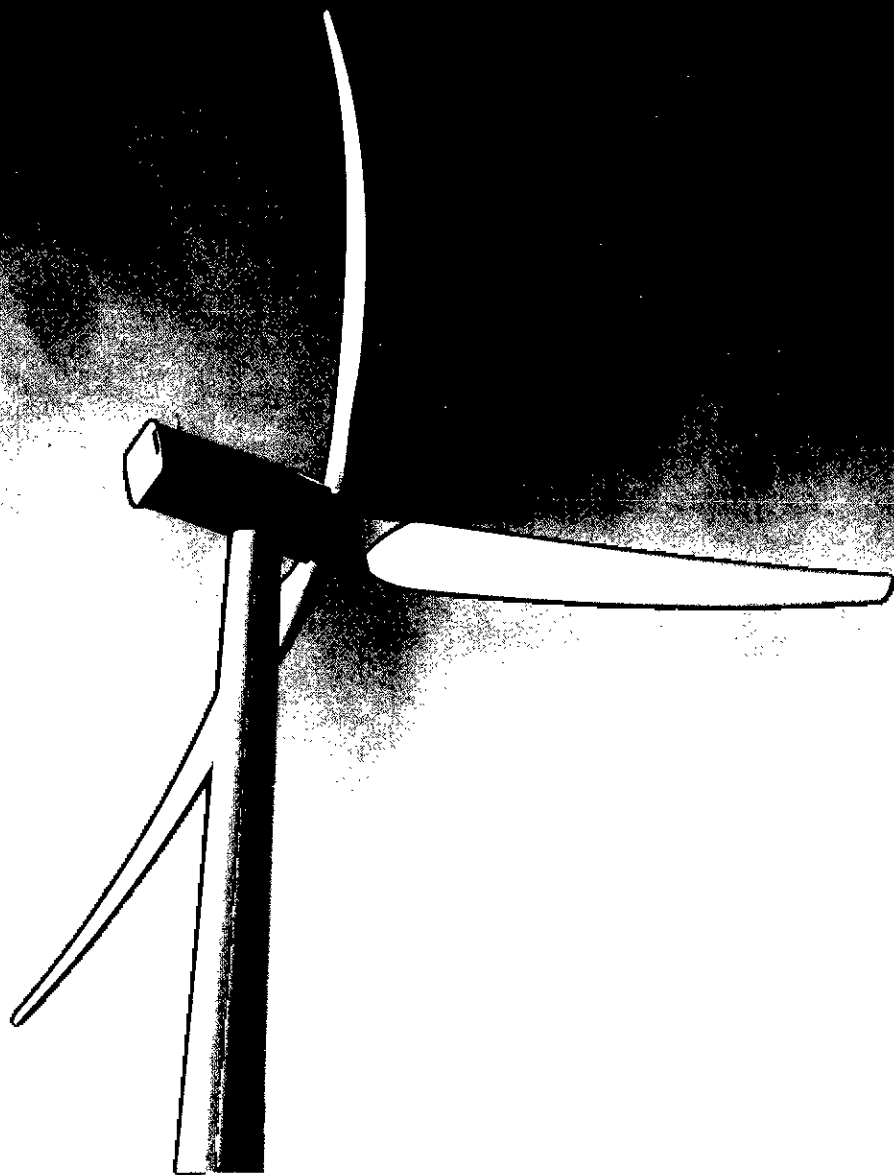


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ACOUSTICS

BULLETIN

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Front cover photograph: Wind turbine noise, and the prediction of noise from wind farms, is a hot topic as large numbers of the renewable energy schemes currently projected are held up in the planning process. Noise from turbines is often a contentious subject, and is widely misunderstood. The recent fifth meeting in the series of the Institute's one-day events on the subject was held in Bristol in January 2009, and attracted a large audience. The proceedings are reported in this issue of Acoustics Bulletin, which also publishes a recent agreement among prominent practitioners in the field on the approach to wind farm noise prediction and mitigation. The cover photograph shows a typical modern large wind turbine generator in action.

