources and signal processing* in which the performances of eight different room mode control systems were evaluated subjectively. Twenty test subjects were used in paired comparison tests and direct attribute assessments. Detailed analysis of the data was also described. In the following discussion, Lucy replied that no redundancy analysis had been carried out on the quality descriptors used.

Appended to that session, we were treated to a 15-minute introduction to our venue, the Wales Millennium Centre, from its chief architect, Jonathan Adams of Capita Architecture. This short talk served as a prequel to the tours made available during the extended lunch breaks on each of the two main days of the conference.

On tour

During an extended lunch break, the first set of tours of the building were conducted by **Jonathan Adams** and his colleagues at Capita Architecture, **Rob Harris** and his colleagues at Arup Acoustics, and **Richard Burgess** and his colleagues from the technical teams at the WMC. Three parties of up to 15 delegates each toured in turn the backstage get-in areas, the lighting and sound control rooms and the grid above the stage house. This was a rare opportunity to quiz the architect, acoustician and theatre technology teams at the same time about the design conflicts and decisions that made up the venue, while examining the venue itself close up. A question and answer session followed back in the auditorium and the general feeling was we had witnessed the fruit of intelligent inter-disciplinary design to produce a facility that ticked all the boxes and approached its quality, facility and cost balance with all the right priorities.

Concurrently with the tours, there was an opportunity for other delegates to hear auralisation examples prepared by **Gry Nielsen** of Odeon A/S. These were played back in the conference hall over a multi-speaker set-up managed by **Chris Full** and **Andy Taylor** and supplied by **Nick Screen** and **Steffan Lewis** of Duran Audio. This same team had also managed, to an impressive standard, all theatre and AV production of the event, with the full and valuable cooperation of the technical teams at the WMC.

Both the tours and the Odeon demonstrations were repeated on the Friday, giving all delegates the chance to participate in both these and the venue tour.

Settling down

Room acoustics

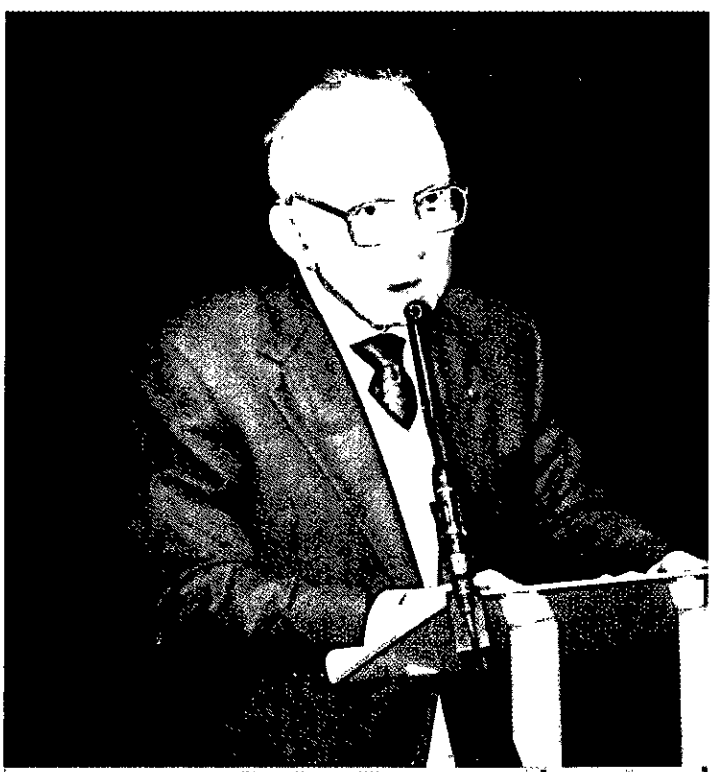
- chaired by Trevor Cox, University of Salford and President of the IOA

After lunch, it was time to settle in to an extended session on Room Acoustics, starting somewhat historically with the award to **Leo Beranek** of the well deserved Peter Barnett Memorial Award 2010. Trevor Cox took up his formal position as IOA President and read an impressive citation of Leo's long and hugely significant career. Following his acceptance of the award, Leo presented the Peter Barnett Memorial Lecture 2010 on the *Strength of sound measure, G and its importance in evaluating and planning the acoustics of halls for music.* He explained its evaluation, calibration and how it can be used to plan the acoustics of auditoria used for music. He mostly examined an 'average' G for a hall, and showed how it could inform explanations of issues such as listener envelopment and the thickness of the walls in a hall.

Andy Munro then described the development of the *BBC glass studios design*, a prototype of a number of studios which are being used by the BBC for speech recording. Andy presented an overview

continued on page 8

Concert pianist and Reproduced Sound regular Shelley Katz gives his performance



Dr Leo Beranek gives the Peter Barnett Memorial Lecture on Strength of sound G, and its importance in evaluating and planning the acoustics of halls for music

Reproduced Sound 2010 - *continued from page 7*

of the acoustical design challenges and the successful outcome of the projects. The glass pods are shaped to reduce coloration; sound is directed towards absorptive material to provide reflection control.

Following a tea break, Ken Dibble took over the chair and **Mark Murphy** of Vanguardia and **John Pellow** of Meyer Sound Laboratories described their work together on the *Design of the Nokia Concert Hall Tallinn with respect to variable acoustics*. This 1800 seat, shoe-box hall has been designed to have a natural reverberation time of one second, but a Constellation acoustic enhancement system has been designed to lift this as far as 2.5s, while supporting a reverberant level of up to 105dB when required within the hall's wide range of intended repertoire.

Continuing the theme of variable reverberation, the presentation up next was entitled *Variable reverberation characteristics in multi-purpose auditoria - theoretical ideals and practical realities*, prepared by **Paul Scarborough** of Akustiks. Paul was unable to attend but the material was ably presented by Helen Goddard, who coped admirably considering she had only very recently found out that she would be presenting. You would never have known!

Next on was **Barry Watson** of the University of the West of Scotland, Paisley, with a paper on *Ambisonic replication of concert hall acoustics for solo musicians within a digital audio workstation: initial evaluation*. This paper examined the use of audio recording techniques to record and reproduce the aural experience of concert spaces from the point of view of the musician. The potential is to allow musicians significantly more rehearsal time in the acoustic environment of the space, albeit virtually, allowing them to develop their playing techniques to the space in the way they would do naturally in the actual space. Subjective testing within the department showed a 'respectable reproduction accuracy'. The group proposes further developments and in-house plug-in developments for the DAW system used.

For the record

The last paper of the Thursday session was from **Ian Knowles** of Arup Acoustics, on *The acoustic design of the BBC Hoddinott Hall*. Ian described the hall which was built in 2008 as an adjunct to the WMC venue, to provide the new home for the BBC National Orchestra of Wales. It was intended not only as an orchestral recording and broadcast space but also as a state of the art 300-seat concert hall. The orchestra's previous home had a reverberation time of just over one second, presenting challenges to the performers who need a good sense of ensemble from their acoustic environment and a space that supports a good orchestral sound as a result of their combined efforts. The new venue was designed to achieve a reverberation time of between 1.6 and 1.8 seconds depending on the musical application, and a noise level of NR15 before the audience are let in. Ian reported that the hall had met all of the BBC's requirements, and to demonstrate it delegates were invited to tour the space and the technical facilities immediately after the paper presentation. It is rare that a paper on a venue can be followed by direct experience of the venue itself, but this was the second example of this that the WMC was able to offer RS2011!

Playing away

Towards a new musical instrument - *Shelley Katz*

After an enjoyable conference banquet in Rehearsal Room 3, delegates were treated to a performance by Shelley Katz of Beethoven's Piano Concerto No. 5. Shelley is an accomplished concert pianist and conductor, and a regular contributor to RS in recent years. With huge investment of time and effort from Shelley, from John Taylor's team from D&B Audiotechnic, from Chris Full and Duran Audio's technical production team and with unfaltering assistance from the WMC tech staff, Shelley and his son David performed the Concerto entirely between them. They were aided by a MIDI score prepared by Shelley on Notion 3, using high quality

Andy Munro, of Munro Acoustics, speaks on BBC Broadcasting House glass studio design

Jonathan Adams (centre), principal architect of the Wales Millennium Centre, conducts a guided tour for delegates with centre staff

orchestral samples, and conducted by David to keep subtle timing in the way any good conductor would with a real orchestra. Sitting at the (real) grand piano, Shelley played his part of the concerto flawlessly and beautifully, and in concert with David's conducting of the 'orchestra'.

All this was very ambitious and impressive, but the really novel thing under scrutiny here was the system, known as Symphanova. Shelley had prepared to route each part of the orchestra to their own hybrid array of loudspeakers, made up from D&B high precision pistonic devices and Shelley's own bending wave panel loudspeaker devices. The blends of acoustic excitation methods made possible, independently assigned and configured by section, allowed the virtual orchestra to fill not only the stage but the acoustic of the performance space. Being a space for speech, an enveloping reverberation was provided via the Duran Audio surround system that was in place for the conference.

Before the performance, Shelley was careful to explain that the ambition of this project was to achieve a feasible business model for more high quality orchestral music in venues not otherwise able to justify the cost of a full orchestra. Rather than taking work away from musicians, the vision is to provide more opportunities for musicians to play in orchestras made up from as many human musicians as can be achieved, with the remaining sections and instruments 'performed' by a distributed digital orchestra such as this.

The overall result, Shelley admitted, was experimental and was being heard in this configuration for the first time by all concerned – including Shelley himself. Clearly, and readily admitted by Shelley, there was some work to be done, as might be expected if trying to mimic the subtleties of an orchestral performance, but the principle could

continued on page 10

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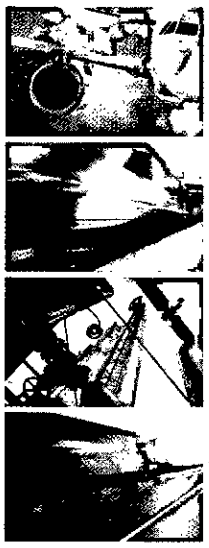

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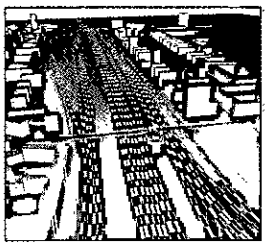

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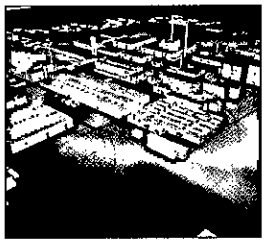

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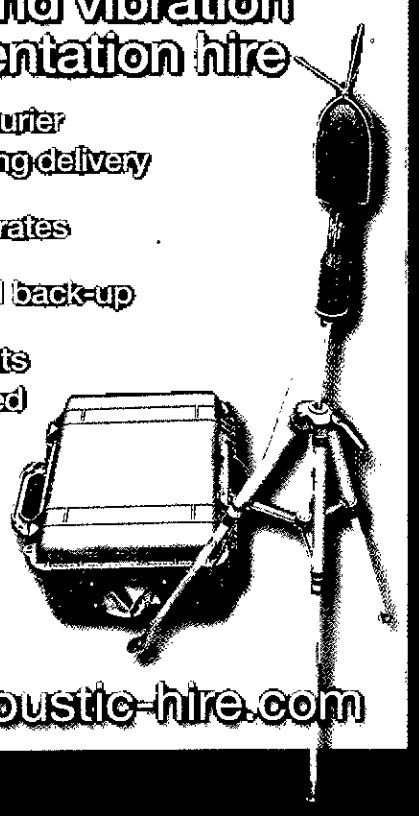

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Product specification subject to change

Reproduced Sound 2010 - *continued from page 8*

be appreciated, as could the role that the distributed and hybrid loudspeaker arrays would play in a further refined version.

Before and after Shelley's performance, delegates congregated in their usual RS style in the bar on site at the WMC. The upstairs bar 'One Bar' had been dedicated to our exclusive use, and the relaxed atmosphere in the sofas and tables encouraged lively discussion and more. They call it 'networking', but that term seems to undersell these invaluable opportunities to discuss the day and all sorts of business. Without the papers we would not have a conference, but without good gatherings at the end of the day, we would not have anything like the full value of attending.

re.Form: Friday 19 November

Venues and the design team

- chaired by Simon Jackson, Arup Acoustics

Having fully realised the value of attending the Thursday evening gathering, attendance at 9am for the second day of papers was reassuringly buoyant. **Paul Malpas** kicked off a session on *Venues and the design team* with a presentation explaining the context of the design team dynamics.

Paul's talk on 'fitting in' was a candid discussion of how specialist design consultants fit into design team working, taking into account all different viewpoints but also making sure to pull weight during the design process to ensure that the end product is fit for purpose and the design is balanced once each member of the design team has pulled in the direction of their own intent. Paul likened this to erecting a tent, where all members need to pull with equal force in opposite directions for the tent to stand proud. This talk served as a narration for the rest of the session.

Jeremy Newton, Arup Acoustics gave us *Acoustic design of the Wales Millennium Centre*. As principal acoustical consultant for the WMC, Jeremy explained the various challenges that he was faced with in its acoustic design. These included environmental effects of the site on sensitive spaces within the building, achieving the required acoustic performance and also how these challenges were overcome working with the architect.

Jonathan Adams of Capita Architecture provided the capping stone to this session in his invited paper *Sound makes vision*. Jonathan was the principal architect for the WMC, and his lecture was a prosaic exploration of the conceptuality and materiality of the design of each of the building's different spaces and how, working with Jeremy and his acoustics team, these concepts were derived from the acoustic aspirations, and how the materials and internal space geometries were selected to achieve the acoustic performance requirements. Interchanged with his description of the WMC design, Jonathan also gave a candid account of working with engineers and consultants within a design team that complemented both Paul's and Jeremy's talks. Thankfully he could not say a bad word against acoustical and audio consultants. Lighting engineers, however...

Highs and lows

Loudspeaker systems

- chaired by Mark Bailey, QSC

After coffee, we changed tack with a session on high performance loudspeakers, started by **Bill Gelow** of Electro Voice Engineering talking on *Very high power transducer requirements and design*. Bill discussed the increase in power usage at live events: this was 0.02W per person at Woodstock, but today 25W per person is not unusual.

continued on page 12

World class: the Wales Millennium Centre

Reproduced Sound 2010 - *continued from page 10*

While many efficiency savings have been possible with the amplifiers, the loudspeakers continue to need a lot of power to produce high sound pressure levels, especially at the low frequencies. Bill went on to talk about the issues of large power input to transducers and their effects on the performance of the loudspeaker and its characteristics. He described FEA techniques and other computer modelling to optimise the designs. He mentioned two methods of reducing power compression implemented by EV and stated that the power compression figures were 3 to 4 dB with the standard cooling method and as little as 2dB with the newly improved spinning air method.

Looking specifically at low end, **Evert Start** of Duran Audio in *Simulation and application of beam-shaped sub-woofer arrays* discussed the control of low frequency arrays in a manner that would complement the control they have at the mid and high frequencies from the current state of the art. He explained the differences of single and multiple subs, cardioids and dipoles, and their operation in full and half space. Evert went on to discuss how to model the associated issues and how best to optimise the design. Their measurements bore well against their predictions and they found that they could achieve good control and good matching with their existing columns.

Continuing the theme, **Adam Hill** of the University of Essex gave a paper *Chameleon subwoofer arrays in live sound* which combined a technical approach with the grounding of being a professional live engineer. He stated that the goals of even sound pressure levels for the audience and minimal sound level on the stage were not always met to his satisfaction. His proposal of chameleon arrays sought to resolve this with a combination of omni-directional and dipole subwoofer arrays in a ratio of 1:3. He has yet to test this in a large scale but has high hopes for success based on the work done so far.

Clear sines

Speech intelligibility

- chaired by Glenn Leembruggen, Acoustic Directions

The afternoon Speech Intelligibility session commenced with **John Culling** of Cardiff University who spoke about improvements in speech intelligibility for bilateral (ie two ears) cochlear implantees in the presence of background noise. If speech and noise sources are spatially separated, the acoustic shadow of the head allows the binaural hearing process to improve intelligibility (called spatial release from masking, or SRM). Bilateral implantees also experience SRM, but studies to date have shown only modest improvements, hardly justifying the expense of a second implant. However, the spatial configurations used in these studies were not optimal, and John and his colleagues have created a computer model of SRM, based on the combination of measurements from an acoustic manikin and theories of binaural hearing and speech reception. The model has been validated against a range of literature on SRM in normally hearing listeners and predicts the optimum SRM for a bilateral implantee to be 10dB.

Continuing their previous work with cinema sound, **Philip Newell** in *Cinema sound: a new look at old concepts* discussed weaknesses of the standardised X curve and the associated third-octave band equalisation process that have been used for almost 40 years in cinema rooms. Noting that the X curve is an empirically derived target for the steady-state frequency response of a cinema room, Newell is concerned that it does not account for recent understandings of psycho-acoustics and the importance of the direct field and that to meet it, often requires distortion of the loudspeakers' direct-field frequency response and likely damage to transient sounds. Using measurements of the frequency responses of 20 Dolby certified cinema rooms at various distances, assessment was made of way the direct sound in theatres is compromised in order to meet the X curve with third-octave-band equalisation.

Measurements and models

- chaired by Glenn Leembruggen, Acoustic Directions

The Measurements and Models session followed tea. **Michael Smyth** of Smyth Research described in *Bringing theatre sound to the desktop* a novel low-cost binaural capture and reproduction system that can accurately recreate the sound of loudspeaker sources in a selected auditorium in normal stereo headphones. The system is intended to assist theatre-sound personnel with off-line audio production and preparation. A key feature of the system is its ability to measure and use personalised binaural room impulse response (PRIR) data with a real-time head-tracked convolution system. The final PRIR data set consists of binaural room impulse responses for up to eight loudspeakers at three head orientations. During the audio rendering stage for headphone replay, interpolation between the measurement positions is applied using a simple, head-tracking system which provides a restricted but useful range of rotational head movements. The system includes measurement and compensation for the non-flat frequency response of each individual to different headphones.

Gareth Fry, consultant, speaks on the role of a sound designer in theatre

Lucy Elmer addresses the conference on the subjective perception of room mode control methods

Jonathan Sheaffer from Salford University, in a paper entitled *PFTD/K-DWM simulation of 3D room acoustics* then spoke about improved computing techniques to predict sound fields in rooms. Among the useful methods to predict sound fields in rooms are the finite difference time domain (FDTD) and the digital waveguide mesh methods, but they suffer from dispersion errors that increase with frequency and vary with propagation direction, thus imposing a high frequency calculation limit. One way to reduce errors is to oversample the grid, but this approach is computationally expensive and thus has often been avoided for room predictions. Jonathan proposed an implementation of the FDTD method that uses general purpose graphics hardware, which allowed for high sampling rates, reasonable calculation times, reduced dispersion errors and a higher frequency limit. A range of graphics processors were evaluated and compared with traditional CPUs in terms of accuracy, calculation time and memory requirements.

Philip Richardson of Anglia Ruskin University described a measurement process to speed the tuning of popular drum kits in *Clearing the drumhead by acoustic analysis method.* The current tuning process involves tapping the drum at a number of perimeter points and aurally checking for uniform pitch. If the fundamental frequencies are not uniform around the perimeter, interference effects produce beat frequencies which degrade the overall pitch of the drum and the smooth decay of the sound. 'Clearing the drumhead removes these beat frequencies. The authors showed that tuning uniformity can be quantified by analysing the acoustic spectra and waveform envelopes when the drum head is struck at different perimeter points. Analysis of measurement data aids the tuning process and provides an alternative to the aural process which is a skill that may take years to develop.

Keith Holland from ISVR gave the final paper of the conference on *A simple model of cabinet edge diffraction* and presented a model to predict diffraction from the edges of a loudspeaker cabinet. Traditionally, diffraction has been calculated using geometric theory of diffraction, but this method is not well suited to low and mid frequencies. Noting that more complex solutions can actually hide the apparent physical simplicity of the problem, Keith grounded the audience in the physics of loudspeaker-cabinet diffraction and then proceeded to describe the operation of his simple model. The model can be implemented in a few lines of MatLab code and yields good estimates of the diffracted sound field at low to high frequencies for sources on baffles of arbitrary shape and size. For those of us who have struggled with predicting loudspeaker diffraction (including the session chairman), Keith's work may be a welcome relief!

Into the night

After drinks at One Bar again, we were treated to a talk and demonstration by Chris Full and John Leonard, both accomplished theatre sound designers. The plan for Martyn Ware of The Illustrious Company to present on Soundscape Experiences was scuppered by a late request for the reformed Heaven 17 to play for the Children in Need telethon at the BBC! Chris Full lived up to his name and made sure that an excellent alternative was on hand in the form of John Leonard, who gave a fascinating run through the history and his experiences of providing sound effects and soundscapes for theatrical stage productions.

The discussions continued in One Bar long into the night and it was generally felt that Reproduced Sound 2010 had not only lived up to its reputation but also gained some more friends in the process. This was the second year running that RS was able to offer students a significantly reduced delegate fee, and 25 were in attendance in 2010. We can already see that this group is likely to produce contributors and regulars to RS in years to come.

In 2011 we return to the Brighton Thistle Hotel on 16 to 18 November. Put the dates in your diary and we will look forward to welcoming you to RS2011.

Meeting report: Midlands branch

Kevin Howell. The implementation of Noise Action Plans in England

The Branch returned to Loughborough University for their November meeting and AGM. The evening's speaker was Stephen Turner of Bureau Veritas. The noise action plans (NAPs) for major roads, major railways and the 23 first round agglomerations in England were adopted and published in March 2010. Stephen described the work carried out since then towards implementing the plans, and provided an update on current activities relating to the Environmental Noise Directive (END).

Defra is the Competent Authority for NAPs except for airports, for which the responsibility falls to the airport operators. There had been informal liaison with the airport operators who had now submitted proposed noise action plans (for 15 major airports and two others that affect agglomerations). These plans were under detailed review and it was hoped that the first ones would be adopted by the end of 2010.

Current controls on noise from industry through planning, statutory nuisance and environmental permitting regulations are considered appropriate and the NAPs do not require anything new. Authorities are, however, being encouraged to review their procedures, for example in investigating noise complaints and for liaison between planning and environmental health functions and the Environment Agency. Defra will continue to liaise with authorities with regard to PPG24 and BS4142, to monitor community response to industrial noise, and to engage proactively with the EC regarding the issue of the mapping of industrial noise.

Stephen then moved on to discuss the issue of Quiet Areas where a number of fundamental questions are yet to be resolved. For example: What do we mean by quiet areas? Are they simply defined by noise level, in which case what indicator is relevant? Does the area need to be quiet all the time? Does it have to be quiet with respect to all noise sources? Can a quiet area have occasional rock concerts? How does 'quiet' contribute to overall quality? Should areas that are not accessible to people be considered? Do we consider implications for biodiversity? Should we include areas for which you have to pay for access, for example golf clubs or National Trust premises? Stephen reported that there are a number of quiet area studies underway in a variety of cities and there is also ongoing research into the monetary value of 'quiet'.

The Noise Policy Statement for England was published in March 2010 and Stephen believes this to be a most important document: he encouraged everyone to read it carefully. It provides clarity concerning what we are trying to achieve and makes explicit some of the implicit underlying principles found in existing documents. It also helps us to interpret the purpose of the END.

Stephen summarised the processes relating to implementation of the NAPs for roads and railways and reported that a NAP support tool is now available on the web and other support documents are in preparation. He felt that with this guidance much of the required assessment work can be done from the desk. A number of workshops were being held around the country to inform the process.

The EC review of the END is taking a considerable time and a report outlining options should be available in March 2011. Attempts to develop a common assessment method have been unsuccessful and the methods to be used in the second round of mapping, due by June 2012, will be similar to the first round.

Thanks are again offered to Stephen for once again finding the time to come and speak to the Midlands Branch, and to Loughborough University for hosting the meeting.

Meeting report

London branch

On Wednesday 20 October 2010 Dr Carl Hopkins gave a presentation to the London Branch of the Institute of Acoustics on the spatial sampling of sound pressure in rooms. The meeting was extremely popular with over 50 members attending.

In building acoustics and environmental noise, measurements are often needed to determine the spatial average sound pressure level inside a room. This is usually carried out by using mechanical scanning devices, fixed microphone positions or manual scanning. In comparison with mechanical scanning devices, the human body allows manual scanning to trace out quite complex paths in three-dimensional space. The talk considered the efficacy of some different averaging paths that can be carried out with manual scanning. The spatial correlation coefficient was used to determine the variance and the equivalent number of discrete, uncorrelated samples for a three-dimensional diffuse field. Numerical simulations indicated the advantages and disadvantages of various manual scanning paths in terms of their equivalent number of discrete, uncorrelated samples.

The London branch would like to extend its thanks to Carl for taking time out of his busy schedule to join them for the evening to give a very interesting presentation. The Committee would also like to extend their thanks to WSP for providing the venue.

Topics and speakers for the evening meetings are generally identified and organised by the London branch committee, but they always welcome new ideas and suggestions for future presentations. If you have any ideas or suggestions, or may even like to give a presentation yourself, then please contact Nicola Stedman-Jones on **stedmann@rpsgroup.com**.

Emerging government planning policy

What does it mean for practising acousticians?

A Workshop organised by the Institute of Acoustics Environmental Noise group

The government is revamping the planning system, to streamline the process, to address the sustainability agenda, and to give local people more say. The new planning system could radically change the backdrop to environmental noise assessment and potentially the way in which we do noise assessments.

This workshop on 24 May 2011, within Noise Action Week, will provide delegates with a full update on emerging government policy, and an insight into what could be ahead. Topics will include:

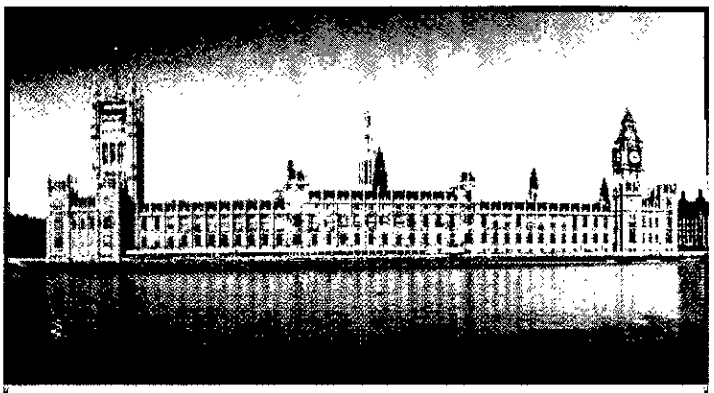
- The Noise Policy Statement for England - what does it mean?
- Draft National Planning Statements - will they remove statutory nuisance?
- What if the localisation agenda means PPG24 is repealed?
- Will the revision to Environment Agency H3 guidance fill the gap?
- What role does the IOA have in steering noise assessment techniques?

Keynote speakers will present the latest position, and delegates will be encouraged, through debate, to seek out what these high level policy developments will mean for their day to day noise assessment work. The workshop will take place at the University of Salford.

Building Regulations

An open letter from the President of the IOA

The letter reproduced below was sent by the President to Andrew Stunell, the Minister responsible for the Building Regulations in the DCLG. It expresses the concern of our profession on the effects of the proposed changes on the design and fitness for purpose of our schools, together with the implications for future generations of schoolchildren and students.



Future changes in Building Regulations?

The Rt Hon Andrew Stunell OBE MP
Department of Communities and Local Government
Eland House
Bressenden Place
London
SW1E 5DU

7 February 2011

Dear Mr Stunell,

Building Regulations changes - Document E4: Acoustics in Schools

The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration, representing over 3,000 members who span a rich diversity of backgrounds, with engineers, scientists, educators, lawyers, occupational hygienists, architects and environmental health officers among their number.

We are writing in response to your Department's document *Future changes to the Building Regulations - next steps* and would like to express our serious concern at the suggestion that section E4 might be withdrawn or watered down without a statutory mechanism for maintaining acoustics standards that carry at least as much weight.

There is a substantial body of scientific evidence that poor acoustics are linked with impairment cognitive performance amongst children (Environmental Noise and Health in the UK: a report by the *ad hoc* expert group on Noise and Health, published by the Health Protection Agency). Put simply, if pupils are unable to hear what they are being taught they are less likely to be able to learn. Likewise if teachers have to regularly raise their voices to be heard, due to poor acoustics, then they risk vocal damage and/or increased stress. For instance, last November a teacher who damaged her voice was award £150,000 compensation.

Building Bulletin 93 currently provides the design standards for acoustics in schools. It now needs updating after eight years to take account of the move towards open-plan teaching and inclusion of vulnerable listeners in mainstream schools who are particularly adversely affected by poor acoustics. This revision is awaiting formal release after an extensive review and consultation phase, with input from a number of our members. However, we acknowledge that there are a number of possibilities and options regarding BB93 (or its replacement) including using it to strengthen the Education (School Premises) Regulations 1999, SI 1999 No 2. There is also the issue of the refurbishment of existing stock (such as "recycled schools") which we would like to discuss with you.

In our experience, mandatory controls are needed to maintain minimum acoustic design standards. Our members have witnessed the improvement in standards that have resulted from mandatory controls in recent years. Removing section E4 from Approved Document E, and therefore the Building Regulations, would run the risk of allowing school buildings to be built that are not fit for their intended purpose. As such we seek reassurance that this would not happen without a carefully thought-out alternative that would maintain a statutory control on the minimum design standard for acoustics in schools.

We would welcome the opportunity for a cross-departmental meeting to discuss our concerns and see how these will be addressed. We hope that we can also offer assistance in ensuring that acoustics in schools will not be compromised by the proposals being considered.

I will be sending similar letters to each Minister in charge of the relevant Departments whom we think should have an interest in maintaining good acoustics within schools. We very much look to you and your department to take the lead, given the current review process.

I therefore look forward to hearing from you at your earliest convenience and the opportunity of discussing the issue in more detail with you.

Yours sincerely,

Trevor Cox

Professor Trevor Cox
President

Institute of Acoustics five-year strategic plan

December 2010

Vision

To promote and advance acoustic science, engineering and technology by: influencing the acoustic agenda; developing tomorrow's professionals; maintaining standards and improving the skills of our members, and delivering excellent services to members and stakeholders through efficient management and effective financial planning.

Objectives

1. Influencing the acoustic agenda

To position the Institute so it is recognised as the independent scientific and professional voice on acoustics.

- Raise profile of acoustics and the impact of noise in the media, professions outside acoustics and the public
  - Promote knowledge and understanding of acoustics
  - Advocate the importance of using trained professionals for acoustic work and establish the role of IOA members as experts in acoustics
- Hold conferences and one-day meetings to shape the future scientific and engineering agenda
- To influence policy with acoustic implications to ensure acoustics is considered and policies are evidence based:
  - Initialise and propose revisions to correct and improve guidance and legislation
  - To respond to consultations from governments and quangos consulting as wide as possible.
  - To provide detailed guidance on specific issues (e.g. pubs and clubs)
  - To set acoustics into the wider context of big societal issues e.g. sustainability
- To provide experts for standards (eg ISO, CEN, BSI) and working groups (eg WHO) and technical committees (national and international) to ensure outputs are scientifically sound
- To engage with international partners such as EAA, I-INCE, ASA, IIAV & ICA to ensure that members can benefit from the activities of the partners
- To engage with research funding bodies in the UK such as the Research Councils, Defra and HEFCE to ensure that acoustics research continues to be funded
- To engage with other organisations and professional institutes such as EC, EngineeringUK, RAEng, IMechE, IOP, RIBA, CIBSE, ANC, EPUK, NAS to work together on activities (eg meetings and conferences, drafting of guidance, responding to consultations) for mutual benefit
- To encourage theoretical, experimental and applied research directed towards the advancement of acoustics by providing fora for exchange of ideas between researchers and providing evidence of need for research to support funding applications

2. Developing tomorrow's professionals

To ensure there are sufficient professionals with appropriate acoustic skills and knowledge to enable high quality acoustic practice.

- To provide opportunities for people to be educated in acoustics: Institute of Acoustics Diploma
  - Certificates of Competence
  - Accredit degree courses with acoustic content
  - Promote the inclusion of sound within the school curriculum
  - Promote the value of true engineering degrees
- Outreach to encourage people to study acoustics, enter the profession and join the Institute through face-to-face activities and the website
- To run tutorials at conferences (eg Reproduced Sound) and one day meetings (eg The Art of being a Consultant) aimed at non-members
- To run conferences, one-day meetings and branch meetings which are open to all
- To promote membership of the IOA to appropriately skilled non-members
- Maintain rigorous standards for membership by ensuring the bar for membership is high enough that the profession is valued

3. Maintaining standards and improving the skills of our members

To promote high standards of acoustics among our members and to assist members to gain and maintain their professional competence

- To promote CEng and IEng registration among members
- To promote career progression of members demonstrated through membership upgrades
- To provide opportunities for members to communicate their work, learn state-of-the-art practice, refresh knowledge and broaden their areas of competence:
  - To run national and international conferences, one-day and free branch meetings
  - To publish proceedings (peer reviewed were appropriate)
  - To run tutorials and masterclasses
  - To publish Acoustics Bulletin technical articles
  - To make Acta Acustica uw Acustica available to corporate members
- To develop a system to ensure that members carry out CPD
- Accreditation of, and keeping a watching eye on, competence of members
- To publish a regular e-bulletin to alert members to upcoming events
- To provide opportunities for members to network through meetings, conferences and the web
- To celebrating the endeavours of our members and the Institute through the Medals and Awards of the Institute
- To maintain the library
- To use the code of conduct to enforce standards
- To support the needs of sponsor members

4. Delivering excellent services to members and stakeholders through efficient management and effective financial planning.

- Effective and accountable operational mechanisms within the IOA's HQ and through the volunteer network
- Maintain high levels of motivation, skills and performance of all staff
- Value members' voluntary time in supporting the activities of the Institution and utilise that support as effectively as possible
- Ensure ongoing value for money and efficiency in the management of the Institution's affairs and where possible the most sustainable approach
- Maintain reserves at a level dictated by the Charity Commission
- To carry out active budgeting
- To ensure Institute services are offered to all regardless of ability, age, gender, race, religion or sexuality
- Determine membership needs through periodic membership surveys.

Meeting report

Nicky Sheirs. London branch

'Distributed noise measurement with MEMS microphones - recent experiences and future potential' was the title of the presentation given by Richard Barham of NPL at the London Branch meeting on Wednesday 8 December 2010.

Richard Barham is a principal research scientist in the Acoustics group at NPL. He specialises in microphone calibration and airborne acoustical assessment and measurement, and is currently involved in a project known as DREAMsys.

As the national measurement institute for the UK, NPL is tasked with a number of directives, including research and development, development of the UK's measurement standards and a drive to be innovative. It is as part of this innovation drive that the DREAMsys project has come into being. In essence the project aims to produce a new kind of measuring system for producing 'real' noise maps by developing instrumentation which can be used in conjunction with MEMS microphones.

Richard began by giving a potted history of microphone technology and then looked at the MEMS microphone in more detail. The MEMS (Micro Electromechanical Systems) is the first microphone to use new technology for 60 years. It was developed for the mobile phone market and is extremely cheap to produce at around £3 a unit. However it has bandwidth and dynamic range limitations and unspecified stability and environmental dependence.

Richard then went on to discuss the current situation following Round 1 of the EU Noise Directive to produce strategic noise maps and how the aim of the DREAMsys project is potentially to improve on these first round results. Essentially the project aims to produce low-cost measurement equipment with appropriate measurement performance. This would allow a number of units to be afforded, which is not possible with existing Class 1 sound level meters whose cost is considerable. With a number of units on site, multiple consecutive measurements can be made, building a much more accurate noise map than the current predicted versions.

Laboratory and site trials of the DREAMsys measurement equipment have been undertaken with eight units installed at Edinburgh Festival Square, about 40 units at Silvertown Quays (close to London City Airport) and a number on site at NPL. Results have shown that the microphones appear to have good weather resilience, good accuracy and low drift — with only a 0.1dB shift over a three-month period. The measurement data has a good correlation between the predicted levels shown on the published noise map for the area surrounding London City Airport, with the added benefit of multiple measurement positions. Multiple positions allowed further local noise sources to be identified and hence could enhance the detail of the existing map.

The instrumentation has been shown to exceed expectations. Future plans are to continue to work on the microphone to move towards an acceptable standard (Class1?); to develop software further, so that the data captured can be analysed simply, by a non-specialist; and to improve the equipment design so that it can be used unobtrusively. It is thought that the applications of the system are potentially many and varied, and could extend into areas such as industrial noise, wind energy noise and auditorium acoustics. Future information on the project can be found at **www.dreamsys.org** .

The London branch would like to extend its thanks to Richard for an extremely interesting presentation and for taking time to join us on what was a very cold, dark December evening. The committee would also like to extend their thanks to WSP for providing the venue.

Topics and speakers for evening meetings are generally identified and organised by the London branch committee, but we always welcome any new ideas and suggestions for future presentations. If anyone has any ideas or suggestions, or may even like to volunteer to give a presentation then please contact Nicola Stedman-Jones on **stedmann@rpsgroup.com** .

ICU 2011: International Congress on Ultrasonics, Gdansk, Poland

First Announcement and Call for Papers

The Institute of Experimental Physics, University of Gdansk, is organising the International Congress on Ultrasonics (ICU 2011) to be held in Gdansk, Poland, on 5 to 8 September 2011.

The President of the International Congress on Ultrasonics (ICU 2011), Professor B B J Linde, Director of the Institute of Experimental Physics, University of Gdansk, invites all scientists and engineers from the academic, scientific engineering and industrial sectors to participate in the Congress and to contribute in the promotion of the scientific knowledge.

We hereby would like to invite proposals for structured sessions to be included in the International Congress on Ultrasonics. Abstracts of papers proposed for oral or poster presentation at the ICU 2011should be approximately 250 words in length and must be submitted before 15 April 2011 using the Congress website http://icu2011.ug.edu.pl. Before acceptance, all contributions will be assessed by experienced reviewers.

The International Congress on Ultrasonics 2011 is the third in the worldwide series (after Vienna, Austria in 2007 and Santiago, Chile in 2009) of meetings of the ultrasonics community, continuing a long tradition of international ultrasonics conferences (organised every second year between 1963 and 2005) as well as world congresses on ultrasonics (organised every second year between 1995 and 2005).The last six years' experience of ICU congresses has shown a real progress in the global integration process of the ultrasonics community and provided an excellent platform for the exchange of professional knowledge among scientists and engineers from academic and industrial centres as well as from other institutions and places where ultrasonics are studied and applied.

Ultrasonics as a multi-disciplinary field covers a great number of topics from fundamental physical aspects through chemical, biological, medical, material inspections and others branches to many applications. Contributions on topics from the entire field of ultrasonics are expected to be presented during the ICU 2011 in Gdansk and it is hoped that the meeting will provide a valuable and unique opportunity for participants to exchange their achievements and experience as well as to enlarge their international contacts on the field.

Keynote speakers will include:

Professor Sadayuki Ueha - *Precision and intelligence laboratory, Advanced Microdevices Division, Japan*

Professor Larry Crum - *Center for Industrial & Medical Ultrasond (CIMU), USA*

Professor Timothy J Mason - *Faculty of Health and Life Sciences, Coventry University, UK*

Professor Andrzej Nowicki - *Institute of Fundamental Technological Research, Polish Academy of Science, Poland*

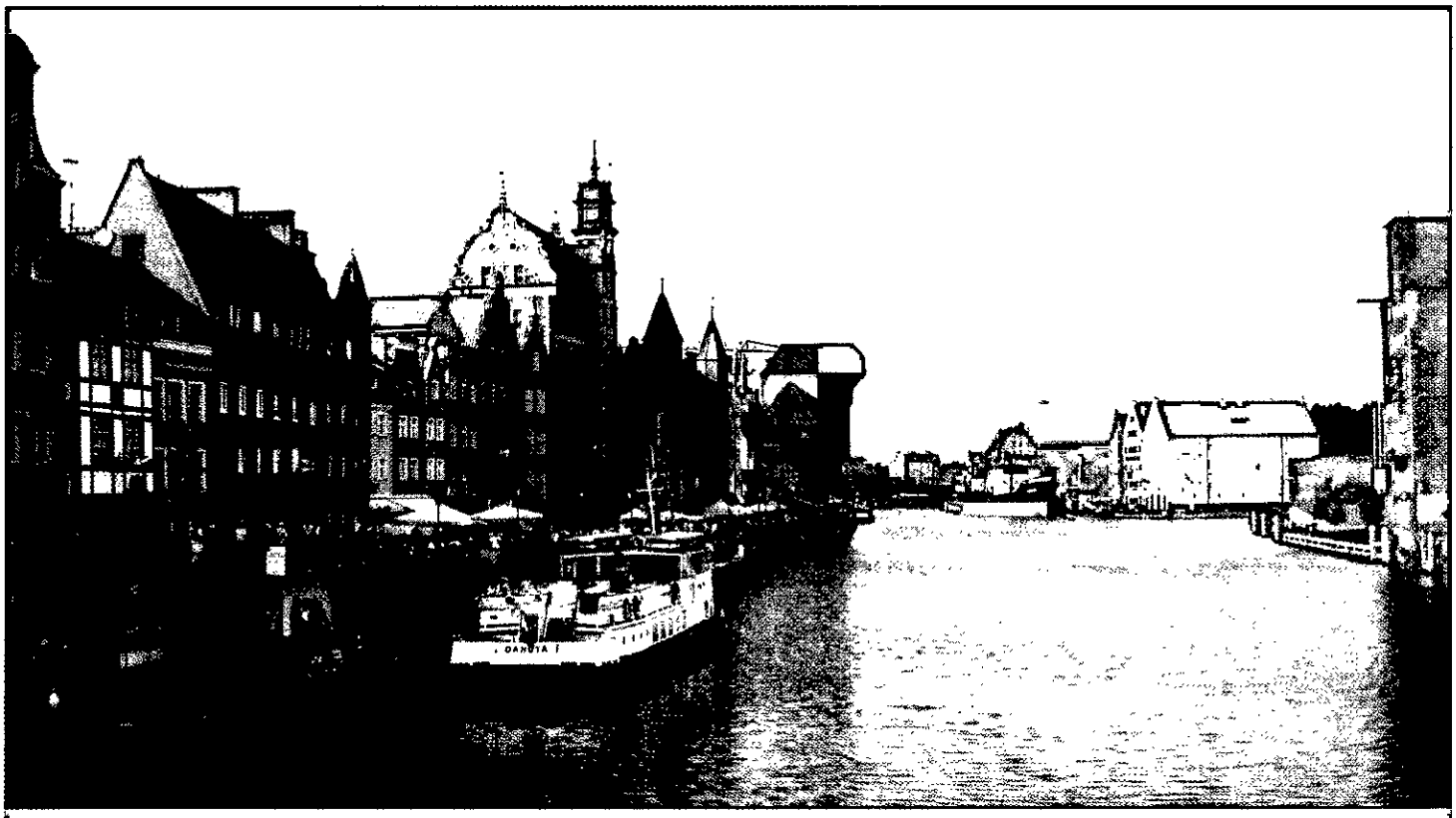
Professor Tadeusz Stępiński - *Uppsala University, Sweden*

Professor Fabio Cardone - *Physics department 'Edoardo Amaldi', 'Roma Tre' University of Rome, Italy*

Dr Victor A Akulichev - *V.I.Il'ichev Pacific Oceanological Institute, Far Eastern Branch, Russian Academy of Sciences*

A detailed programme will be available in June 2011.