The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration. It was formed in 1974 from the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society.

The Institute of Acoustics is a nominated body of the Engineering Council, offering registration at Chartered and Incorporated Engineer levels.

The Institute has over 3000 members working in a diverse range of research, educational, governmental and industrial organisations. This multidisciplinary culture provides a productive environment for cross-fertilisation of ideas and initiatives. The range of interests of members within the world of acoustics is equally wide, embracing such aspects as aerodynamics, architectural acoustics, building acoustics, electroacoustics, engineering dynamics, noise and vibration, hearing, speech, physical acoustics, underwater acoustics, together with a variety of environmental aspects. The Institute is a Registered Charity no. 267026.



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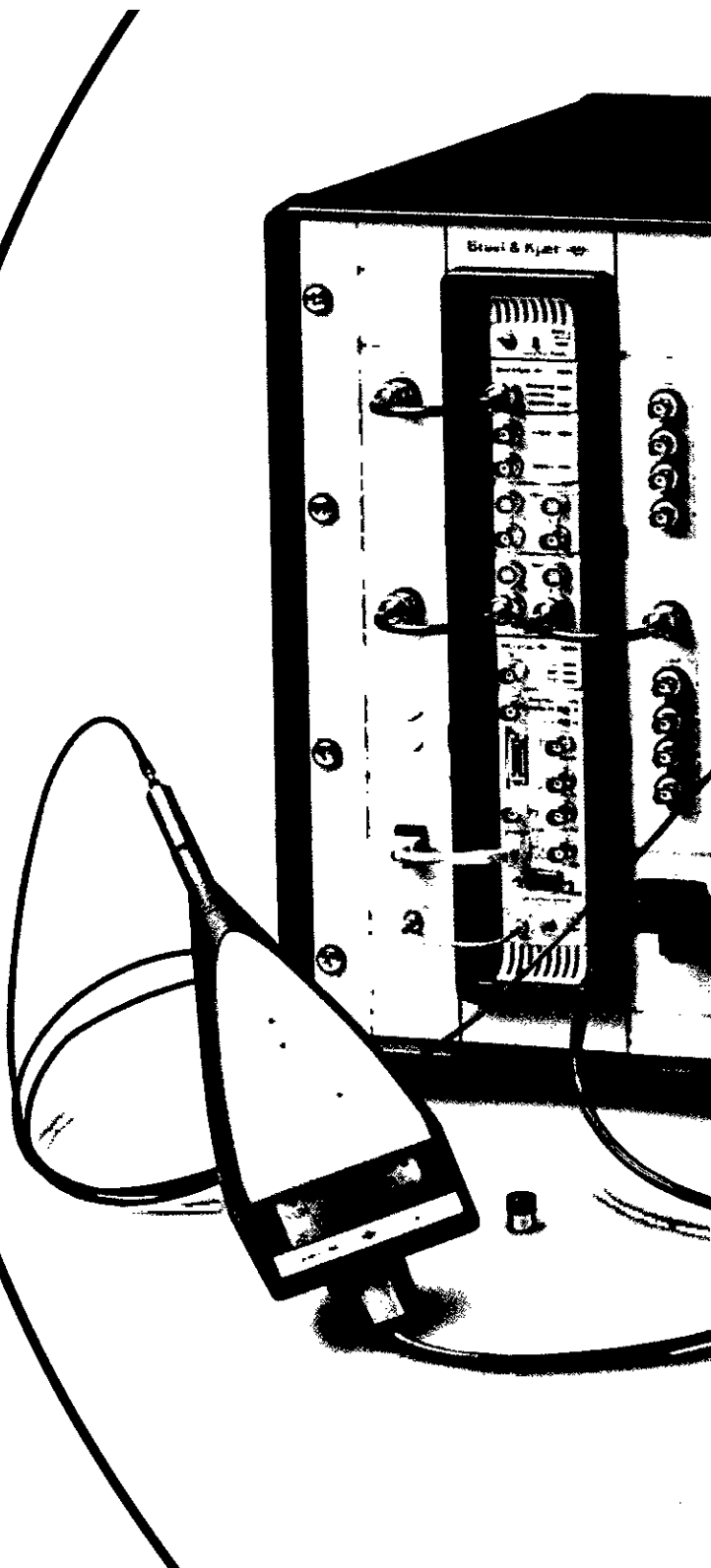
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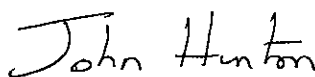
The period after Christmas and the New Year is always a busy one for the Institute. All the activity has reminded me of how much work goes on behind the scenes, particularly at Council, in our standing committees and in the management committees of our various groups and branches. I would like to take this opportunity to thank all those members who find the time to participate on these bodies. Without your help and support there would be no Institute. I would also like to encourage all other members to consider sharing their knowledge and expertise by becoming actively involved in one of these bodies. If you feel that you may be able to do so as a first step please e-mail our Chief Executive at kevin.macan-lind@ioa.org.uk.