Prof Bogumil B J Linde
President of ICU, Head of the Institute of Experimental Physics, University of Gdansk ul. Wita Stwosza 57, 80-952Gdansk
tel: **+48-58523-22-54** or **22-13**; fax: **(+48 58) 523-20-63**



Historic Gdansk is the setting for the International Congress on Ultrasonics

Meeting report

Kevin Howell. Midlands branch

Derby University was the venue on 18 January for the first Midlands Branch meeting of 2011, entitled BS.5228 - *Predictions, problems and practice*. Andrew Nash and Robert Colder of URS Scott Wilson presented work they had carried out looking at various aspects of the new (2009) version of BS.5228. The topic is clearly of great current interest as the meeting attracted a large audience.

Andrew and Robert began the evening with a presentation they called '*Software or spreadsheet? You decide*'. The presentation included studies to determine the variations in predicted noise levels using different calculation methods. It was stated that most construction noise predictions are still carried out using spreadsheets although an increasing number of projects now require software modelling techniques. The BS.5228 procedures are fairly simple and so lend themselves to spreadsheet calculation. Modelling is most useful where there are a large number of noise sources or a large number of receptors - or both - to be considered, and although they take longer to set up than a spreadsheet they are quicker to manipulate, and clients seem to like pretty pictures!

Several cases were presented comparing predicted results using a BS.5228 spreadsheet, a BS.5228 software model and ISO 9613-2. A number of findings were presented including the fact that in situations where there was no screening there was good agreement between the methods, but where screening was included the differences became apparent. The BS.5228 software model did not appear to be implementing the BS.5228 barrier corrections properly. Also for moving sources the degree of agreement between the methods depended on the direction of movement of the source in relation to the receiver.

Results of a field study of a slope stabilisation project involving piling work were presented. The study found that noise measurements agreed well with predictions using the ISO method while both BS.5228 approaches overpredicted the levels. The presentation included a brief video of the piling operation. Later in the presentation a fascinating video was shown of a quiet and vibration-free hydraulic method of piling called G-Pile, which provoked considerable interest in the audience.

During the summing up the presenters advised that when using a software model we should make sure it was doing what we thought it was! They also raised the question of whether we should be using BS.5228 predictions if ISO was shown to be more accurate in certain circumstances, or is the over prediction in BS.5228 in such situations advantageous as it introduces some breathing space? The meeting was then thrown open to the audience for further discussion.

Many thanks are due to Andrew and Robert for their presentations, and also to John Pritchard and Derby University for hosting the meeting.

Coming attractions

Special features

Would you like to be a Guest Feature Editor for *Acoustics Bulletin*? The Publications Committee extends an invitation to members to participate in the production of the Bulletin by arranging for a number of Technical Contributions to be produced in any topic area they find of particular interest.

The concept is that those working in a particular field are best placed to know who is doing what, and can 'commission' articles from their colleagues, peers and research students. The opportunity is open to all members, whether they are in education, consultancy, industry or public authorities.

A few subject areas have already been suggested and we are open to ideas. Would you like to be the guest feature editor for one of these topics?

- Noise from wind farms
- Soundscapes and 'quiet areas'
- Acoustics in schools
- Latest developments in noise measurements
- Noise or vibration impacts on wildlife
- European noise policy affecting UK practice
- Applications of acoustics in medicine

Technical contributions will not be peer-reviewed (in the strict sense), and the Editor will retain responsibility for all the regular features in the Bulletin. It is anticipated that these special feature issues would alternate with issues covering the usual selection of technical contributions and technical notes from minority (acoustical) interests and esoteric topics.

The Editor will happily advise as necessary on numbers of articles, matters of style, images and graphs, word count and general presentation, and will proof-read and copy-edit any submissions pre-production. We hope the innovation will make the Bulletin an even more interesting read! Any member willing to take on the role for a single issue should contact the Editor (email **Ian.Bennett@ioa.org.uk**), or phone **0161-487 2225** for an informal discussion.

Meeting report

Kevin Howell. Midlands branch

The December meeting was once again held at The Arup Campus in Solihull where Kelvin Griffiths, Gabriel Ruiz and Adrian Cartlidge of Harman Automotive, an organisation employing 10,000 staff worldwide, described the advanced development of automotive audio systems.

What ensued was an interesting and detailed insight into the design of loudspeakers and their integration into modern 'infotainment' systems for the premium automobile industry. Systems have developed significantly in recent years with, for example, advances enabling users to be 'online' whilst travelling and also to enjoy high quality multi-channel audio. These systems must also satisfy the stringent robustness requirements of automotive components.

Adrian explained that the design of new loudspeakers is driven by customer requirements that include restrictions on mass and the packaging envelope. He described Harman's extensive facilities which included a prototype manufacturing capability, unique tools and software, climate and durability testing rooms and an acoustics evaluation area with two anechoic chambers and a listening facility.

Kelvin described in some detail the loudspeaker design process which begins with very simple assumptions and simulations before utilising more sophisticated techniques such as finite element modelling and high speed cameras. He illustrated some of these methods through a case study of an investigation into a loudspeaker failure.

Gabriel described the assessment methods for the integration of the loudspeakers into the vehicle. Acoustic modelling is carried out and for a large saloon car may have 250,000 degrees of freedom. The modelling is combined with data from sound measurements taken within the vehicle which, depending on the size of the vehicle, may require between 100 and 150 measurement positions. A rotating manikin head is used to evaluate different head alignments and auralisation techniques are used to provide input for subjective evaluation tests.

This was an extremely interesting and comprehensive presentation. Thanks are offered to all the presenters and to Stuart Colam and Arup for hosting the meeting. This twelfth meeting concluded what had been a very successful 2010 season for the Midlands branch, the first in which a programme of monthly meetings had been organised. The response has been very positive and it is planned to continue the format in 2011.

Meeting report

Charles Ellis. Senior Members' group

A new chapter in the history of the IOA was written in January 2011 with the inaugural meeting of the Senior Members' group at London South Bank University.

More than 30 members, with am aggregate professional experience well over 1000 years, travelled from across the country to the campus where, after a pleasant buffet lunch, they were warmly welcomed by group chairman Ralph Weston.

After briefly recapitulating the background to the formation of the group – the idea was originally mooted as far back as the late 1990s - Ralph called for volunteers to help organise meetings, write reports for *Acoustics Bulletin* and *Acoustics Update* and to liaise with and look after the interests of overseas members.

He said the group's aims were fourfold: to provide a forum for senior members to keep in touch; to improve their benefits; to maintain their technical expertise; and to help those about to retire.

Its activities would centre on the organisation of visits, meetings and hotel stays, the exploration of the best way to communicate between the committee and members, the collation of the IOA's history, assistance with professional development (CPD), mentoring and, possibly, Code of Conduct cases, and preparation for the IOA's 40th anniversary in 2014.

Geoff Kerry, President between 2002 and 2004, then called for help with a major project to publish the history of the IOA in time for the 40th anniversary. While there were plenty of memories of the events leading up to the birth of the Institute, he said there was no overview of its development, operation, significant events or contribution to society.

As well as including details of the history of the parent societies and that of the IOA itself, he said the plan was to include anecdotes, photographs, and, possibly, comments in order to enhance its interest and make it more 'readable'.

In order to get the project off the ground, volunteers were required to serve on an editorial committee to decide content as well as help with research, writing and proofreading. Anyone interested should contact Geoff at **geoffkerry@tiscali.co.uk** or via the Senior Members' group at **smg@ioa.org.uk** .

In another appeal for help, Peter Wheeler, President between 1992 and 1994 and now IOA Engineering Manager, said that SMG members could play a vital role as mentors and guides to those younger members struggling to identify what they needed to do for CPD, in particular those working for small firms where the level of support they needed was not available.

On a high: Members enjoy a panoramic view of London before the start of the meeting

Professor Tony Day of London South Bank University then gave an overview of the K2 building where the meeting was being held, which is home to the Centre for Efficient and Renewable Energy in Buildings (CEREB). He explained that through its use of such state-of-the-art systems as ground source heat pumps, photovoltaics, solar fibre optics and urban wind turbines, it served as a showcase for efficient and renewable energy technologies and was an important resource for students of energy engineering.

The meeting closed with a fascinating and often amusing talk by Bridget Shield, President-elect, on her career in acoustics. This began in 1974 at Birmingham University, where her early work included industrial noise measurement projects, and has taken her to where she remained for 25 years: in the Faculty of Engineering, Science and Built Environment at London South Bank University, where she is now Professor of Acoustics.

Reflecting on the changes over the years, Bridget said the biggest she had seen were in instrumentation, in measurement parameters, which she described as 'to dB(A) and back again', and in the gender balance of the IOA which had resulted in far more women taking part in its affairs.

Looking to the future, she said she wanted see more to be done to encourage people returning to acoustics after a career break, and to this end the IOA should investigate the possibility of initiating a mentoring scheme and refresher courses.

Charles Ellis, IOA Publicity and Information Officer

The Noise Policy Statement for England

Significance, application and implications

Introduction

'Official policy statements from Whitehall tend to be bland and full of sincere-sounding generalities, but just now and then something important, perhaps even revolutionary, can be glimpsed in their pages. So it is with the latest paper from Defra, The Noise Policy Statement for England ... Indeed it should influence many of the most significant proposed changes to our national life over the next decade.' The Independent, 17 March 2010

The Noise Policy Statement for England, published by Defra in March 2010, describes a '*policy vision to facilitate decisions regarding what is an acceptable noise burden to place on society*'. The publication of the NPSE coincided with the formal adoption and publication of the Noise Action Plans as required by the Environmental Noise (England) Regulations 2006[1] (as amended) and the Environmental Noise Directive[2]. However, the potential implications of the NPSE go much wider, and as this article shows, it may well turn out to have a considerable impact on the work of most members of the Institute of Acoustics.

Description of the Statement

Contrary to the original intention it is not a long, top-down document. Rather it is a short, tiered document consisting of:

- a succinct '*Noise Policy Vision: Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development*';
- six brief paragraphs of text;
- a statement of three aims;
- five guiding principles for sustainable development;
- four pages of explanatory notes.

Separation of policy and technical advice

The NPSE separates policy from technical advice, which in principle allows

continued on page 22

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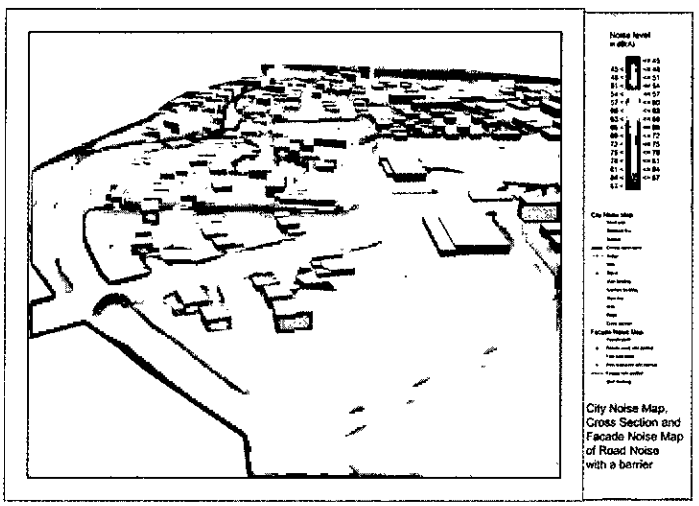
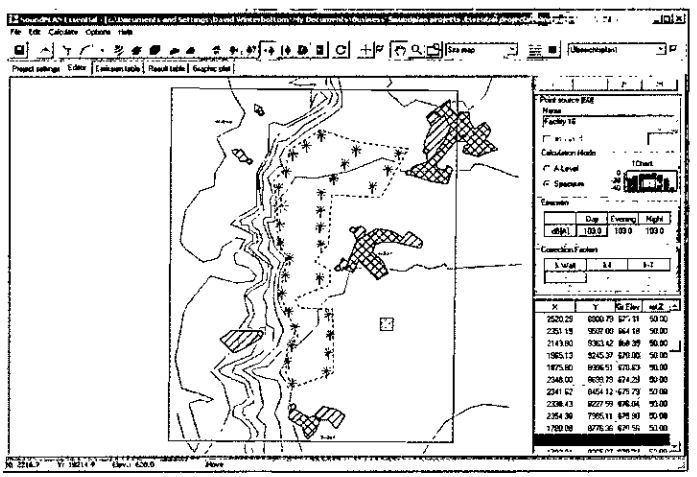


City Noise Map, Cross Section and Facade Noise Map of Road Noise with a barrier



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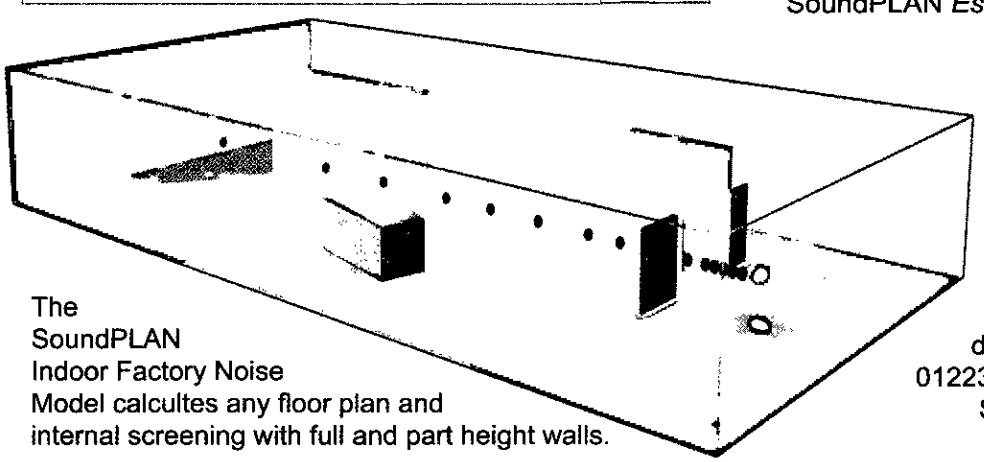

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The Noise Policy Statement for England - *continued from page 20*

more rapid changes to how noise is managed as knowledge about impacts develops, without the need to go back and review policy. However, the lack of a technical appendix could be a cause for concern, as application of the policy could become piecemeal if different decision making bodies choose different targets or interpret existing guidance differently.

Scope and applicability of the Statement

Any organisation that has a responsibility for managing noise is responsible for implementing the NPSE. Deceptively simple, it applies to all noise not simply ambient noise, with only workplaces excluded. The long term vision is supported by the following aims:

- avoid significant adverse impacts from noise;
- mitigate and minimise its lesser but still adverse impacts;
- contribute to the improvement of health and quality of life through the effective management of noise, for example through the promotion of quiet areas.

Arguably these are not specific commitments, but the document goes on to provide useful advice on interpretation of its aims, including the need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects. This means for example that the NPSE should be a consideration for industry applying for and regulated under an Environmental Permit administered by the Environment Agency. However, what is not yet clear is what the implementation would mean in practice if, for example, all Local Authorities were to review their noise and planning and sustainable community policies to ensure that they help to deliver the vision and aims of NPSE.

Definition of levels having adverse effects on health and quality of life

The definition of statutory noise nuisance includes the phrase 'noise ... so as to be prejudicial to health' and the Environmental Protection Act (EPA) 1990 defines prejudicial to health as being 'injurious, or likely to cause injury, to health'. The NPSE utilises two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

- NOEL - No Observed Effect Level. Below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL - Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.

The NPSE extends these to the concept of a

- SOAEL - Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

However, the NPSE does not explore the possible interactions between the EPA definition of statutory nuisance, NOAEL, LOAEL and SOAEL. Long established case law means that there are no 'fixed standards of comfort' *ie* noise conditions that are applicable in all circumstances. Furthermore, the existence of a statutory nuisance is influenced by non-acoustic factors such as the nature and character of a location. This is one of the issues that will undoubtedly be debated at the forthcoming IOA Workshop being organised by the Environmental Noise Group at the University of Salford in May 2011.

Aims of the Statement and some surprising implications

Adverse effects on health and quality of life

The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.

Minimise adverse effects on health and quality of life

The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This is consistent with consideration of Best Available Techniques (BAT) or appropriate measures under Environmental Permitting regulations. Significantly, this would mean that any time noise levels could be above LOAEL there will need to be a demonstration of what noise mitigation has been considered, what will be adopted and a cost benefit demonstration why other measures are not being implemented.

For example a decision maker might decide that when it receives applications for noise generating development, they could adopt an approach based on the three aims of the NPSE, in reverse order, as follows:

1. Preferably the scheme should lead to a reduction in noise in noisy locations or no increase in noise in quiet areas.

However the decision maker would have to also recognise that under the wider sustainability agenda it may not be possible or desirable to achieve a reduction in noise or no increase in noise in quiet areas in all cases, in which case:

2. The scheme should use all reasonably practicable measures to avoid increases in noise or minimise any increase in noise.

Where it is not reasonably practicable to achieve the preferred nil increase or the 'minimisation' standard then as a backstop to prevent significant adverse effects on health and quality of life, the decision maker could invoke a policy that:

3. The maximum noise level that would be acceptable under these circumstances is one that reflects significant adverse impacts.

This would apply to otherwise sustainable schemes that are valued for planning, environmental, social and economic reasons, if the minimum standard of avoiding significant adverse impacts cannot be achieved by mitigation incorporated into the scheme. The next option should be to offer mitigation at the receptor and compensation for loss of amenity, even if property values are unaffected.

Improve adverse effects on health and quality of life

The third aim seeks, where possible, positively to improve health and quality of life through the proactive management of noise while also taking into account the guiding principles of sustainable development. The management and control of such noise impacts is achieved by avoiding (*ie* preventing from happening) any significant adverse impacts on health and quality of life, and minimising (reducing to the smallest possible) adverse impacts on health and quality of life.

It is not immediately apparent that older methods of demonstrating that noise level increases would have no unacceptable impact will not satisfy this requirement. This is because such methods will usually result in the opposite effect, which is continually raising ambient noise levels. This also means that an industrial installation would need to be able to demonstrate that an expansion project had actively considered methods and designs that reduced the noise effects of the existing installation, for example by the location of a new building and the possibility of using it as a noise barrier to a sensitive receptor, or making a building on the new project slightly larger to house some of the existing equipment to reduce impact on sensitive receptors.

This aim could also be used to counter or minimise 'creeping' background and ambient noise levels when assessing the impacts of planning applications for noise generating activities. Significant negative impacts due to incremental increases in noise levels may arise when the noise levels in a locality are borderline acceptable or are already unacceptable. Consequently, when considering applications for noise generating development an authority may wish to apply the aims and objectives of the NPSE to prevent incremental increases leading to unacceptable overall noise levels in noise-sensitive locations.

Target levels for significant adverse impacts

Levels for avoiding significant impacts

Crucially the Statement does not expect that the noise levels representing

the onset of effects, or at which effects can be detected, should be the overriding control values. Instead the NPSE focuses on avoiding significant impacts, which may not arise until noise levels are substantially higher than the lowest values at which effects can be detected.

The policy statement is very clear that judgements as to significance should be made 'in the context of Government policy on sustainable development'. Some may be concerned that the NPSE may appear to lessen the rigour with which noise is controlled for proposals that deliver high sustainable development gains, such as sustainable energy schemes. The negative impacts of noise could be outweighed by the wider benefits of such developments and noise impacts that might otherwise have been weighed against planning consent may be allowed.

NPSE and the WHO guidance on night-time noise levels

For example, in 2009 the World Health Organisation WHO published guidance on night-time noise levels[3] that supplemented the earlier Community Noise Guidelines, based on external noise levels averaged over a whole year. This suggests an ultimate target value of L_{night} externally of 40dB(A), and an interim value of 55dB(A) L_{night} externally. The WHO document makes it clear that the ultimate night noise guideline (NNG) is the Lowest Observable Adverse Effect Level LOAEL, although as with all WHO guidance there is no suggestion that this has any potential application in planning or local noise management.

Realistic and achievable target levels

However the Noise Policy Statement for England at paragraphs 2.20 and 2.21 reinforces that it seeks to avoid 'significant adverse impacts' and distinguishes these from the more stringent Lowest Observable Adverse Effect Levels used to set the WHO's ultimate night-time noise target by referring to Significant Observed Adverse Effect Levels SOAEL *ie* the levels above which significant adverse effects on health and quality of life occur. It appears that the NPSE does not promote or otherwise sanction the ultimate WHO night noise target of L_{night} externally of 40dB(A) as an overall policy objective. Instead it seeks to promote a more realistic and achievable target in order to avoid significant adverse effects.

Influence on cost-effective management of noise

The application of the NPSE should mean that noise is properly taken into account at the appropriate time. In the past, the opportunity for the cost-effective management of noise has often been missed because the noise implications of a particular policy, development or other activity have not been considered at an early enough stage. For example, this means that noise needs to be considered at the earliest stages, to satisfy planning and any permitting requirements of any regulating body such as the Environment Agency, rather than being dealt with as two separate requirements.

Consideration of noise alongside other issues

The application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. For example, the positive benefits of wind turbines in reducing emission of pollutants would be considered alongside environmental impacts of noise. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications. This means that strategic nationally important projects such as alternative energy projects would need to be viewed more favourably than other projects with less benefit to society as a whole.

Implications for localism

Instead of trying to put a national stamp on areas of widely differing character, the Statement allows a bottom-up, even neighbourhood-based, approach well suited to the current theme of localism. For example,

continued on page 24

The Noise Policy Statement for England - *continued from page 23*

planners and the Planning Inspectorate should take the NPSE into account when determining planning applications if they feel that current policies and practices are unclear. Its application should have no cost, and it is intended that if anything there may be a cost benefit by providing clarity regarding current policies and practices.

However, along with the benefits of 'localism' there come substantial risks of inconsistent or inappropriate application of the policy. For example, a busy road may separate planning authorities, but each planning authority could have a different interpretation of the NPSE and apply widely different targets to noise sensitive development in locations that whilst separated by an administrative border are essentially the same in nature and character.

NPSE and the Government's policy on sustainable development

The NPSE provides a description of desired outcome from the noise management of a particular situation. The guiding principles of Government policy on sustainable development[4] should be used to assist in its implementation. Central Government provides policy guidance on delivering sustainable development in Planning Policy Statement 1 (PPS1)[5]. In that document, the Government sets out four aims for sustainable development:

- social progress which recognises the needs of everyone;
- effective protection of the environment;
- the prudent use of natural resources;
- the maintenance of high and stable levels of economic growth and employment.

PPS1 goes on to advise that planning should facilitate and promote sustainable and inclusive patterns of urban and rural development by:

- making suitable land available for development in line with economic, social and environmental objectives to improve people's quality of life;
- contributing to sustainable economic development;
- protecting and enhancing the natural and historic environment, the quality and character of the countryside, and existing communities;
- ensuring high quality development through good and inclusive design, and the efficient use of resources;
- ensuring that development supports existing communities and contributes to the creation of safe, sustainable, liveable and mixed communities with good access to jobs and key services for all members of the community.

There is repeated reference throughout the NPSE to 'within the context of Government policy on sustainable development' and these terms are included in both the Noise Policy Vision and the Noise Policy Aims. It refers to the five guiding principles of sustainable development but the NPSE itself does not help clarify the conflict that is often faced between, for example, accepting that a particular development will have some negative impact on the noise climate of some individuals, although that impact is acceptable for the wider benefit to society.

Legal status in the devolved administrations

The NPSE has the legal status of a statement of government policy, not simply Defra's policy. Consequently every department will be expected to noise-proof future policies against it. In time, departments will be expected to review their existing policies against the Statement too. There is no equivalent in the devolved administrations. However, officials are liaising so that the DAs can form a view regarding whether such a statement would be helpful for them.

Effects on other Government policy areas

The Statement is already having an effect on other Government policy areas. The revised draft Overarching National Policy Statement for Energy (EN-1)[6] published by the Department of Energy and Climate Change (DECC) in October 2010, for example, says that the Infrastructure Planning Commission (IPC) should not grant development consent for a major infrastructure project unless it is satisfied that the proposals will meet the Statement's aims. The IOA's response to the consultation on the National Policy Statement for Energy can be found on the IOA web site[7].

Perhaps unexpectedly, EN-1 consequently incorporates the core policy aims of the NPSE into Wales. It should be noted that for industry applying for and regulated under an Environmental Permit administered by the Environment Agency, it is also likely that application of the statement to Wales will be considered as it is largely consistent with the fundamental principles of the Environmental Permitting regulations. Likewise, the Environment Agency is currently reviewing and rewriting its Horizontal Guidance for Noise[8]. It is certain that the updated guidance will be consistent with the aims of the NPSE.

Conclusions

The declaration of overarching noise policy presented in the Noise Policy Statement for England is welcomed as it should lead to a joined-up approach to dealing with noise at all levels ie central, regional and local government, and between potentially competing jurisdictions and departments within those bodies. The application of the NPSE should mean that noise is properly taken into account at the appropriate time. Consequently, its application should have no cost, and there may indeed be a cost benefit by providing clarity regarding current policies and practices. The NPSE concerns the management of noise. This implies that it might include aspects of the wider management of the overall acoustic environment. The Statement should therefore be interpreted to embrace more than just the reduction of noise levels. The commitment to, and placing of noise in the health and sustainability agenda demonstrates the importance of these issues and their priority relative to other important considerations. The possible implications for acousticians in England and for the Institute of Acoustics have not yet been fully realised. Should, for example, the Institute endorse the NPSE? Would Council then be required to ensure the vision and aims of NPSE are enshrined in the day-to-day activities of all members? These issues and the wider implications of the NPSE will be discussed in depth at an IOA Workshop to be held at the University of Salford on 24 May 2011. The authors urge members to make their views known at that event.

Acknowledgements

This article was written by David Waddington, Tony Clayton, Dani Fiumicelli, Tim Clarke, and Steve Mitchell.

The authors would like to thank Colin Grimwood and Stephen Turner, who as Defra advisers were directly involved in drafting the NPSE, and Howard Price at the CIEH, for their contributions to this article.

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Noise Policy Statement for England

Selected extracts

The article by David Waddington, Tony Clayton, Dani Fiumicelli, Tim Clarke, and Steve Mitchell describes some of the possible impacts of the NPSE on the work of acousticians throughout the country. The Policy Statement and Explanatory Note is readily available in its entirety at **http://www.defra.gov.uk/environment/quality/noise/policy/documents/noise-policy.pdf**. Since readers of Acoustics Bulletin may find it helpful to have the document to hand when studying the foregoing article, the policy and various extracts from the Explanatory Note are reproduced here.

Noise Policy Statement for England

1.1 The Government is committed to sustainable development and Defra plays an important role in this by working to secure a healthy environment un which we and future generations can prosper. One aspect of meeting these objectives it the need to manage noise for which Defra has the overall responsibility in England.

1.2 The Government recognises that the effective management of noise requires a coordinated and long term approach that encompasses many aspects of modern society.

1.3 The aim of this document is to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion.

1.4 The document seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. It has been developed following discussions with stakeholders regarding the effects on the noise environment of current policies and practices

1.5 This Noise Policy Statement for England (NPSE) should apply to all forms of noise including environmental noise, neighbour noise and neighbourhood noise. The NPSE does not apply to noise in the workplace (occupational noise).

1.6 This Noise Policy Statement for England (NPS E) sets out the long term vision of Government noise policy:

Noise Policy Vision

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

1.7 This long term vision is supported by the following aims:

Noise Policy Aims

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.

1.8 The vision and aims of NPSE should be interpreted by having regard to the set of shared UK principles that underpin the Government's sustainable development strategy.

Guiding principles of sustainable development

Ensuring a Strong Healthy and Just Society - Meeting the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, and creating equal opportunity for all.

Using Sound Science Responsibly - Ensuring policy is developed and implemented on the basis of strong scientific evidence, whilst taking into account scientific uncertainty (through the precautionary principle) as well as public attitudes and values. Living Within Environmental Limits - Respecting the limits of our planet's environment, resources and biodiversity - to improve our environment and ensure that the natural resources needed for life are unimpaired and remain so for future generations. Achieving a Sustainable Economy - Building a strong, stable and sustainable economy which provides prosperity and opportunities for all, and in which environmental and social costs fall on those who impose them (polluter pays), and efficient resource use is incentivised.

Promoting Good Governance - Actively promoting effective, participative systems of governance in all levels of society - engaging people's creativity, energy and diversity.

Explanatory Note

Why do we need a Noise Policy Statement for England (NPSE)?

2.1 Noise is an inevitable consequence of a mature and vibrant society. For some the noise of city life provides a desirable sense of excitement and exhilaration, but for others noise is an unwanted intrusion that adversely impacts on their quality of life, affecting their health and well being.

2.2 The management of noise has developed over many years as the types and changed. The Noise Abatement Act came into law in 1960 and the Report from the Committee on the Problem of Noise was published in 1963 (the Wilson report). Since then, examples of noise management can be found in many areas including reducing noise at source; the use of the land use and transport planning systems, compensation measures, the statutory nuisance and licensing regimes and other related legislation.

2.3 Furthermore, the broad aim of noise management has been to separate noise isolation and to a literal extreme, noise minimisation would mean no noise at all. In reality, although it has not always been stated, the aim has tended to be to minimise noise 'as far as reasonably practical'. This concept can be found in the Environmental Protec tion Act 1990, where, in some circumstances, there is a defence of 'best practicable means' in summary statutory nuisance proceedings.

2.4 By describing clear policy vision and aims th e NPSE provides the necessary clarity and direction to enable decisions to be made regarding what is an acceptable noise burden to place on society.

What types of noise are addressed by the Noise Policy Statement for England?

2.5 The intention is that the NPSE should apply to all types of noise apart from noise in the workplace (occupational noise). For the purposes of the NPSE, 'noise' includes:

- 'environmental noise' which includes noise from transportation sources;
- 'neighbour noise' which includes noise from inside and outside people's homes; and
- 'neighbourhood noise' which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.

What will the Noise Policy Statement for England achieve?

2.6 The application of the NPSE should mean that noise is properly taken into account at the appropriate time. In the past, the opportunity for the cost effective management of noise has often been missed because the noise implications of a particular policy, development or other activity have not been considered at an early enough stage.

2.7 In addition, the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered

in isolation. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications.

2.8 In the longer term, the Government hopes that existing policies could be reviewed (on a prioritised basis), and revised if necessary, so that the policies and any noise management measures being adopted accord with the vision, aims and principles of the NPSE.

How should the Noise Policy Statement for England be used?

2.9 Noise management is a complex issue and at times requires complex solutions. Unlike air quality, there are currently no European or national noise limits which have to be met, although there can be specific local limits for specific developments. Furthermore, sound only becomes noise (often defined as 'unwanted sound') when it exists in the wrong place or at the wrong time such that it causes or contributes to some harmful or otherwise unwanted effect, like annoyance or sleep disturbance. Unlike many other pollutants, noise pollution depends not just on the physic al aspects of the sound itself, but also the human reaction to it. Consequently, the NPSE provides a clear description of desired outcome from the noise management of a particular situation.

2.10 The guiding principles of Government policy on sustainable development, (paragraph 1.8), should be used to assist in its implementation. The development of further principles specifically to underpin implementation of noise management policy will be kept under review as experience is gained from the application of the NPSE.

Paragraphs 2.11 to 2.22 deal with key phrases such as health and quality of life, and with the concepts of NOEL, LOAEL and SOAEL.

The first aim of the Noise Policy Statement for England

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.23 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).

The second aim of the Noise Policy Statement for England

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.24 The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

The third aim of the Noise Policy Statement for England

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.25 This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

Extract from House of Commons Hansard

Ministerial Statements for 20 December 2010

Major Infrastructure Planning Reform

The Minister of State, Department for Communities and Local Government (Greg Clark): I am today publishing the Department's work plan on major infrastructure planning reform. This Government believe that securing investment in new infrastructure is essential to deliver sustainable growth over the coming decades and is an integral part of our efforts to rebuild the UK economy and provide new jobs. We cannot expect to meet the needs of tomorrow with yesterday's infrastructure and we cannot secure essential investment without a planning system designed to meet this need. The work plan sets out the steps that we are taking to deliver this reform.

It is right that decisions on infrastructure of national importance should be taken by democratically elected representatives and not by an unelected quango. The Localism Bill therefore provides a legislative framework for the abolition of the infrastructure planning commission (IPC) and the creation of a major infrastructure planning unit (MIPU) in a new, more streamlined and efficient planning inspectorate. The MIPU will be responsible for examining applications for major infrastructure development and providing high quality advice to Ministers.

For the majority of schemes, decisions will be taken by the Secretary of State responsible for the policy: the Secretary of State for Energy and Climate Change will take decisions on major energy infrastructure and the Secretary of State for Transport will take decisions on major transport infrastructure.

We envisage that applications relating to hazardous waste will be determined by the Secretary of State for Communities and Local Government, and that applications relating to waste water and water supply will be determined jointly by the Secretaries of State for Communities and Local Government and for Environment, Food and Rural Affairs. This is in line with the position prior to the establishment of the IPC.

The Government are determined to ensure that a return to ministerial decision-making does not mean a return to slow and protracted consideration of applications. It supports the fast-track approach established through the 2008 Planning Act, that is to say that decisions will be taken within 12 months of commencement of an application's examination. We will set up a ministerial group to oversee the effectiveness of the regime and explore whether additional efficiencies can be made to speed up the process further.

The work plan confirms the Government's intention to press ahead with the development of national policy statements and indicates a timetable for their production and designation. The Government have made clear their position on additional runways at London's three major airports and their priority is to create a sustainable framework for UK aviation rather than to produce a national policy statement at this time.

National policy statements should have the strongest possible democratic mandate and subject to the passage of the Localism Bill, they will in future be subject to approval of the House of Commons following parliamentary scrutiny by the House of Commons, the House of Lords or a Joint Committee of both Houses. For those national policy statements which are currently subject to public consultation and parliamentary scrutiny, it is the Government's intention to adopt a similar, informal approach for parliamentary approval to that set out in the Localism Bill.

National policy statements will continue to be the primary documents by which decisions are made on schemes which fall within the 2008 Planning Act regime for major infrastructure. Decisions must be made in accordance with them, although the Secretary of State will also have to take into account any other matters considered both important and relevant to the decision. Those matters can include policy contained within the new national planning policy framework on which I have made a separate statement to the House today.

A copy of the work plan has been placed in the Libraries of both Houses and is available at: http://www.communities.gov.uk/publications/planningandbuilding/mipworkplan

National Planning Policy Framework

The Minister of State, Department for Communities and Local Government (Greg Clark): The coalition agreement states that the Government will publish and present to Parliament a simple and consolidated national planning framework that covers all forms of development and sets out national economic, environmental and social priorities.

The planning system is vital to the re-building of Britain's economy. We need to reinvigorate our construction and development industries and the investment that goes with them and to ensure that we develop and protect our national assets. We need a planning system which encourages the idea that development can positively benefit a community. We need a planning system that enables local people to shape their surroundings in a way that, while heeding national objectives and constraints, is also sensitive to the history and character of a given location. We need participation and social engagement enabling communities to formulate a positive vision of their future development.

The Localism Bill sets out a legislative framework for achieving these goals.

The Government have made it clear that with the exception of nationally important projects, planning should be a local matter. The role of central Government is to determine and define environmental, economic and social priorities for the country and design a planning system which helps ensure a pattern of development that matches these priorities and local aspiration. This role is currently fulfilled through legislation, and through the suite of planning policy guidance notes (PPGs) and minerals policy guidance notes (MPGs), and more recently planning policy statements (PPSs) and minerals policy statements (MPSs).

These documents, which run to over 1,000 pages, set out central Government policy on various aspects of development and land use to local planning authorities, who must legally have regard to them when drawing up their local development frameworks. They are also often relevant to making decisions on planning applications. They cover broad policy themes such as planning aspects of climate change, housing, renewable energy, flood risk, green belt and waste, and also procedural themes such as how to compile local development plans.

The Government believe that the current suite of planning policy statements and guidance notes is too centralist in its approach, and too long and cumbersome for councils and developers to use effectively. There is no over-arching integrated statement of the Government's priorities for the country and the role which planning can play in delivering them.

Therefore the Government will produce a simple national planning policy framework setting out their priorities for the planning system in England in a single, concise document covering all major forms of development proposals handled by local authorities. All the national planning policies set out in PPSs, MPSs, PPGs and MPGs, will be integrated into a single document.

The national planning policy framework will set out the Government's views on how the planning system in England can contribute to the delivery of a prosperous, competitive and attractive country based on the values of freedom, fairness and responsibility. The framework will set broad economic, environmental and social priorities and how they relate to each other, but will ensure that the majority of planning decisions are made at the local level, with the minimum of interference from Whitehall. The framework will also set out a strong basis for economic growth, a presumption in favour of sustainable development,

Major reforms to the planning system will impact on the work of many IOA members

as well as any further policy needed to establish and implement neighbourhood plans.

The Government will apply the following principles when considering what the framework should contain. The framework will be:

- localist in its approach, handing power back to local communities to decide what is right for them;
- used as a mechanism for delivering Government objectives only where it is relevant, proportionate and effective to do so; and
- user-friendly and accessible, providing clear policies on making robust local and neighbourhood plans and development management decisions.

In the past, Governments have issued vast swathes of non-statutory guidance in addition to policy. However, such guidance can unintentionally take on a force which constrains rather than helps practitioners and users on the ground. This Government, therefore, believe that we should keep central Government guidance to a minimum. Accordingly, the Government will radically reduce the amount of guidance they issue and will work to withdraw or shorten existing guidance wherever they can.

The Government will publish and consult on a draft of the new national planning policy framework in 2011. We will invite Parliament to hold a Select Committee inquiry on the framework during the consultation period, so that it is subjected to additional democratic scrutiny.

For the time being national policy statements (which are separate statutory documents published in accordance with the Planning Act 2008, setting out the Government's policy on major infrastructure projects such as nuclear power stations and ports) will not be included in the framework. Further detail on our approach to major infrastructure is set out in the work plan on major infrastructure planning reform which I am also publishing today. Copies of the work plan have been placed in the Libraries of both Houses and are available on the Department's web site:
http://www.communities.gov.uk/planningandbuilding/planningsystem/planningpolicy/planningpolicyframework

This Government have a commitment to greater transparency and openness in developing their policy. To begin the process of writing the framework, therefore, and in advance of formal consultation on a draft, I invite organisations and individuals to offer their suggestions to the Department on what priorities and policies we might adopt to produce a shorter, more decentralised and less bureaucratic national planning policy framework. Details of how to do so have been placed on the Department for Communities and Local Government website. I would be pleased to receive proposals by 28 February 2011. The Department will also organise a number of roundtable discussions with key organisations to promote debate on the framework.

Recent developments concerning aircraft noise annoyance

Mike Rickaby.

Introduction

The European Environment Agency has produced a good practice guidance report [1] intended to assist policy makers and competent authorities in understanding and fulfilling the requirements of Directive 2002/49/EC relating to the assessment and management of environmental noise. It summarises the latest European view on issues such as exposure-response relationships and thresholds for health endpoints (annoyance, sleep disturbance, cardiovascular effects and cognitive impairment). Individual annoyance relationships with Lden are given for road, rail and aircraft noise. Of particular interest is recognition in the EEA report that aircraft noise is more annoying at a given noise level than previously believed.

EU models for aircraft noise annoyance

Previous European guidance on aircraft noise annoyance was given in the Position Paper of 2002 [2]. This gives annoyance relationships in terms of approximate polynomial expressions for estimating percentage of persons highly annoyed at a given L_{den} noise exposure for dwellings. The EEA report suggests that the relationships given in the 2002 paper are based on studies carried out prior to 1990. The EEA report refers to criticism of the annoyance relationships of the 2002 paper. Studies are referred to showing a decrease over time of the noise level needed to cause 25% highly annoyed, and a trend change in annoyance around 1990. The EEA report refers to estimates for the average of aircraft noise studies carried out after 1990. These were all European studies (Switzerland, Germany, Netherlands) regarded as more appropriate for the EU than the pre-1990 studies which were mainly carried out in the USA and Australia.

The EEA report gives tabulated data of percentage highly annoyed for the post-1990 studies. Figure 1 gives percentage highly annoyed in relation to L_{den} for the pre-1990 studies (determined from the polynomial expressions) and for the post-1990 studies (determined from the tabulated data). Figure 1 is similar to Figure 3.3 of the EEA report, although the latter also gives 95% statistical confidence bands.

At 59dB L_{den}, the relationship adopted for the pre-1990 studies in Figure 1 gives 15.9% highly annoyed. In the case of the post-1990 studies, the relationship adopted gives that same percentage highly annoyed at around 49dB. Thus, the EEA report suggests that levels of annoyance (expressed as percentage highly annoyed) that occurred at 59dB L_{den} in pre-1990 studies occurred at around 49dB L_{den} in the post-1990 studies, a reduction of around 10dB.

UK models for aircraft noise annoyance

The Government's aviation policy uses 57dB $L_{Aeq,16h}$ as the level of daytime noise marking the approximate onset of significant community annoyance. This level is based on the Aircraft Noise Index Study (ANIS) [3] carried out in the UK in the 1980's. The more recent Attitudes to Aviation Noise Sources in England (ANASE) study reported in 2007 [4] that annoyance with a given level of aircraft noise is higher than when the ANIS study was carried out. The ANASE study made a direct comparison with the ANIS study in terms of 'mean annoyance' with aircraft noise. This showed that the level of mean annoyance found at 57dB $L_{Aeq,16h}$ in the ANIS study was found in the ANASE study at a level of just over 50dB $L_{Aeq,16h}$, a reduction of just under 7dB.

The Government accepted that the ANASE study demonstrated that annoyance with a particular level of aircraft noise is higher than found in the ANIS study. However, on advice contained in an independent review report [5], the Government decided that the detailed findings of the ANASE study should not be relied on.