As we are in difficult economic times I believe that the role of branch meetings and events could become even more important for our members but as an ex-chair of the Midlands branch I realise that sometimes it is difficult to get speakers, particularly for evening meetings. However, since becoming President I have attended some really good conferences with some great papers and presentations, for example, the Underwater Noise Measurement, Impact and Mitigation Conference last October. So my suggestion to the Chairs and Secretaries of our branches is to at least consider holding an evening meeting with a presentation on something slightly different eg underwater acoustics, bioacoustics or medical acoustics. You might be pleasantly surprised at the levels of attendance.

We are now well into a new year of conferences, workshops and meetings. In fact by the time you read this letter a Forum on the review of Building Bulletin 93, the 'Bioacoustics 2009' Conference and at least two one-day meetings or workshops should have already taken place. I am delighted that the Forum was a joint venture with the Association of Noise Consultants and I look forward to hearing about further partnerships of this nature. Looking forward to the remainder of the year we not only have EURONOISE 2009 in October but also the fast approaching Spring Conference 'Environmental noise management in a sustainable society' which will be held in Rugby on 28 and 29 April. Please do your best to support these events.

I am very pleased to tell you that at its meeting in December 2008 the IOA Council decided that the Institute would donate £1000 to Environmental Protection UK to cover the design, printing and distribution of full colour A4 flyers to promote Noise Action Week 2009 which will take place from 18 to 22 May. This well-established annual initiative is aimed at raising awareness of neighbourhood noise problems and promoting practical solutions. The flyers will be branded with both IOA and Euronoise logos and the Institute's sponsorship will be acknowledged on the Noise Action Week and Environmental Protection UK websites. I hope you agree with me that this is money well spent from the proceeds of our charitable fund.

Finally, I am happy to announce that Kevin Hyatt has recently joined our staff at IOA Headquarters. We welcome him as our new Publicity and Information Officer.



John Hinton OBE

PRESIDENT



Conference Report

R Walker. Reproduced Sound 24

The 24th Reproduced Sound Conference was held on Thursday 20 and Friday 21 November 2008. This year, the **Old Ship Hotel** in Brighton provided a new location and a return to the familiar type of venue. The change was primarily intended as a return to the integrated conference style. At RS 23 it had been felt that some of the social aspects of previous conferences had been lost because of the distances to the hotels and because no convenient late-night venue was available for the customary 'out of hours' music and discussion sessions. Many delegates agreed that the new venue had been successful and a welcome return to the previous format. However, there were some significant issues with the cost of the accommodation - the substantial differences between the rate obtained through the conference registration and those obtained by direct booking.

The Institute's thanks and appreciation go to Sam Wise for chairing the organising committee and to Allen Mornington-West for the substantial assistance given in organising the event. The contributions made by the other members of the Electro-Acoustics group committee are also much appreciated. Thanks also go to the hotel staff, who were extremely helpful and co-operative, adding greatly to the smooth running of the conference, in particular assisting with moving and setting up the equipment. Special thanks also go to the RS regulars **Ken Dibble**, who provided the PA and replay facilities for the technical sessions throughout the conference, and **Filippo Fazi**, who managed the presentation facilities and other technical matters.