Most of the analysis in the ANASE study related to 'mean annoyance', and trend lines were fitted to graphs of mean annoyance versus $L_{Aeq,16h}$. The ANASE report did contain a graph of percentage 'at least very annoyed' versus $L_{Aeq,16h}$, but no trend line was fitted to the plotted data points. Section 6 of the ANASE peer review report presumes that the ANASE term 'at least very annoyed' is equivalent

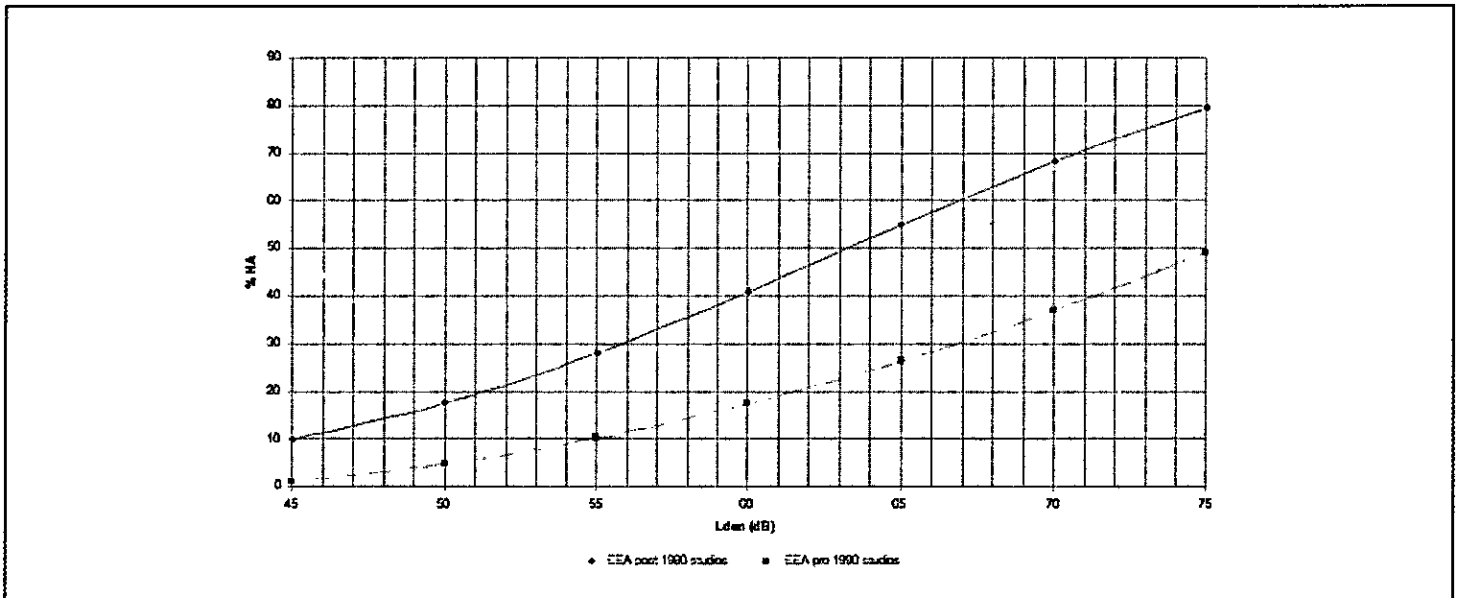

Figure 1

EU models of aircraft noise annoyance

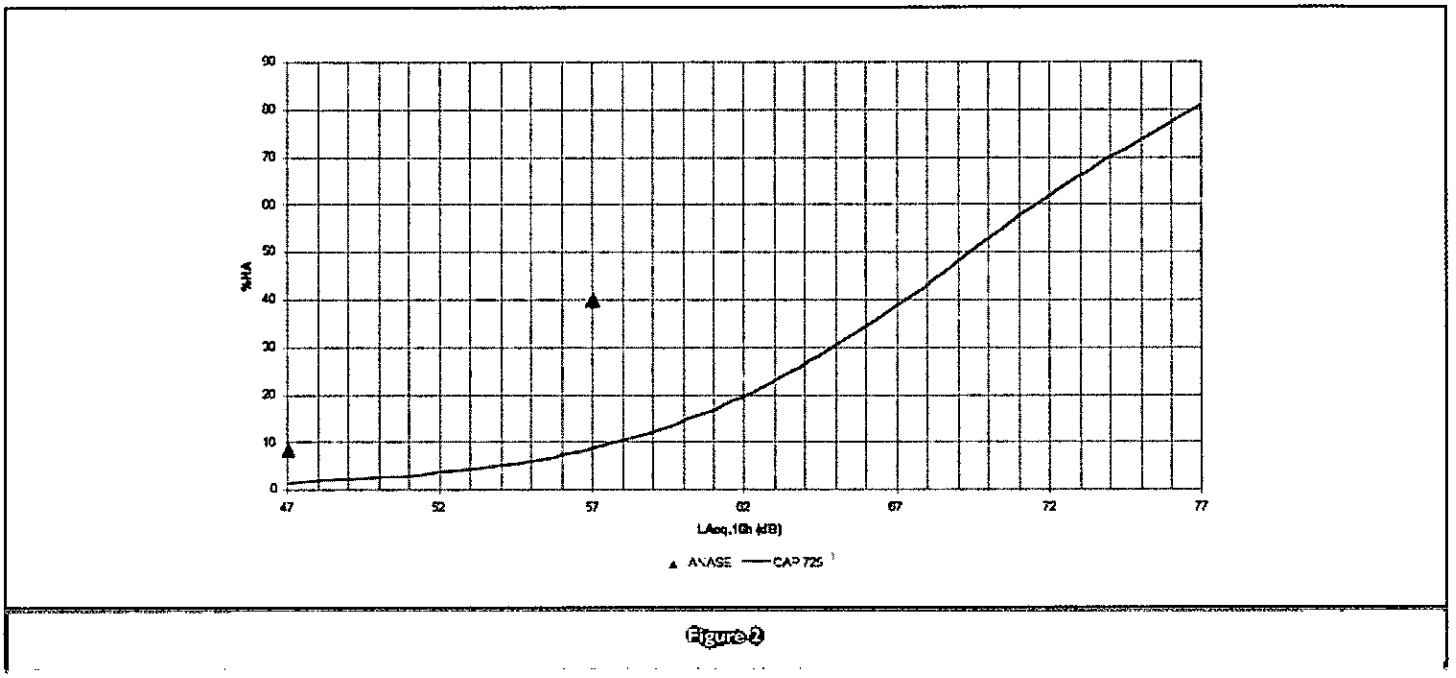

Figure 2

UK models for aircraft noise annoyance

to the term 'highly annoyed' used in other studies. This presumption allowed the peer reviewers to deduce two trend points for the plotted ANASE data points (apparently assessed by eye). These two ANASE trend points given in the peer review report are 8.5% highly annoyed at 47 to 48 dB $L_{Aeq,16h}$, and around 40% highly annoyed at 57dB $L_{Aeq,16h}$. These two ANASE trend points are plotted in Figure 2.

The CAP 725 document [6] produced by the Civil Aviation Authority in 2007 outlines relevant methodologies for use in environmental assessment in relation to an airspace change proposal. The document states that it is possible to calculate the number of people who would be 'highly annoyed' at particular levels of aircraft noise by using $L_{Aeq,16h}$ contours and the response relationship known as the Schultz curve produced in 1978 [7]. An equation based on the Schultz curve is given in the CAP 725 document for calculating the percentage of people 'highly annoyed' using $L_{Aeq,16h}$ values. The document contains a comparison of ANIS and Schultz, and states that it is clear that the ANIS results exhibit the same general trend as the aircraft studies in the Schultz analysis. Values of percentage highly annoyed calculated using the equation given in the CAP 725 document are also plotted in Figure 2.

Comparison of EU and UK models for aircraft noise annoyance

It is not easy to draw valid conclusions from a comparison of the results of the pre-1990 and post-1990 studies referred to in the EEA report with the aircraft noise relationships used in the UK. This is because the studies referred to in the EEA report were carried out in countries other than the UK where annoyance responses of the public and annoyance scales may differ. Also, the studies use the L_{den} noise metric rather than the $L_{Aeq,16h}$ metric used in the UK. The relationship between the L_{den} and $L_{Aeq,16h}$ noise metrics depends on the relative contributions of noise during the day, evening and night periods. The two noise metrics use different measurement heights and relate to different, although overlapping, durations within the year. This means that the relationship between the two noise metrics will vary, in general, from airport to airport, and from year to year.

Both L_{den} and $L_{Aeq,16h}$ data are available for Heathrow from year 2006 [9, 10]. Figure 3 shows plots of contour area versus L_{den} and $L_{Aeq,16h}$ for the available data ('actual' contours used for $L_{Aeq,16h}$). Visual inspection of the data for 2006 [8] shows that L_{den} is typically around 2dB higher than $L_{Aeq,16h}$ at any given location for Heathrow in 2006. This information enables the data in Figure 2 relating to $L_{Aeq,16h}$ to be transposed into data relating to L_{den}, by adding 2dB to $L_{Aeq,16h}$ as derived specifically for Heathrow in 2006. Figure 3 gives the transposed data from Figure 2, together with data from Figure 1.

Figure 3 shows that percentage highly annoyed for CAP 725 derived data for Heathrow in 2006 is lower than for the EEA pre-1990 studies trend line up to around 67dB L_{den}. Also, the ANASE derived trend point for Heathrow in 2006 at 59dB L_{den} shows remarkable agreement with the EEA post-1990 studies trend line.

Since the Government rejected the detailed results of the ANASE study, current advice from the Government would seem to be continued use of the ANIS, Schultz and CAP 725 relationships. It is important to note that the ANIS and Schultz relationships, and hence the CAP 725 relationships, are based on social surveys carried out more than 30 years ago. The question has to be asked whether the relationships derived from those studies remain in calibration for flight numbers, aircraft fleet mixes, aircraft noise characteristics and

continued on page 32

Recent developments concerning aircraft... - *continued from page 31*

public attitudes of 2011 and beyond. The publication of the EEA report seems to throw further doubt on the continued validity of the ANIS, Schultz and CAP 725 annoyance relationships.

Aircraft noise action plans

The EEA report provides the dose-effect relationships intended to be used to assess the effects of noise on populations as required by the Directive. Section 6 of the EEA report suggests that the lower noise thresholds for mapping are intended to delimit the area where noise is 'considered to be a problem'. The EEA report makes a distinction between thresholds for noise mapping and thresholds as noise levels above which health effects start to occur.

The EEA report accepts that use of the current threshold levels for noise mapping of 55dB L_{den} and 50dB L_{night} is understandable as a first step because of the large scale noise mapping required. However, the report points out that member states are free to choose their own noise thresholds from where to start action planning, and the L_{den} threshold for noise mapping of 55dB L_{den} does not take into account differences that exist between different noise sources.

The differences between different noise sources are illustrated by Table 6.1 of the EEA report giving respective percentages highly annoyed at 45, 50 and 55 dB L_{den} for road, rail and aircraft noise. It is stated that 55dB L_{den} is a 'fair' threshold for rail noise, and use of 55dB L_{den} for other noise sources leads to an underestimate of the actual burden. The percentage highly annoyed at 55dB L_{den} for rail noise is given as 4%, while the percentages highly annoyed at 45dB L_{den} for aircraft noise is given as 12%. This means that to achieve annoyance levels approaching that regarded as 'fair' for rail noise, the threshold for aircraft noise may have to be lower than 45dB L_{den}. In fact, Section 2 of the EEA report gives 42dB L_{den} as a general threshold above which annoyance effects start to occur or rise above background. It would therefore appear that the EEA report implies that the threshold for noise mapping where aircraft noise is considered to be a problem should be much lower than 55dB L_{den}.

Conclusions

The Government has discounted the detailed results of the ANASE study published in 2007, and continues to rely on the ANIS study of the 1980s. The Civil Aviation Authority document of 2007 bases its advice on the Schultz curve produced in 1978, and states that the ANIS and Schultz show the same general trends. The EEA guide accepts that levels of annoyance found in pre-1990 studies were found in post-1990 studies at L_{den} noise levels 10dB lower. This throws further doubt on the continuing validity of the ANIS and Schultz relationships used in UK. It is therefore believed that there is an urgent need for updated guidance from the Government and the Civil Aviation Authority in relation to the annoyance dose response relationship for aircraft noise, and the level at which aircraft noise is considered to be a problem.

Acknowledgements

The author wishes to thank colleagues in the Local Authorities Heathrow Aircraft Noise Working Group, especially John Coates and Dr Chris Hill, for much stimulating discussion of the subject of this article.

Mike Rickaby is an Environmental Protection Officer with the London Borough of Hillingdon.

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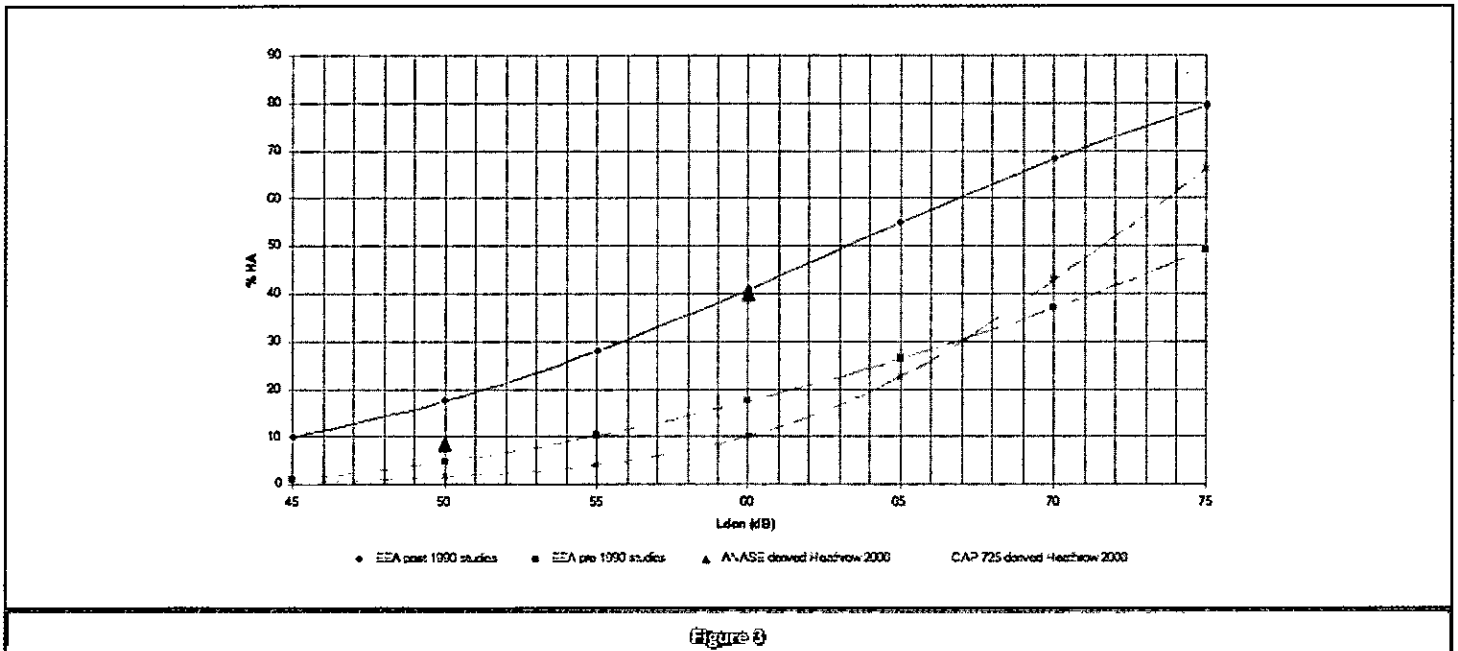

Figure 3

Comparison of EU and UK aircraft noise annoyance models

A review of trailing edge noise generated by airfoils at low to moderate Reynolds number

E J G Arcondoulis, C J Doolan, A C Zander and L A Brooks.

Introduction

This article contains a detailed literature review of research findings regarding the cause of flow-induced noise created by airfoils operating at low to moderate Reynolds numbers. Airfoils produce tonal and broadband noise at low to moderate Reynolds number flow conditions ($50{,}000 < Re < 200{,}000$; $Re = UL/\nu$, where U is the freestream velocity, L is the airfoil chord and ν is the kinematic viscosity of the fluid). Many important engineering applications (including micro-wind turbines, compressor and cooling fans, small unmanned air vehicles and submarines) operate at this flow condition and hence it is important to understand and control this undesired noise.

The tonal and broadband noise is produced in the vicinity of the trailing edge of an airfoil [1]. Although there is no consensus, various explanations for the trailing edge noise mechanism have been proposed. Quadrupole noise sources in the boundary layer and near wake are made more efficient through a diffraction process at the sharp trailing edge, forming a cardioid directivity pattern [1], [2]. Sound at certain acoustic frequencies is thought to be amplified, via an acoustic feedback mechanism near the trailing edge [3], [4], [5], [6]. There exists some disparity in the explanations for this mechanism and where the origin of the feedback loop is located. A schematic diagram illustrating the fluid flow and cardioid directivity pattern is provided in Figure 1.

This aim of this article is to provide a review of airfoil trailing edge noise mechanisms at low to moderate Reynolds number. The flow structure around an airfoil in this flow regime is described, followed by an explanation of the diffraction and acoustic scattering observed at the trailing edge and the nature of the trailing edge noise. The postulated feedback mechanisms causing this trailing edge noise are then discussed and summarised.

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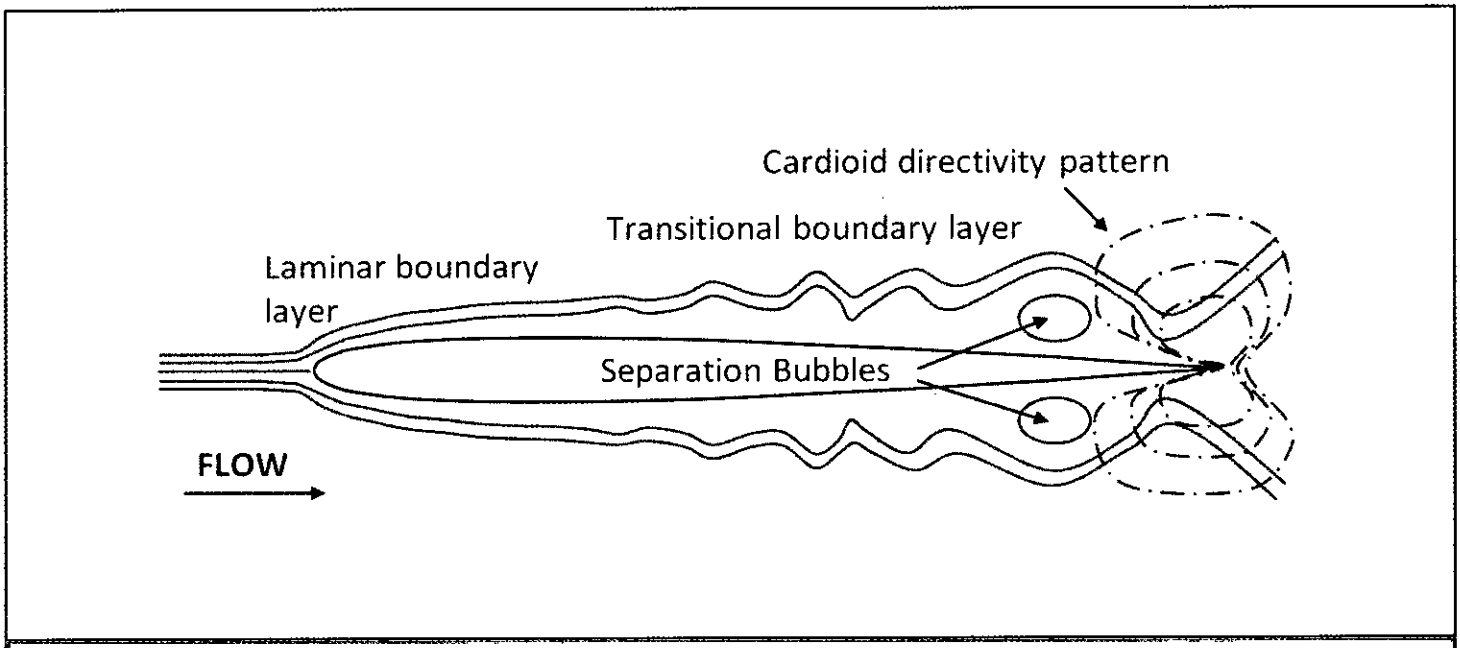

Figure 1

Schematic diagram of low to moderate Reynolds number and 0° angle of attack airfoil fluid flow and cardioid directivity pattern.

A review of trailing edge noise... - *continued from page 33*

Flow structure

At low Reynolds number, the flow about airfoils has different characteristics from that found at high Reynolds number. Sandberg *et al* [2] show that at Re = 50,000 and 0° angle of attack, laminar boundary layers form initially on the airfoil surfaces but unsteady disturbances appear (Tollmein Schlicting or T-S waves) that are the first stages of transition to a turbulent state. Depending on local flow conditions, the boundary layer may also separate, creating an oscillating shear layer. These unsteady flow fields are on each side of the airfoil and interact at the trailing edge, forming a complex wake [7].

At non-zero angles of attack, the flow structure is asymmetric about the airfoil chord. The boundary layers on each side of the airfoil grow and become more unstable at different rates relative to the distance from the airfoil leading edge. The boundary layer on the suction side of the airfoil becomes highly unsteady and generally separates from the airfoil, forming an unstable shear layer. The separation takes place further upstream than the 0° case, resulting in a turbulent shear layer at the trailing edge. The pressure side boundary layer generally remains laminar along the entire chord for relatively low angles of attack.

Diffraction and acoustic scattering

A more complete description of the edge diffraction process is given in Figure 2, which replaces the airfoil with a semi-infinite half plane. The noise sources in the boundary layer are now represented as quadrupoles [8] that can be considered as a pair of dipoles whose major axes are orthogonal. Five quadrupoles are drawn so that the major axis of one of the dipole pairs is oriented towards the sharp edge. When a wave from a dipole encounters the edge, a diffracted wave is produced that travels back towards the quadrupole with opposite phase. This diffracted wave combines with outgoing waves from the other side of the dipole (that has similar phase to the diffracted wave) to create an efficient source of sound. In this way, one side of the quadrupole is made an efficient radiator of sound and results in the cardioid directivity pattern commonly associated with trailing edge noise [1], [9].

The nature of trailing edge noise

The noise generated by airfoils at low to moderate Reynolds number can be generally classified as either tonal or broadband. The noise is observed to contain a superposition of discrete tones on a broadband hump [3], [10]. This is demonstrated in Figure 3 which

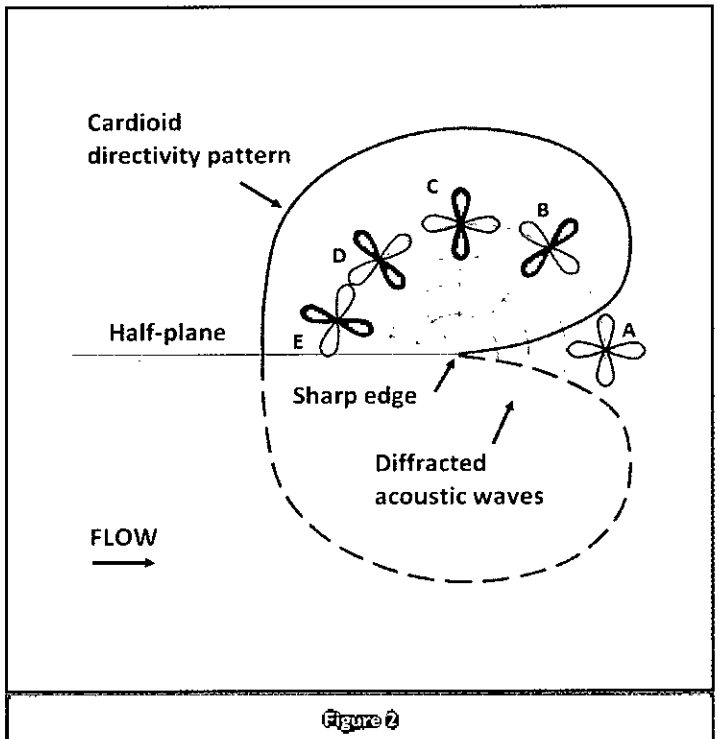

Figure 2

Cardioid directivity pattern of the noise emitted from eddies in various locations relative to a sharp edge.

presents the noise spectrum generated by a NACA0012 airfoil at a Reynolds number of 75,000 and 0° angle of attack. Figure 3 shows a primary tone (*fn,max*) and a series of secondary tones (*fn*) [3]. The broadband hump (*fs*) is also evident in Figure 3 and is defined as the centre frequency of the broadband noise component.

Broadband noise is due to a large number of incoherent eddies with a variety of sizes and strengths. The tonal noise however is due to reasonably coherent and strong eddies in the trailing edge region. The questions of how tonal noise is generated and why some eddies are more coherent and stronger than others remain unsolved. Many studies have attempted to answer these and other related questions regarding low Reynolds number trailing edge noise.

The first comprehensive study of airfoil self-noise at low to moderate Reynolds numbers was performed by Paterson *et al* [11]. They presented the measured tonal noise frequency for each flow velocity case and observed that for a small increase in flow velocity, U, the primary tonal noise frequency (*fn,max*) would increase by $U^{0.8}$. At certain flow velocities, the tonal frequency was seen to instantly 'jump' to a higher frequency, forming a new 0.8 power relationship with velocity. This overall pattern of increasing frequency with respect to $U^{0.8}$ for a given velocity range forms a 'ladder structure' [3], [12], [13]. Looking at a range of Reynolds numbers and angles of attack, there are many $U^{0.8}$ power curves. If a line is fitted through all these data points, the overall frequency dependency will fit a $U^{1.5}$ curve, given by

$$f = \frac{0.011U^{1.5}}{\sqrt{Cv}} \qquad (1)$$

where f is the frequency of the primary tone, U is the fluid freestream velocity, C is the airfoil chord length and v is the

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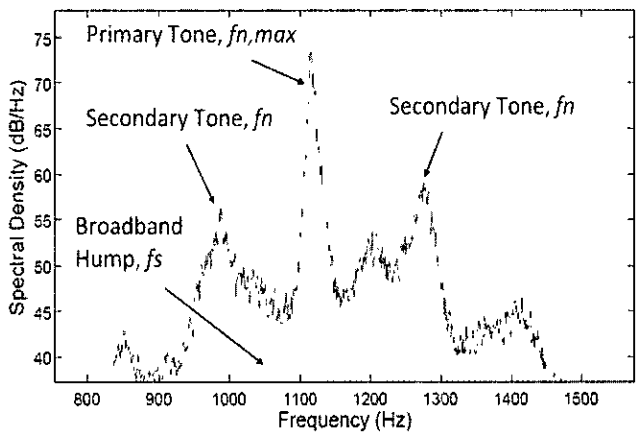

Figure 3

Noise spectrum for a NACA0012 airfoil at a Reynolds number of 75,000 and 0° angle of attack [10].

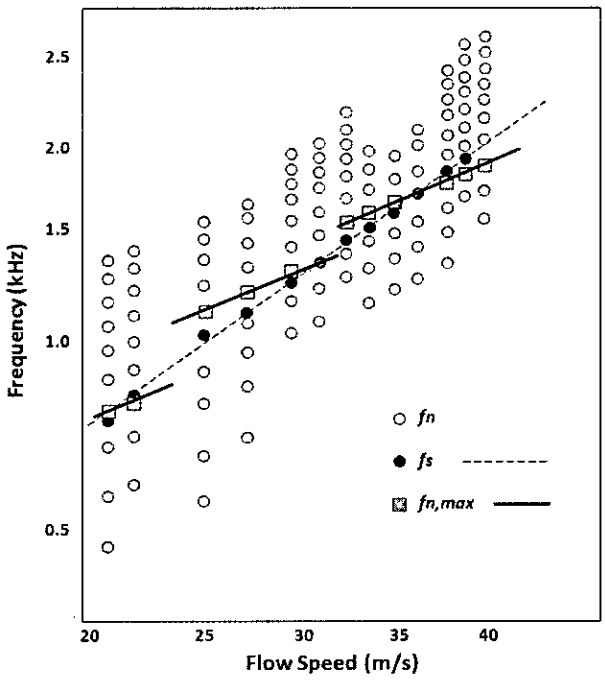

Figure 4

Ladder-type evolution of the dominant discrete frequency, fn,max, for a NACA0012 airfoil with 160mm chord (adapted from [3]).

A review of trailing edge noise... - *continued from page 35*

kinematic fluid viscosity. Figure 4 shows the results of Arbey and Bataille [3], displaying this ladder structure.

Arbey and Bataille [3] show that for the same airfoil profile at 0° angle of attack, increasing the Reynolds number (by increasing the freestream flow speed and/or airfoil chord) results in a decrease in the primary tonal noise amplitude (*fn,max*). This implies that there exists a Reynolds number for a given airfoil and angle of attack that results in the greatest tonal noise amplitude. Note that the quantity and amplitude of the secondary tones (*fn*) are also influenced by the increase in Reynolds number. The main frequency (*fs*) was observed to have a Strouhal number dependence, based on the boundary-layer thickness at the trailing edge. Arbey and Bataille [3] also confirmed that the broadband contribution is a result of the diffraction of pressure waves at the trailing edge.

Preliminary investigations show that the primary tonal noise frequency can be estimated using a parametric fit to empirical data [11], but there is still no formal method for determining which angle of attack and Reynolds number causes the greatest tonal sound pressure level for an airfoil under low to moderate Reynolds number flow conditions.

Feedback mechanism

Although there have been many investigations into the causes responsible for the trailing edge noise of airfoils in low Reynolds number flow regimes, there is no general consensus amongst the acoustics community for the cause of tonal trailing edge noise. Further, insufficient experimental measurements have been performed to confirm the mechanisms proposed in the literature. The following is a discussion of the various proposed causes of tonal noise.

Paterson *et al* [11] postulated that the observed ladder structure behaviour was due to a vortex shedding phenomenon, located at a distance downstream of the trailing edge. Tam [12] disputed Paterson *et al's* [11] explanation of the cause of the tonal noise, arguing that vortex shedding noise is Strouhal number dependent, which is inconsistent with the data of [11]. Tam [12] recognised the $U^{1.5}$ increase of the tonal noise frequency; however, he claimed that this was only an empirical fit over a large frequency range and did not capture the detail of the ladder structure.

Tam [12] proposed that the ladder structure of tonal noise was due to a self-excited feedback loop of aerodynamic origin. Acoustic disturbances originating at the sharp trailing edge propagate downstream along the airfoil wake. When these disturbances are of sufficient magnitude they induce lateral oscillations in the wake, resulting in the emission of acoustic waves. A portion of the acoustic wave energy is propagated upstream to the pressure side of the airfoil near the trailing edge, forcing the boundary layer to oscillate, thereby completing a feedback loop.

Arbey and Bataille [3] agree in some aspects with Tam [12], in that the existence of regularly spaced discrete tonal frequencies is linked with an aeroacoustic feedback mechanism. However, they propose that hydrodynamic fluctuations (which generate acoustic waves as they are diffracted at the trailing edge) propagate upstream to a point on the airfoil where the hydrodynamic instabilities are formed. This explanation differs from that of Tam [12] in both the location at which the acoustic feedback loop closes and the distance from which the acoustic source is located relative to the trailing edge.

Arbey and Bataille [3] suggest that the location of the hydrodynamic instabilities is the point of maximum flow velocity in the laminar boundary layer. If both the acoustic wave and the hydrodynamic fluctuation frequency are in phase at this location, the hydrodynamic fluctuation will become amplified [12], [14]. This fluctuation then propagates downstream, thus closing the feedback loop.

Nash *et al* [13] disagreed with others ([3] and [12]) and proposed that the feedback mechanism responsible for the tones is based on a vortex shedding process. As the unstable boundary layer forms, T-S waves continue to grow as they propagate toward the trailing edge of the airfoil and begin to roll up into a vortex. The interaction of this vortex with the trailing edge generates a scattered oscillating field around the airfoil which oscillates at the same frequency as the T-S wave. This oscillating field extends upstream to approximately half the chord which is close to the point at which the boundary layer becomes unstable.

Nash *et al* [13] hypothesise that the oscillating mean flow provides an upstream feedback mechanism for the most amplified instability, resulting in the narrow-band acoustic tones observed. However, McAlpine *et al* [15] suggest that the vortex shedding at the pressure side owing to the separation bubble acts in a similar way to the vortex shedding behind a cylinder. They propose that there is a small region of instability close to the body, which explains why the vortex shedding is a self excited mechanism. Nash *et al* [13] also identify that previous work has neglected the influence of a laminar separation bubble near the trailing edge and its influence on the tonal noise generating mechanism.

Nash *et al* [13] agree with Arbey and Bataille [3] in that there exists a point upstream of the trailing edge which is responsible for the activation of an acoustic instability via the amplification of T-S waves. While Arbey and Bataille [3] identify this location as the maximum boundary layer velocity on the airfoil, Nash *et al* [13] do not refer to the maximum boundary layer velocity and estimate its location as half the airfoil chord.

Nakano *et al* [4] indicate from their experimental results of a NACA0018 airfoil that the tonal noise source is distributed on the trailing edge region of the pressure surface. The periodic variations of the velocity field are observed in the separating region on the pressure surface, which is followed by upwash and downwash motion at the trailing edge of the airfoil. This separating region is also observed by Nash *et al* [13] for a NACA0012 airfoil. These flow phenomena over the airfoil surface result in the periodic formation of vortex streets in the wake of the airfoil. The tonal noise appears when the adverse pressure gradient on the pressure surface is sufficiently small to allow instability waves to grow slowly along the surface. They then scatter as sound when they travel past the trailing edge and propagate upstream toward the point of boundary layer instability, initiating a feedback loop.

Nakano *et al* [4] and Desquesnes *et al* [16] observed that a separation bubble forms near the airfoil trailing edge on the pressure side of the airfoil under non-zero angle of attack flow conditions. The existence of this recirculation bubble had already been identified as a necessary condition for the tonal noise phenomenon to occur [17]. This periodical oscillation is amplified as it approaches the trailing edge, due to the upwash and downwash motion in the downstream of the airfoil.

Desquesnes *et al* [16] propose that a secondary feedback loop exists. They explain that a laminar boundary layer is formed near the leading edge of an airfoil when the flow is steady and continues along the airfoil chord until boundary layer separation occurs, leading to an unstable shear layer with T-S instability waves. The T-S waves interact with the trailing edge, forming a dipolar acoustic source. They suggest that the acoustic waves then travel upstream along the airfoil chord and generate an acoustic feedback loop, as depicted in Figure 5.

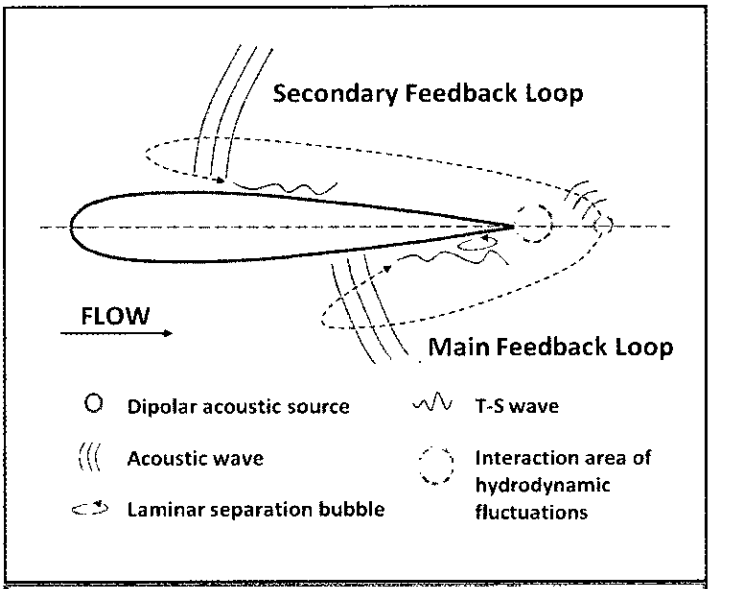

Figure 5

Schematic of the tonal noise mechanisms proposed by [16].

Desquesnes *et al* [16] further explain that if the flow onto an airfoil is fast enough, or if the airfoil is located at a sufficient angle of attack, a turbulent boundary layer may form on the airfoil surface. The acoustic waves generated within the turbulent boundary layer

continued on page 38

A review of trailing edge noise... - *continued from page 37*

are diffracted at the trailing edge, similar to the laminar boundary layer case, forming a dipole-like acoustic source with cardioid directivity [1]. Due to the hydrodynamic fluctuations in the immediate vicinity of the trailing edge and the turbulent nature of the flow, the noise emission is broadband. If the flow onto the airfoil is sufficient to generate a turbulent boundary layer, then the tonal noise is not observed.

The secondary feedback loop proposed by Desquesnes *et al* [16] does not contradict the work of Arbey and Bataille [3]. Arbey and Bataille [3] only investigated airfoils at 0° angle of attack and Desquesnes *et al* [16] only investigated non-zero angle of attack cases. It is possible that the secondary feedback loop exists in conjunction with the model proposed by Arbey and Bataille [3] at angles of attack greater than zero. It is also possible that Arbey and Bataille's [3] model could be the secondary loop shown by Desquesnes *et al* [16]. A comparison of each model and their ability to predict the discrete tones of airfoil self noise for varying angles of attack has not been investigated.

Chong and Joseph [6] investigated a NACA0012 airfoil for both zero and non-zero degree angles of attack. Similarly to others ([3] and [16]), they show that acoustic waves travel upstream to complete a hydrodynamic and acoustic feedback loop. They do, however, disagree with others ([3],[5],[12],[13] and [16]) and argue that the location which 'closes' the feedback loop is the point at which the boundary layer instabilities on the airfoil profile originate (consistent with Nakano *et al* [4]). This may not coincide with the location of maximum velocity on the airfoil profile [3] or half the airfoil chord length [13].

It should be noted that differences in the experimental results discussed may be due to varying testing conditions, such as freestream turbulence, vibration of the airfoil or other factors that can influence boundary layer transition at low to moderate Reynolds number.

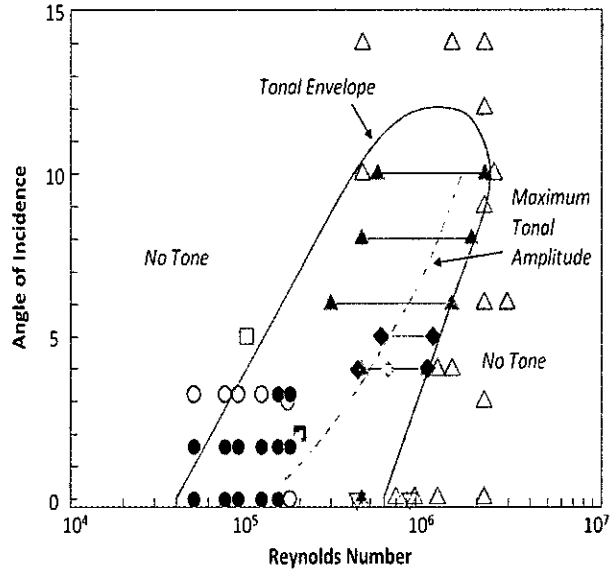

Figure 6

Pattern showing where tonal noise is likely to occur for a NACA0012 airfoil (adapted from [17]). Filled markers represent that a tone was present, whilst unfilled markers represent that a tone was not present. Data sources: shaded/unshaded circles [10], shaded/unshaded triangles [11], unshaded inverted triangles [3], shaded/unshaded squares [16], shaded diamonds [17]. The tonal envelope and the maximum tonal amplitude lines are from [17].

Occurence of tones

Desquesnes *et al* [16] took previous work [3], [11], [13], [17] further, and generated plots of angle of attack against Reynolds number, identifying regions of the plot surface which exhibited tones or no tones. Some of these results, including some results

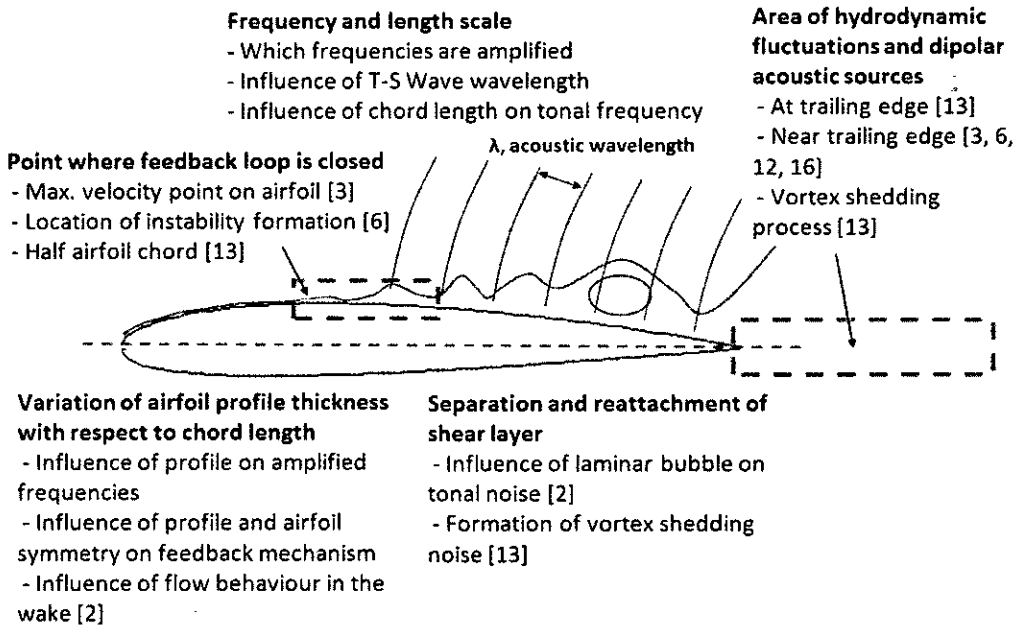

Figure 7

Summary of some of the unresolved flow features and acoustic feedback mechanism characteristics of an airfoil at 0° angle of attack.

from Arcondoulis *et al* [10] are provided in Figure 6. The proposed tonal noise envelope [17] shown in Figure 6 conflicts with some of the presented data. Charts of this type for other NACA airfoil profiles are not known to the authors.

Influence of airfoil profile

The aforementioned research provides a detailed investigation of specific airfoil sections with varying flow conditions. Sandberg *et al* [2] identified a reverse flow region for the NACA0012 airfoil which is not displayed by the thinner airfoils. They explain that the flow oscillates around the trailing edge at the wake frequency; however they are unclear as to why there is a unique behavioural flow pattern for the NACA0012 airfoil profile. This finding suggests that the airfoil profile has a significant effect on the flow in the wake. Many of the theories suggest that the hydrodynamic instabilities in the wake are important in the structure and physics of the acoustic feedback loop. Thus it can be deduced that the airfoil profile influences the nature of the acoustic feedback mechanism.

Summary

This article reviewed previous work on trailing edge noise generated by airfoils at low to moderate Reynolds number. The flow structure around an airfoil is reasonably well established: however, the physics of the feedback mechanism which results in the production of tonal noise is still unclear. Understanding the processes which cause this tonal noise is important, as this will allow advancements in quieter designs of engineering applications involving airfoils. There are many unresolved areas in this field of research, which are summarised in the text below and where appropriate, in Figures 7 and 8.

- There are limited mean and unsteady velocity data for various NACA airfoil profiles, for various angles of attack and at low Reynolds number.
- A comprehensive understanding of tonal noise production at various Reynolds numbers, angles of attack and for different airfoil profiles (obtained in an anechoic environment) has not yet been obtained.
- The effect of the airfoil profile on the tonal and broadband noise components for various Reynolds numbers and angles of attack has not been comprehensively investigated.
- There is no consensus on the location and physics of the activation of the acoustic feedback loop(s). Also, the position on the airfoil chord where the acoustic feedback loop(s) is (are) closed on the airfoil chord is not resolved. These require investigation.
- There does not yet exist an accurate model which predicts the magnitudes of the primary and secondary tones and the broadband noise.

Future work

It is the intention of the authors to further pursue this ongoing study at the University of Adelaide, via the use of more refined experimental methods, including the use of aeroacoustic beamforming in conjunction with hot-wire anemometry. It is anticipated that a greater understanding of the acoustic feedback mechanism for the trailing edge noise of airfoils at low to moderate Reynolds number will result.

continued on page 40

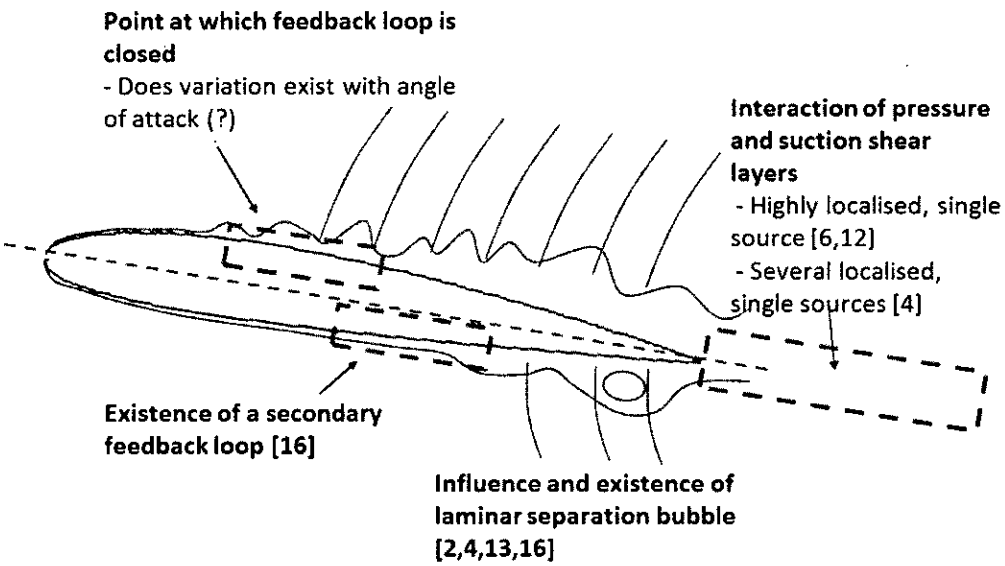

Figure 8

Summary of some of the unresolved flow features and acoustic feedback mechanism characteristics of an airfoil at non-zero angles of attack.