The contributions of the exhibitors to the success of the conference are gratefully acknowledged. Thanks also go to Sound Technology for sponsoring the Reception on Thursday evening and to AMS Acoustics for sponsoring the Reception on Friday evening.

The technical presentations took place in the *Paganini Ballroom*. The *Regency Room*, immediately adjacent, provided a generous space for the exhibitors and for the refreshment breaks. The venue facilities fitted the conference requirements reasonably well, though there were some complaints about the quality of the décor, the lack of lighting control, the room acoustics and the small size of the projection screen. However, most delegates were reasonably content. The hotel bar and lounge areas provided larger groups with ample and comfortable space for the informal evening breaks and numerous smaller corners for more private discussions. Those areas were extensively used after the formal sessions had finished. As usual, some of the delegates had brought instruments and provided musical entertainment in the evenings.

As a new feature, Wednesday evening was used for a tutorial session, organised and presented by **Prof Trevor Cox**, **Dr Keith Holland**, **Paul Malpas**, **Peter Mapp** and **Mark Bailey**. That had been intended mainly for the relatively small group of newcomers to Reproduced Sound and for students. However, in the event, it was attended by nearly all those delegates who had arrived that evening. The small room was rather crowded but everyone felt that it had been a valuable addition to the conference.

The conference theme continued from previous years, with its main focus on developments in electroacoustics, room acoustics and intelligibility. In addition to one invited lecture and the Peter Barnett Memorial Award lecture, 22 technical papers were presented in eight sessions by nationally and internationally respected authors. Because of the over-subscription of papers, another departure was the re-introduction of posters, after a break of many years. Four poster presentations were available in the *Paganini Room* throughout the conference and attracted a lot of interest. It is hoped that this will continue for future conferences - the posters providing a valuable and less formal outlet for their authors and added interest, especially during the breaks from the formal presentations, for the other delegates. Many discussions took place around the poster displays.

The conference was well attended, with 125 registered delegates, with about 35% registered as students, plus six exhibitors. The committee was pleased to see the large proportion of the delegates that were students, probably the result of much promotion and possibly the substantially reduced student fee.

The delegates certainly appeared to have had an enjoyable and worthwhile conference, with many already looking forward to next year. Overall, the Electro-Acoustics group committee was happy with the response to the programme and is now planning the 25th in the series, to be held in November 2009 at a venue yet to be decided.

The conference programme

Registration was open from 6pm on Wednesday 19 November in the hotel reception area, with a glass of wine and opportunity for new arrivals to find friends and colleagues and to explore the venue. The tutorial session was held from 6.30pm to 9pm.

The conference was opened at 9.15am on Thursday 20 by the chairman, Sam Wise, who welcomed the delegates. He said that the conference had been well supported, with many papers submitted and excellent attendance numbers. He introduced all of the speakers and thanked the committee, the delegates, the Institute, the students and all of the other people who had helped to make sure the conference happened.

The Chairman's opening address was followed by the Institute President, **John Hinton**, presenting the Peter Barnett Memorial Award to **David Griesinger**. The citation was read by **Peter Mapp**.

After the Award lecture, the technical sessions continued, with breaks for refreshments and meals, until 6pm. Afterwards, a reception sponsored by Sound Technology was held in the *Regency Room*, followed by the Conference Dinner at 7pm.

After dinner, **Matt Trevor** (University of Derby) gave a presentation of WATMM, an interactive multimedia installation using Nintendo Wii controllers that allowed members of the 'audience' to interact dynamically with Ambisonic surround sound and pictures. The overall effect was intriguing and entertaining and went on for some time, with many delegates queuing up for their turns with the controllers.