A review of trailing edge noise... - *continued from page 39*

The authors are with the School of Mechanical Engineering, University of Adelaide, South Australia. This article first appeared in Acoustics Australia, vol 38 no3, December 2010 and permission to reproduce it is gratefully acknowledged.

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Control of Vibration Regulations

Council found guilty of offence

In a rare prosecution under the Control of Vibration at Work Regulations 2005, Cheshire East Council has been ordered to pay more than £11,000 in penalties after an employee developed severe hand arm vibration syndrome (HAVS).

The employee, a mechanic, had regularly used heavy duty vibrating equipment including pneumatic jack-hammers and handheld grinders, in his employment with Crewe and Nantwich Borough Council since 1984. The council has now been subsumed into the unitary Cheshire East Council.

The Council first recognised that he was suffering from the early stages of HAVS in July 2005, and decided that he should be reassessed annually. The first such assessment took place in 2006, but there was no follow-up assessment until 2009. The mechanic now finds it difficult to pick up small objects such as coins, and his hands become painful in cold weather.

The HSE's investigating inspector Chris Goddard said that the council had failed to take any significant action for more than four years. It should have limited the amount of time their employees spent using vibrating equipment, or provided alternative tools, but instead one particular employee was allowed to continue with his job without any changes.

The Council pleaded guilty to breaching Regulations 5(1) and 6(1) of the Control of Vibration at Work Regulations. These require employers that might expose workers to vibration to carry out an appropriate risk assessment, and then either eliminate any risk at source or reduce it to a level as low as is reasonably practicable.

At South Cheshire Magistrates' Court on 21 January 2011, the Council was fined £5300 with costs of £5860.

2260 Investigator Sound Level Meter

Bows out gracefully

The last sound level meter type 2260 has left the Brüel & Kjær production line. After almost 17 years of faithful service that saw it travel into space and appear on the BBC, the distinctively shaped 2260 'Investigator' has finally come to the end of its natural life after stocks of its custom-built membrane key pad were allowed to run out, leaving it to be superseded by sound level meter type 2270.

After being introduced in May 1994, the Investigator went on to sell over 7000 units worldwide, thanks to its revolutionary use of new technology. With a dedicated digital signal processor and an LCD screen, the instrument set the bar high, providing powerful real-time analysis in a sleek, hand-held package. Thanks to many different software modules, it was the first multi-tool from Brüel & Kjær, allowing engineers effectively to carry around a full toolkit in one unit.

A full range of accessories, application modules and repair services will continue to be available for 2260 Investigator into the future. For the full story, see the next issue of Waves magazine, out on 8 March 2011.

For more information, please contact: **01763 255 780** or **ukinfo@bksv.com**

7,000 B&K 2260s were sold

Letters to the Editor

Dear Ian

In this letter I would like to make some comments on the Technical Contribution in Acoustics Bulletin, Vol.35, No.6 entitled *The application of scale models to predict the acoustical performance of screens attached directly to vented façades*. Non-dimensional indicators of acoustic performance, such as the insertion loss, of any rigid structure that is exposed to an incident acoustic field in an otherwise free field environment must be a function only of the Helmholtz number, or ratio of wavelength to typical geometric dimension. Hence, only a frequency correction should be made. No 'amplitude correction' as suggested by Figure 11 and the 'scaling effects' table should be made. In fact, the frequency scaling factors in the table are incorrect: if the geometric scale factor of the model is 1:2, the frequency scale factor must be 2:1.

The other problem with using scale models that incorporate sound absorbent materials is that the effect of the absorbent on the sound field has a complex thickness and frequency dependence which cannot be scaled according to the Helmholtz number. Other unsatisfactory factors in this investigation are that the insertion loss of the solid test chamber wall, without aperture, does not seem to have been checked; the insertion loss appears to have been measured at only one point; and there is no evidence of an attempt to suppress ground reflections. I am sorry to be so heavily critical, but such serious technical errors do nothing for the reputation of the IOA and, in my view, should not remain unchallenged, because the conclusions are seriously misleading.

Kind regards

Frank Fahy

The author of the article in question has responded to Prof Fahy as follows.

Dear Frank

Firstly thank you for your comments, which were not the most positive but nonetheless I appreciate receiving them.

The work we presented in *Acoustics Bulletin* looked at establishing the feasibility of using scale models to assess screens in combination with vented facades. In defence of the presented work, we have to date only undertaken an introductory part of the research. A full, definitive analysis of the application of scale models to screened facades has not been completed.

Our work has included an initial assessment of the key factors which affect the performance of screens in combination with vented facades. The objective was to provoke ideas and make people think. This has happened, not always positively as can be seen from your letter, but BDP Acoustics and other consultants have been in touch with me with respect to this publication with ideas and comments. This is an important, interesting piece of work since noise break-in to low energy buildings is a key part of modern building design.

I would like to answer your comments more specifically.

1. An error was been made with respect to the frequency scaling. This was a simple typo and should not have been made. [*the one I missed - Ed*]
2. The MACH team has undertaken testing to all test samples without vents and ensured that the solid sample had a performance better than 10dB compared with the same sample containing vents. This information was not published, but it should have been.
3. We have tested at more than one location and results appear to show the effects of angle of incidence and other factors. Since this work is not fully completed, this was not published.
4. Using acoustic absorption within scale model applications is a complex subject and scaling the thickness of absorbent materials is over simplistic. For this reason, absorption was added to surfaces to reduce reflections only. You will note that we did not present results at different scales which included absorption. I fully respect that more work needs to be done in this area, especially if one is going to scale the thickness of the acoustic absorption.
5. We have spent a great deal of time thinking about whether one should scale with magnitude or not. The problem starts with the fact that it is exceptionally difficult to establish the acoustical performance of a vented facade, let alone one which includes a screen. What this means is that it is difficult to derive a benchmark from which to work. My next article in *Acoustics Bulletin* (which I hope you prefer) will deal with this question. To overcome the difficulty we have attempted to use insertion loss, an approach I am not overly happy with. We used insertion loss to attempt to show a relative increase or decrease in performance with the application of different screens.

Throughout our experiments, we kept the sample size fixed and reduced the opening size of the vent depending upon the scaling factor. Because the sample is exposed to the same input power but the vent size is scaled, it is necessary to scale the result in terms of magnitude.

In conclusion, I attempted to sponsor (to the tune of £5k) an MSc student at the ISVR or Salford University with respect to this project some time ago, but neither University took up the opportunity. This is an important subject and many acoustical consultants working in sustainable design would very much appreciate a better understanding of it. I value your comments and would be very grateful for any technical support we can get with respect to this project. I am happy to attend a meeting and sponsor work if required.

Once again, thank you for your comments.

Regards,

Ze Nunes, Mach Acoustics, Bristol
ze@machacoustics.com
www.machacoustics.com

Obituary

Barry Uscinski (1935-2010)

Dr Barry Uscinski died on 22 October in Queensland, Australia, in a tragic flying accident at the controls of a Spitfire replica which, as a keen flyer and accomplished pilot, he had helped develop.

He was closely involved over many years, both in organising and as major contributor, with several meetings of the Institute of Acoustics which have proved to set important milestones. These include the conference organised jointly with Peter Dobbins on stochastic volume and surface scattering concerning underwater acoustics held in Robinson College, Cambridge in 1999, and more recently validation of sonar performance assessment tools, jointly with Peter Dobbins and Mike Ainslie, in 2010. His involvement with IOA had begun many years earlier; he was for example invited keynote speaker at the conference in 1986 on fluctuation phenomena in underwater acoustics.

Barry was a long-standing and highly active member of the department of Applied Mathematics and Theoretical Physics at the University of Cambridge, and was a board member and former associate editor of *Waves in complex and random media* from its inception. He received his BSc in 1963 from the University of Melbourne, his MSc in 1965 from the University of Queensland, and his PhD in 1969 from the University of Cambridge. He was a PhD student in radio astronomy at the Cavendish Laboratory, where he examined the scintillation of stars under K G Budden. It was an exciting time there with the discovery of pulsars, and it led to a lifetime of contributions to the theory of, and experimental work in, multiple scattering in random media. Following his PhD and his election to Research Fellow of Clare Hall Cambridge, Barry became Senior Research Fellow in the Radio group, Cavendish Laboratory and from 1972-77 a Fellow of King's College Cambridge as Lecturer in physics. From 1977 he was with the department of Applied Mathematics and Theoretical Physics, Cambridge University, and was appointed Assistant Director of Research from 1990.

Barry's work became increasingly concerned with acoustic propagation in the ocean. He worked closely with Terry Ewart and others in the Cobb Seamount MATE (Mid-ocean Acoustic Transmission Experiment), crucial in explaining the structure of acoustic intensity fluctuations. He built the Ocean Acoustics group, which, among other activities, conducted research programmes for the Royal Navy. He was one of the early scientists to derive the moment equations for the propagation of a complex field in a random medium. Later he published the first analytical solution of the 4th moment equation for propagation in a medium with a Gaussian correlation function, and went on to publish many papers in that field, including the first accurate prediction of the 4th moment observations in the Mid-ocean Acoustic Transmission Experiment. His strong physical insight and mathematical flair are evident throughout much of his theoretical work, and he was able to couple this with an innate sense of engineering in his experimental designs. In particular his multiple convolution treatment of the 4th moment problem simplified and made tractable an extraordinarily technical set of equations. He was directly responsible for the design of several major ocean experiments with which he was involved and he was elected a Fellow of the Acoustical Society of America in 1998 and a Fellow of the Institute of Physics in 1999.

Barry was a remarkable man with accomplishments in many diverse fields. He was in many ways eternally youthful and known universally for his irrepressible sense of humour. A natural story-teller, he had a gift for poetry, literature and languages. He was a devoted family man, who would speak with enormous affection and pride about his wife Barbara, and daughters Kasia and Ela. Barry would unfailingly find the time to chat over coffee and was always willing to guide and offer advice to students and younger researchers. He took a deep and genuine interest in those around him from all walks of life, and his kindness was reflected in the great affection in which he was held by so many. He will be sadly missed.

His funeral took place in Australia on 11 November 2010, and a memorial celebration was held in Girton College, Cambridge on 11 December.

Mark Spivack

The Conference on Fluctuation Phenomena in Underwater Acoustics, Weymouth, 1986. (L-to-R) Colin Schofield (British Aerospace), Peter Dobbins (British Aerospace), Antony Hewish (Cavendish Laboratory, University of Cambridge), Barry Uscinski (DAMTP, University of Cambridge), Terry Ewart (University of Washington), Robert Urick (Catholic University of America).

New URS/Scott Wilson acoustics team

full-time noise staff in Nottingham, Birmingham, Cambridge and London

The acoustics teams at URS and Scott Wilson have now combined, offering increased breadth and depth across the entire range of acoustical services. Scott Wilson is now part of URS Corporation headquartered in San Francisco. URS is a leading provider of engineering, construction and technical services for public agencies and private sector companies around the world.

URS/Scott Wilson offers an expanded portfolio of professional services, access to increased professional and technical resources and a broader network of offices throughout the world. The new acoustics team offers a range of services from noise in the workplace assessments to the strategic noise mapping of entire cities and provides a dedicated noise and vibration service to the rest of the consultancy. The union brings the number of full time acousticians to 21 in the UK, and 66 globally.

Back row (L-R) Paul Shields, Alf Maneylaws, Dan Atkinson, Dr Robin Hall
Front row Nick Conlan, Graham Cowling

With full-time noise staff now based in Nottingham, Birmingham and Cambridge and with a significantly expanded team in London, the team has a much wider geographical spread in the UK. All its members are qualified professionals with membership of the Institute of Acoustics. They each bring experience from a wide range of backgrounds including consultancy, local authority, research and development, regulatory responsibilities and industrial noise control.

URS/Scott Wilson technical director Paul Shields will lead the new team, and commented that each of the previous teams brought particular strengths to the mix. The previous Scott Wilson team had considerable experience with environmental impact assessments, in particular on road, rail and waste processing schemes. It also brought an established building acoustics team which had worked on a number of prestigious projects. It had unique experience in the assessment of tranquillity and was currently working with in-house environmental economists on a Defra-funded project to develop a robust methodology for identifying, quantifying and monetising the benefits that people derive from quiet areas.

URS was experienced in complex industrial modelling and assessment, particularly in the onshore and offshore oil and gas industries. It also had a very strong capability in the assessment of wind farm noise as well as specialising in building acoustics on major developments including tall buildings in London. The combined team is well placed to offer a full range of quality services to existing and new clients.

In the UK, the team is split, with divisions in the north and south. Graham Cowling will head the southern team of eight London-based staff. Alf Maneylaws heads the 12-strong northern division. The team also includes seven air quality specialists managed by Dr Garry Gray. Further air quality specialists are already based in other parts of the UK business.

For further information, please contact Paul Shields by email:
paul.shields@scottwilson.com

Robert Bradford Newman medal

UK student wins ASA prize

For the fourth time in five years a student on the Masters course in Environmental and Architectural Acoustics from London South Bank University has won the Acoustical Society of America Robert Bradford Newman Medal for Merit in Architectural Acoustics. The Robert Bradford Newman Fund honours outstanding students throughout the world at schools of architecture and architectural engineering that have demonstrated excellence in this discipline and its application toward acoustical design.

John Zeman was awarded the medal for his dissertation entitled *The measurement and evaluation of bespoke three-dimensional absorptive panels - A comparative analysis.* John is currently preparing his presentation for the 161st meeting of the Acoustical Society of America in Seattle, Washington.

John Zeman

Unique sound insulation prediction tool

INSUL Software - version 6.4 released

Marshall Day Acoustics is pleased to announce the release of Version 6.4 of its popular INSUL prediction software. INSUL is a program for predicting the sound insulation of walls, floors, ceiling, roofs and windows. It can predict:

- Sound Reduction Index, R
- Impact noise level, L_n
- Rainfall noise, L_i

It uses robust theoretical models to predict the sound insulation of new constructions or to evaluate the effects of changes to an existing construction. It can model all types of multi-layered masonry and light-weight constructions with an extensive array of user definable parameters. INSUL features a database of common building materials including plasterboard, timber, metal, glass, concrete and masonry. The materials list has been tailored to each region of the world.

Over a thousand INSUL licenses have been sold worldwide in the last ten years. The software is used by consultants, manufacturers and universities including Kingspan, ISVR, Arup Acoustics, Knuaf, Lafarge, BDP and AECOM. INSUL has a proven track record for ease of use and accuracy.

The package allows accurate estimation of third-octave band values for airborne sound, impact noise and rainfall noise. All standardised indices are calculated including R_w, $D_{nT,w}$ (C; C_{tr}), $L_{n,w}$ and L_{iA}. INSUL takes account of finite size effects which are especially important when predicting small samples such as windows.

The user interface has been designed to be efficient and intuitive with an extensive 'help' menu. The program has evolved over several versions and has been refined through continual comparison with laboratory test data. INSUL reliably predicts Rw values to within 3dB and $L_{n,w}$ values to within 5dB for most constructions.

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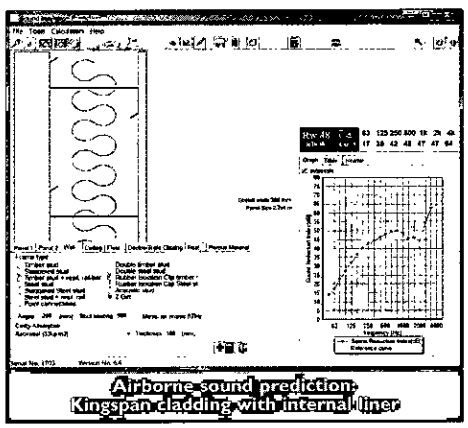
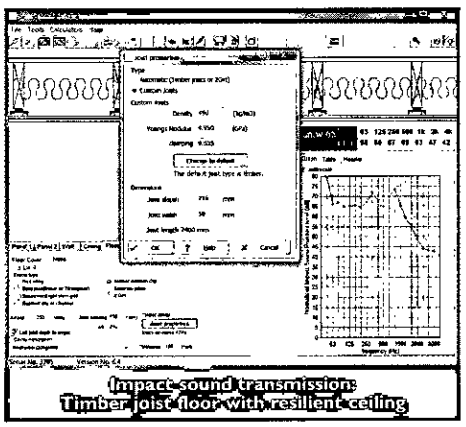


Airborne sound prediction: Kingspan cladding with internal liner



Impact sound transmission: Timber joist floor with resilient ceiling

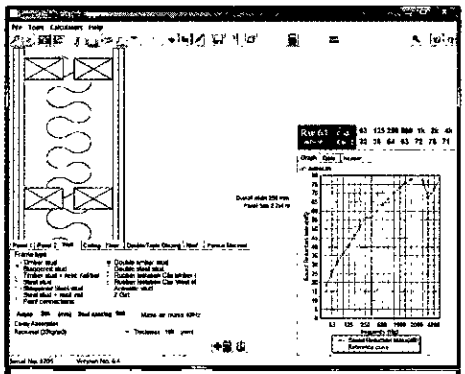
INSUL Software - *continued from page 45*

The key upgrades for **INSUL Version 6.4** include:

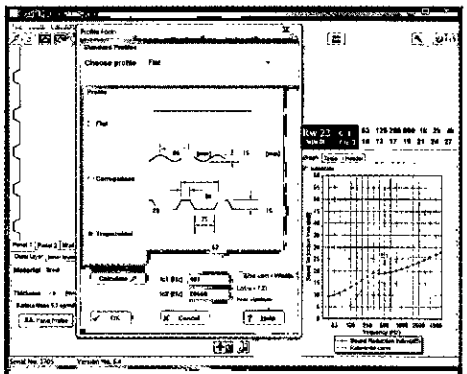
- Predictions for composite panels such as Kingspan and Europanel. The properties of the core and outer skins can be adjusted using the inbuilt materials properties editor. This also allows panels with much stiffer cores, such aerated concrete, to be modelled.
- Improved prediction of profiled metal panels as typically used in commercial and industrial buildings. Flat, corrugated and trapezoidal sheets can be modelled with user definable profile patterns.
- Impact sound insulation prediction of lightweight floors. A range of floor and ceiling linings is available and the prediction routines are sensitive to joist dimensions, mass and spacing. Various ceiling layer connection types can be selected including resilient bars, rubber isolation clips and metal grids.

Summary of features:

- Database of common materials and floor coverings



Airborne sound insulation for a twin timber stud wall



Airborne sound insulation for a profiled metal sheet

- Calculation range 50 to 5000 Hz
- Wall, floor and roof airborne sound insulation prediction
- Floor impact sound insulation prediction
- Double and triple glazing sound insulation prediction
- Rainfall noise calculation
- Material parameters are user definable
- Leakage calculation
- Composite transmission loss calculator
- Indoor to outdoor calculator
- English, French, German and Spanish languages
- Imperial or metric units
- Stand-alone or network licenses available

For further information, please visit the INSUL website **www.insul.co.nz** or contact the UK distributor **andy.irwin@marshallday.co.uk** **028 308 98009**.

APL Systems

Nordic noise monitoring device endures harsh conditions

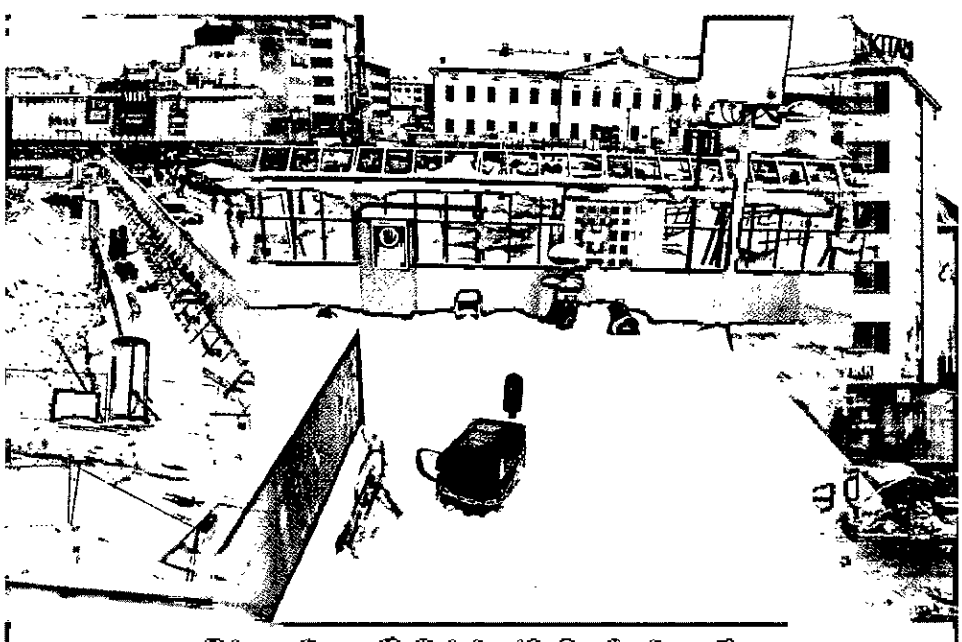
Weather is a constant source of problems in designing any long term noise monitoring system. APL Systems from Finland has developed a series of noise monitoring products that have endured altogether tens of thousands of hours of uninterrupted operation in the particularly harsh weather of recent times in Scandinavia.