The second day of the conference started at 9am with an invited lecture and further technical sessions. They continued until the last paper of the conference ending at 5.30pm. The Electro-Acoustics group AGM was held immediately after the last technical session of the day. A reception sponsored by AMS Acoustics was followed by dinner in the hotel restaurant at 7pm.

After dinner, an evening workshop on *Real time measurements - Theory and practice* was presented by **Wolfgang Anhert** (ADA Acoustic Design), **Stefan Feistel** (ADA Acoustic Design), **Peter Mapp** (Peter Mapp Associates) and **Mark Bailey** (JBL Professional). The topics covered a wide range of theoretical and practical issues relating to the measurement of acoustic responses in venues, including demonstrations of a number of software measurement packages. Many of the delegates stayed right up to the end, which says much given the competition from the hotel bar, though the two were not mutually exclusive.

Technical sessions

Thursday 20 November

Session 1 *Installation and Room Design I:* Chairman - Mark Bailey

The technical programme began with the **Peter Barnett Memorial Award** lecture *The importance of the direct to reverberant ratio in the perception of distance localisation, clarity and envelopment* by **David Griesinger**. David began by emphasising the importance of measurements being made at the eardrum and handed round a special microphone developed for the purpose. In a wide-ranging talk, he discussed the preferred range of early reflections, direct-to-reverberant ratios in some well-known halls and the importance of ensuring that the direct sound should be distinguishable from the whole. He described how the ear-brain manages to do that and said that the objective should be 'involvement' rather than 'envelopment'. The initial time delay gap was crucial but was ignored by many of the standard acoustic measures. He presented numerous audio demonstrations of the effects of changes in the D/R ratio and early time delay gaps, based on acoustic models.

The programme continued with *The effect of visual stimuli on the perception of 'natural' loudness and equalisation* by **Philip R Newell** (consultant), **Keith R Holland** (ISVR), **Branko Neskovic** (Tobis), **Sergio Castro** (Reflexion Arts), **Matthew Desborough** (Dolby Laboratories), **Soledad Torres Guizarro** (University of Vigo), **Antonio Pena** (University of Vigo), **Eliana Valdigem** (freelance recording engineer), **Diego Suarez Staub** (Cinemar Films), **Julius P' Newell** (electro-acoustics engineer), **Lara Harris** (ISVR), and **Christian**



Sam Wise, Electroacoustics Group chairman



John Hinton presents David Griesinger with the Peter Barnett Award

Beusch (Magnetix AG, & Tonstudio Beusch). The paper discussed the effect of visual stimuli on the perception of loudness and equalisation in the context of mixing sound for the cinema in rooms of widely differing sizes. Substantial preference differences for the overall level and the bass balance resulted from different screen sizes and distances. A correction curve was proposed, based on the standard 50° subtended angle of the viewing screen. In reply to a question from the audience, Philip said that no correlations with screen brightness had been found. A number of members of the audience questioned the validity of discarding outlying results with such small samples.

The final paper in the session was *The effect of diffusers on low frequency modes* by **Prof Jamie Angus** (University of Salford). Theoretically, acoustic diffusers should scatter modal sound energy into the diffuse field. Using radio-frequency electromagnetic signals as models of acoustic fields in reverberation chambers, Jamie demonstrated that diffusers certainly did affect the modal behaviour of the chamber and helped to even out the response. In reply to a question from Glenn Leembruggen, Jamie said that the low-frequency irregularities were still present in the frequency response.

The three papers were followed by a coffee break in the exhibition area. There, delegates could take a break, get some refreshment and discuss matters of interest, as well as talking to the exhibitors.

Session 2 Installation and room design 2: Chairman - Paul Malpas

After the break, **Dr Roger Schwenke** presented *Electroacoustic architecture at Universidad Laboral* by himself and **John Pellowe** (both of Meyer Sound Inc.). It described the renovation of a 1400-seat hall at the University as a multi-purpose auditorium. A number of different schemes for providing variable reverberation were described in principle. The choice of an electroacoustic system based on a combination of regenerative and non-regenerative had resulted in the ability to vary a range of relatively independent acoustic parameters, such as RT, warmth and clarity. In the discussion, David Griesinger said that regenerative systems generally suffered from problems in smaller rooms if the acoustic reverberation was not very good to start with. Dr Schwenke replied that this was discussed with clients in advance.

In his paper *Acoustic geometry sculptor - a computer program for optimising room surfaces*, **Michael Whitcroft** (Sandy Brown Associates) presented a room optimisation programme for early reflection control. By subdividing the room boundary surfaces into relatively small movable triangles, an optimisation routine using ray tracing could produce the best fit to a target impulse response. Examples had been calculated for monophonic, two-channel and five-channel systems. The target response could include any definable feature, such as initial time delay gap. When asked by Julian Wright how long the optimisation took, Michael replied that it could take up to two days.

In *Real world line array optimisation*, **Ambrose Thompson** (Martin Audio) described how a complicated BEM calculation routine for loudspeaker array responses could be made accessible to less expert sound system designers by



Matt Trevor demonstrates interactive sound and vision control

means of a simplified front end. He showed that having a rapidly calculated space-frequency response allowed system designers to be more intuitive about adjusting loudspeaker array parameters such as splay angles and array height. A method was also described that allowed interoperability between the new system and EASE via GLL configurations where the accuracy of the hybrid model was preserved.

The session was followed by a break for lunch in the hotel restaurant.

Session 3 Loudspeakers and microphones: Chairman - Julian Wright

After the break, **Tom Back** (Alcons Audio BV) presented *Alcons pro-ribbon transducer technology* in which he described five different historical categories of 'ribbon' tweeter. He presented comparisons between the characteristics of conventional compression drivers and drivers based on ribbon technology. The distortion performance of a ribbon tweeter was potentially much better than a compression driver but did not have such high power-handling capability. By developing a new transducer technology, 'pro-ribbon', based on the old principles but using modern materials and a revised drive motor, the ribbon technology was now a real alternative giving high sound pressure level with low

continued on page 8

Reproduced Sound 24 - continued from page 7

distortion. Because of the inherent length of such ribbon arrays, they could find application in venues requiring good directivity control in one plane. In the discussion, John Taylor asked whether the efficiency could equal that of the compression driver. Tom replied that it could not, but that the distortion was very much lower.

In *Microphone techniques for surround sound: how many microphones and where to put them?* **David Carugo** (Oxford Brookes University) posed the question of optimum microphone arrangements for multichannel sound recording. He described the inherent problems with common arrangements and their lack of compatibility for monophonic and two-channel down-mixes. He described the development of his own arrangement, which resulted in reduced overlap in the front giving sharper front images. In the discussion, David Griesinger suggested that if a good stereo-compatible recording was obtained from the front microphone pair then all of the stereo information was already contained in that and the surround sound balance would be impaired by the additional information. David replied that the work was still ongoing.

The final paper in the session was *Evaluating loudspeaker reproduction quality at low frequencies: optimisation of a music-focussed modulation transfer function technique* by **Lara Harris** and **Dr Keith Holland** (ISVR). The paper was presented by Lara. It continued the theme from RS23 of synthesising different loudspeaker responses and carrying out subjective tests. The objective was to establish whether the MTF could be used as a predictor of low-frequency sound quality for music reproduction. In the extensive discussion that followed, a number of queries about technical details were resolved, especially relating to the selection of the particular MTF frequencies. It was suggested that a continuous MTF might offer some advantages.

The presentation was followed by a break for tea in the exhibition room.

Session 4 Transducer modelling and development: Chairman - Bob Walker

The session started with *Accuracy issues in loudspeaker simulation* by **Patrick Macey** (PACSYS Limited). Patrick is well known to regular RS delegates for his presentations of aspects of finite element analysis relating to loudspeakers and sound reproduction in an accessible style. His presentation this year was on optimising the techniques, detail and approximations necessary to make any problem tractable. With continuing improvements in hardware, those decisions change continuously. Problems that used to take days can now take minutes. To illustrate the principles, a typical, but non-specific, loudspeaker model had been used. Patrick concluded by demonstrating that the inclusion of additional details in the models was generally beneficial. In the discussion, Julian Wright asked where the data for the properties of adhesives had been obtained. Patrick replied that he had used manufacturer's data.