APL Systems conducted test measurements recently at the centre of a city in eastern Finland. The market square in the heart of the city was being torn up because of the construction of underground parking spaces, and provided an excellent test case for the company's latest version of the noise measurement device Aures (version 2.0). The measurements were conducted over an extended period of time in late autumn 2010. The measurements provided a continuous sound recording for the entire period and measurement results of dozens of parameters for each second of that time. The test case was a great success, according to company chief executive Antti Leskinen. The technology proved its worth in demanding outdoor conditions, and he was sure that the company's partners were equally happy with the performance of the equipment and the usefulness of the data produced with the measurements.

Since most environmental noise measurements are performed periodically, APL Systems believes that making its products primarily available for renting will serve its clients best. The idea is that their clients and partners in Finland and all over Europe would have the devices they needed at their disposal only for as long as they actually needed them, as Mr Leskinen explained.

Aures 2.0 is available as a wireless version capable of delivering audio in real-time or as a self-sufficient measurement station recording audio onto its internal memory.

For further information: **www.apl.fi**



Noise monitor specifically designed for Scandinavian weather

The Trojan

Cirrus Research launches its new noise nuisance recorder

Specialist noise measurement equipment manufacturer, Cirrus Research, is pleased to announce the launch of its new noise nuisance recorder, the Trojan. Local authorities and housing associations across the length and breadth of the United Kingdom now have a simple, accurate, and ultra compact noise nuisance recorder at their disposal.

Drawing on Cirrus Research's 40 years of experience the company has ensured that the Trojan meets and exceeds its customers' expectations. James Tingay, group marketing manager at Cirrus Research Ltd explained that a noise nuisance recorder was an extremely valuable piece of equipment for local authorities and housing associations to use as it provided the means of monitoring whether a noise complaint by a local resident was credible. It was therefore vital that the recorder was as simple as physically possible to use and that the measured noise levels were accurate. He believed that the Trojan did just that: it provided the latest technological innovation and added functionality that was necessary for environmental noise to be accurately measured.

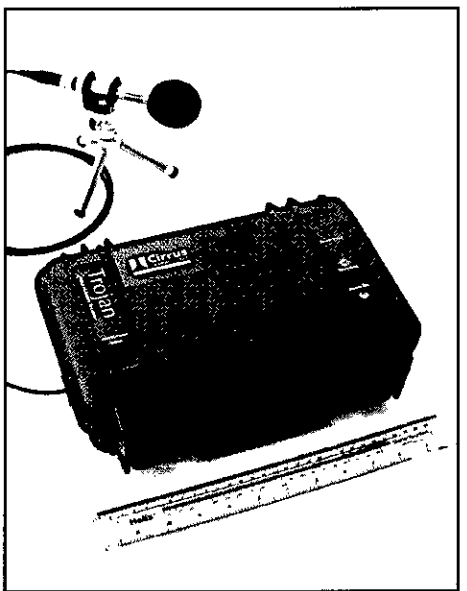
One of the major issues with other noise nuisance recorders currently on the market is that they can be complex to use and difficult to configure. With the Trojan, Cirrus has opted for simplicity over complexity. When the instrument is inside the small black box it is connected to an interface. When this is connected, the instrument recognises that it is plugged in and switches to noise nuisance mode. This configures the instrument automatically to give the functions and features needed, removing the need for any setup or configuration.

The Trojan comes with a whole host of benefits including:

- The ability to store audio recordings from 30 seconds before the 'record' button is pressed, even if the noise has stopped. This allows short noises to be recorded successfully.
- The instrument can be removed easily and used as a hand-held sound level meter.
- An added layer of automation on the equipment allows the Trojan to be set up quickly and easily: it is as simple as plugging in the microphone and plugging in the power supply.
- It comes with a Class 1 real-time analyser which is suitable for other environmental noise measurements.
- It has a large memory, up to 64GB, enabling it to monitor for long periods.
- It allows the simultaneous measurement of all parameters ensuring that no data is missed.
- It provides the highest quality uncompressed audio for stronger evidence collection.
- The case for the Trojan is only 300mm long, substantially smaller than its competitors.
- An automatic re-start is provided after power failure, preventing data loss.
- It is supplied in a back-pack, allowing the officer who will install the Trojan to leave with the same backpack so as not to arouse the suspicion of neighbours.
- It is supplied with NoiseTools software which includes new features such as calibrated audio playback. This software is provided licence free and comes complete with free lifetime updates.
- The Trojan is designed, manufactured, and calibrated in the United Kingdom.

The company is extremely proud of the new addition to the Cirrus Research range of equipment. Environmental noise nuisance is a topic that is not going to disappear, so providing relevant and smart equipment to help officers deal with noise complaints is a simple step forward in dealing with noisy neighbours.

The complete Trojan system starts from £4,495 which includes calibrator, software, and all accessories. For further information on the Trojan please contact Cirrus Research on **0845 230 2434** or visit **www.cirrus-trojan.co.uk**.



Trojan noise nuisance recorder

Svantek UK

World's first dual channel type 1 noise dosimeter

Svantek UK is the exciting new joint venture between Svantek S.p.o.o of Poland and AcSoft Ltd. Svantek is the designer of the world's most innovative noise and vibration monitoring instrumentation. The SV 102A noise dosimeter is the world's first dual channel, type 1 noise dosimeter and is in a class of its own. It is now available in the UK.

The dual-channel SV 102A is a Type 1 instrument giving a completely new approach to health and safety noise monitoring. This innovative dosimeter can be used as both a dual-channel Type 1 sound level meter and as a real-time octave band analyser.

Octave analysis provides the necessary data for the correct specification of ear protection devices. This instrument also optionally provides audio event recording (AER) as required by the new reference standard on acoustic dose measurement. It carries out binaural dose measurement and octave analysis simultaneously.

The small and compact microphone unit is attached to the wearer using either a mounting clip or a dedicated headband attachment. Data from the instrument can easily be downloaded to any PC using a USB interface and the dedicated SvanPC+ software.

An exciting new feature of the SV102A is that it is also able to measure noise inside the human ear by using a miniature smart microphone with an automatic calibration function. This means that it can be used for measuring the hearing protection noise reduction ratio using the MIRE technique (microphone-in-real-ear) according to ISO 11904 Part 2.

Svantek UK will be demonstrating the SV 102A and other instruments from its range of products at Safety and Health 2011 at Sandown Park in March.

For more information contact:
Paul Rubens, Svantek UK Ltd via email:
paulrubens@svantek.co.uk

New outdoor sound propagation calculation software

Olive Tree Lab Terrain

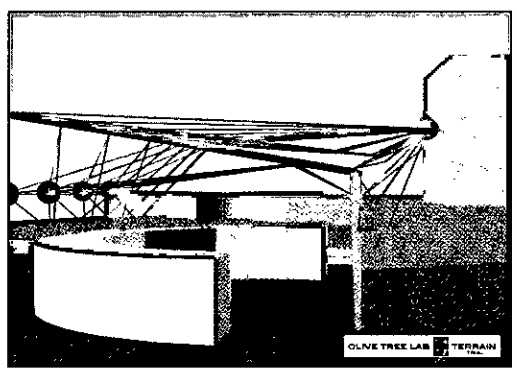
Based on state of the art calculation methods, Mediterranean Acoustics Research & Development has released new outdoor sound propagation calculation software called Olive Tree Lab Terrain. OTL Terrain is aimed at small scale projects as opposed to large mapping software. It addresses mostly fixed noise sources within a small area where there is control over most of the parameters involved in the calculations. It is based on high frequency resolution calculations, as opposed to just third-octave band analysis. The current version of OTL Terrain will be sold in three different levels of complexity: OTL Terrain - Viewer (for which basic acoustical knowledge is needed); OTL Terrain -Solver (working at engineering level); and OTL Terrain - Analyser (for advanced level users). In the Solver mode the software checks whether solutions meet noise criteria, with results being given in real time whenever any parameter is changed or any object is moved (such as a source, a receiver, a barrier or wall, and the ground level). OTL Terrain can be used for engineering, research and educational purposes.

Calculations are based on the Hadden & Pierce diffraction 3D model implemented with finite impedances faces using Salomon's semi-analytical method including ground effects (where multiple barrier diffraction is calculated in a recursive way at any diffraction order). It uses in-house sound path detection methods, ground effects using the one parameter theory of Chessell based on Delany and Bazley, reflections from finite surfaces based on Clay-Medwin's work to include Fresnel zones contribution at any order level, atmospheric absorption based on ISO 9613 -1, and turbulence coherence factor based on HARMONOISE WP3.

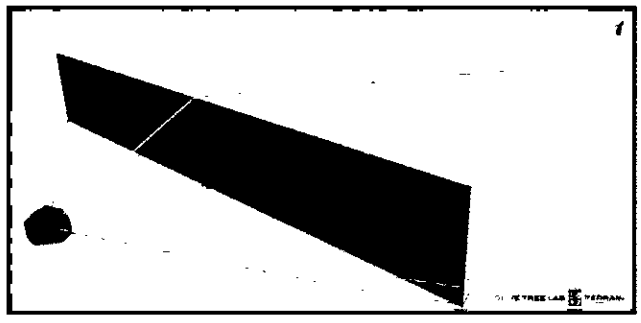
Features include:

- Several types of barriers of finite size with special properties for the design of remedial measures (wedge barriers, I-shape, Γ-shape or Π-shape barriers, thin or thick).
- Designed to offer an unlimited order of diffraction and reflections (although at this stage for efficiency reasons these are limited to an order of two reflections and diffractions, until calculation time is improved either by hardware or software). The number of paths can be limited by distance, frequency, or other parameters, based on the user's settings.
- Reflection calculations are based on the Fresnel zones approach, taking into consideration the finite size of a potential reflector.
- Reflections and diffractions between noise sources and receivers are calculated independently and are taken into account based on user's settings in the OTL Terrain calculation options module on the number of strongest path contributions. This enables the removal of weaker noise level paths, thus turning OTL Terrain into a design tool for remedial measures.
- The software calculates sound pressure levels from a single source to a receiver or receivers by coherent summation over all possible paths. For sources which are coherent, coherent summation over all possible paths also applies. If sources are incoherent, then coherent summation is performed for each source over all possible paths to the receiver, and then added incoherently.
- 3D sound mapping, import and export of DXF, images and objects are included.

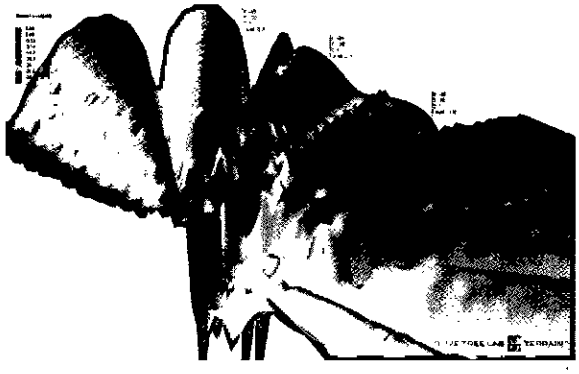
For more information please visit **www.mediterraneanacoustics.com** or contact the company on **info@mediterraneanacoustics.com**



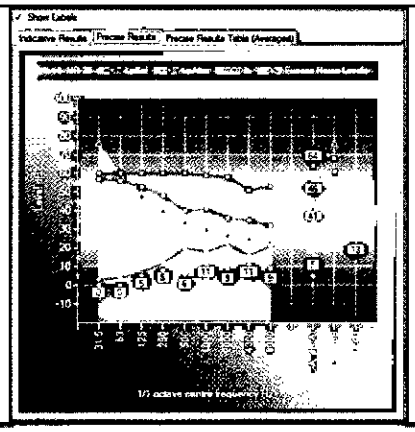
An actual case where outdoor music club is affecting residents. An inverted L-section barrier is erected between the noise source and receiver.



Iset's Standard Configuration setup



3D Mapping of Iset's standard configuration with the ground not visible



Results shown in graphical format

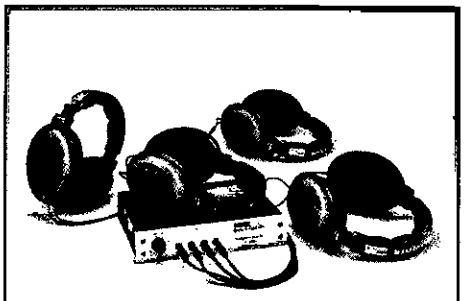
Amp it up

Brüel & Kjær launches sound quality focused headphone amplifier

Sound quality testing using consumer panels is now a much quicker process with Brüel & Kjær's new headphone amplifier type ZE-0769-004.

Subjective listening tests are vital for assessing a product's competitiveness and usually involves the evaluation of a product's sound quality by a group (or jury) representing the targeted customer group, who undertake a listening test. Usually this is a lengthy and expensive procedure, requiring each jury member to test drive the prototype vehicle, in order to report back on the sound quality. This process has been sped up by using a binaural head - such as a head and torso simulator (HATS) - in the car to make a high quality recording of the sounds directly onto the hard disk of a computer. The recording is then played back to all the panel members via headphones, at an off-site venue.

Since the absolute level has a direct effect on juror preference, the headphone amplifier is designed to give the same level in all channels and has stepped gain control to be able to accurately return to a previous setting. The amplifier produces an exact replica of the input signal and delivers the unfiltered (and possibly attenuated) signal to all outputs. It supports listening panels for up to twelve people and is ideal for sound evaluation during the design, prototype evaluation or troubleshooting of new vehicles.



Headphone amplifier supports listening panels up to 12 people

For more information, please contact:
01763 255 780 or **ukinfo@bksv.com**

Echo Barrier keeps the peace

Temporary noise control for construction sites

A new and highly effective solution to the problems of excessive noise from work sites has been launched by Echo Barrier, and is already being used on major construction projects such as Crossrail, and engineering works at London Underground stations.

The Echo H1 acoustical barrier is said to absorb sound rather than reflecting it, reducing noise by up to 30dB. Designed for quick and easy installation on standard Heras fencing or similar, the H1 is aimed at sites where it is important to reduce noise levels and maintain good community relations, such as construction works in residential and public locations.

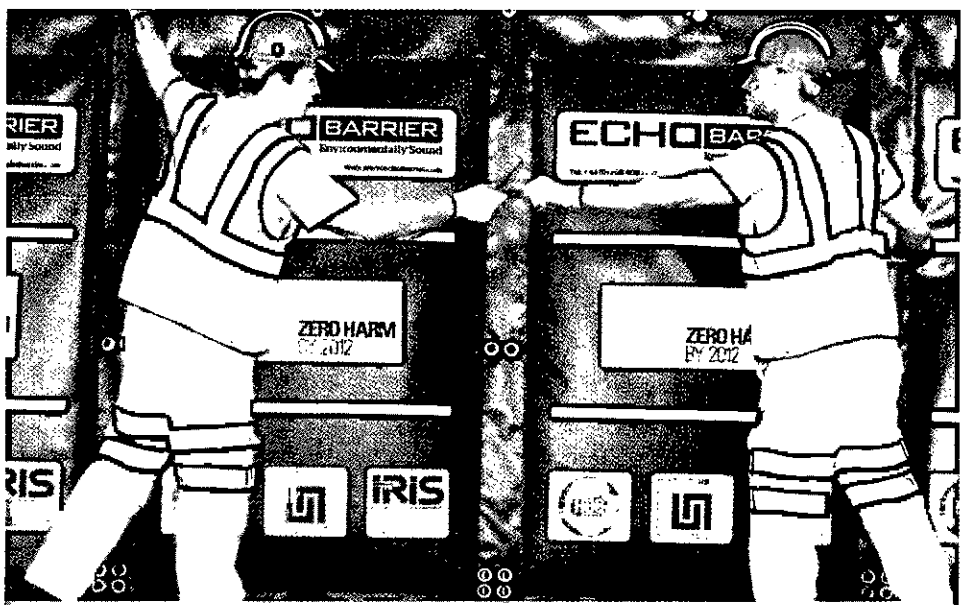
The benefits of reducing on-site noise using Echo Barriers are considerable, including reducing the likelihood of noise complaints, creating a more productive working environment, extending site operating hours and ultimately providing significant cost savings.

The Echo H1 barrier is weatherproofed, fire resistant, lightweight yet hard-wearing, and also gives the opportunity for the display of client advertising or branding. It can also be rolled, making transport and storage very easy. The barrier system can be used in any high noise environment such as road and railway maintenance, construction sites, demolition and piling work, loading and unloading areas, and around staff welfare facilities.

Balfour Beatty Rail has endorsed the product commenting that the organisation would recommend them to any contractor looking to contain excessive noise on a work site.

There is more information about Echo Barriers at **www.echobarrier.com**

For further information, please contact:
Helen Rudd, tel: **01473 326405**
helen.rudd@projectpr.biz
or Charles Arbuthnot, tel: **01473 326402**.
charles.arbuthnot@projectpr.biz



The Echo Barrier Echo H1 is an innovative solution to noise control

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Committee meetings 2011

DAY	DATE	TIME	MEETING
Thursday	3 March	10.30	Engineering Division
Tuesday	8 March	10.30	Diploma Examiners
Thursday	**10 March**	**11.00**	**Council**
Monday	4 April	11.00	Research Co-ordination
Tuesday	5 April	10.30	CCWPNA Examiners
Tuesday	5 April	1.30	CCWPNA Committee
Thursday	14 April	10.00	Meetings
Thursday	5 May	10.30	Membership
Thursday	19 May	11.00	Publications
Tuesday	24 May	10.30	CMOHAV Examiners
Tuesday	24 May	1.30	CMOHAV Committee
Thursday	2 June	10.30	Engineering Division
Thursday	16 June	11.00	Executive
Wednesday	22 June	10.30	CCENM Examiners
Wednesday	22 June	1.30	CCENM Committee
Thursday	23 June	10.30	Distance Learning Tutors WG
Thursday	23 June	1.30	Education
Thursday	**30 June**	**11.00**	**Council**
Tuesday	5 July	10.30	ASBA Examiners
Tuesday	5 July	1.30	ASBA Committee
Thursday	7 July	10.00	Meetings
Tuesday	2 August	10.30	Diploma Moderators Meeting
Thursday	8 September	11.00	Executive
Wednesday	14 September	10.30	Membership
Thursday	15 September	11.00	Publications
Thursday	**22 September**	**11.00**	**Council**
Thursday	29 September	10.30	Diploma Tutors and Examiners
Thursday	29 September	1.30	Education
Thursday	6 October	11.00	Research Co-ordination
Thursday	13 October	10.30	Engineering Division
Thursday	3 November	10.30	Membership
Tuesday	8 November	10.30	ASBA Examiners
Tuesday	8 November	1.30	ASBA Committee
Thursday	10 November	10.00	Meetings
Thursday	17 November	11.00	Executive
Wednesday	23 November	10.30	CCENM Examiners
Wednesday	23 November	1.30	CCENM Committee
Thursday	24 November	11.00	Publications
Thursday	**1 December**	**11.00**	**Council**
Tuesday	6 December	10.30	CCWPNA Examiners
Tuesday	6 December	1.30	CCWPNA Committee

Refreshments will be served after or before all meetings. In order to facilitate the catering arrangements it would be appreciated if those members unable to attend meetings would send apologies at least 24 hours before the meeting.

Meetings Programme 2011

12 April 2011
The Art of being a Consultant
The Royal Society, London

20-22 May 2011
8th International Conference on Auditorium Acoustics
Convention Centre, Dublin

24 May 2011
Environmental Noise Group Workshop
Emerging Government Planning Policy: What does it mean for practising acousticians?
University of Salford

21-22 July 2011
The 5th International Symposium on Temporal Design
Joint event with University of Sheffield

24-28 July 2011
ICBEN 2011
Imperial College, London

14-15 September 2011
Organised by Building Acoustics Group, Environmental Noise Group, Measurement & Instrumentation and Noise and Vibration Engineering Group
ACOUSTICS 2011
A new decade - A new reality
Rethinking acoustic practices for the austerity decade
Crowne Plaza Glasgow

3-5 October 2011
Underwater Acoustics Group and the Underwater Sound Forum of the Marine Science Co-ordination Committee
Ambient noise in Noise-European seas: monitoring, impact and management
National Oceanography Centre, Southampton

17-18 November 2011
Organised by the Electroacoustic Group
REPRODUCED SOUND 2011 - Sound Systems: Engineering or Art
Thistle Hotel, Brighton

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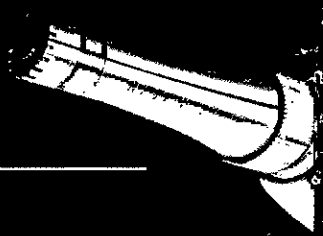

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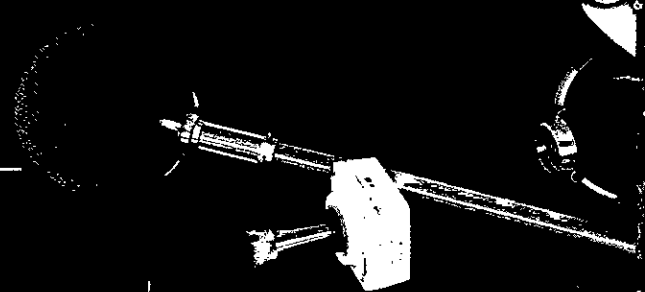

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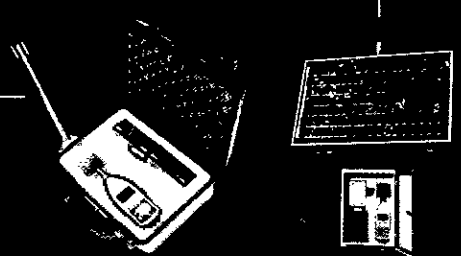

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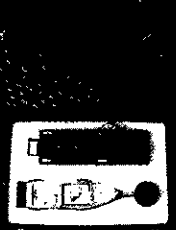

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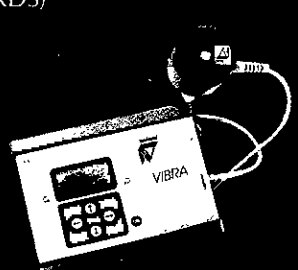

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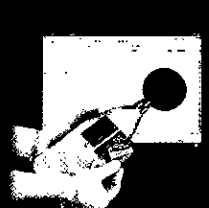

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