That was followed by *Insights into loudspeaker diaphragm radiation using the finite element method* by **Kelvin Griffiths** (Harman Becker Automotive Systems). Kelvin began by describing how accurate predictions of loudspeaker performance helped to save time and costs in product development. By using FEA, motor design and the effects of non-linearity in the suspension could be investigated without having to construct many revised prototypes. The paper concentrated on the vibro-acoustic behaviour of the cone and coil assembly and the resulting acoustic radiation, mainly on the effects of deformations. A number of comparisons were presented demonstrating the effects of choices in the specification of the model. In particular, axi-symmetric analysis was shown to be around 100 times faster than a full, three-dimensional approach and was therefore preferable in most cases.

The final paper of the day was *A new methodology for the acoustic design of compression driver phase-plugs with concentric annular channels* by **Mark Dodd** (Celestion) and **L J Ocle-Brown** (ISVR and KEF Audio (UK)). Mark presented an analysis, using finite element methods, of the sound field in and around the phase plug channels in a compression driver. He referred to some of the history of studies of this problem and to a seminal paper from 1953, which had given optimum design values for flat diaphragms. With the current use of curved diaphragms for higher power ratings, those ratios needed to be updated. After an extensive programme of work, Mark had derived improvements, which were illustrated by animations of the sound fields. Mark also presented a comparison with measured results from a real driver.

That concluded the Technical Sessions for the first day of the conference.



Old Ship Hotel cellar

Session 5 Evaluation, auralisation and realisation: Chairman - Sam Wise

The second day of the conference began with an invited lecture entitled *Multichannel sound reproduction* by **Prof Philip Nelson** (ISVR and Deputy Vice-Chancellor, University of Southampton). The presentation began with a description of a hearing model based on cross-correlation using an array of time delays and attenuators. Phil demonstrated how the features of the model fitted the measured subjective performance of the human hearing system, could explain the peaks in localisation acuity at 500 Hz and above 3 kHz and the absence of stereophonic perception to the sides. He concluded that the model seemed to be a reasonable one. Phil then went on to describe a loudspeaker-based system for presenting binaural sound fields to the listener, using an array of cross-talk cancelling filters. Systems using three frequency bands had been used to overcome the differences in optimum loudspeaker spacing at low, medium and high frequencies. Tests had shown that the system also behaved reasonably well for azimuth changes.

The invited lecture was followed immediately by *Has Ambisonics finally come of age?* by **Bruce Wiggins** (University of Derby). The paper asked whether the Ambisonics principles could be incorporated into a simplified control package to make them accessible to less experienced users. The numerous problems that needed to be solved included devising coders and decoders appropriate to the microphone and loudspeaker layouts and accommodating real microphone polar responses. Bruce showed that, by adding higher-order components, the polar responses and channel separations could be improved. He then described how a set of VST plug-ins had been developed for use in common types of audio processor applications. Those were now available, at a relatively small cost, for non-commercial use.

Auralisation level calibration by **Serafino Di Rosario** and **Alistair Meachin** (Buro Happold) was presented by Alistair. He described the use of Ambisonics systems to improve business presentations. The objective was to provide more realistic presentation of acoustic issues to architects and planners. The major problems were the achievement of accuracy, frequency response and absolute level in what were usually acoustically poor rooms. The level errors over the listening area were said to be especially severe. Alistair then described an equalisation scheme based on coherently adding the low-frequency sound levels and summing the high frequency sound energy. Several additional problems remained, including large local errors. Subjectively, the equalisation appeared to result in shifts in source locations and additional work remained to be done. In the discussion, David Griesinger said that the approach was known to be limited and asked whether better results might not be obtained by simple hypercardioid decoding. In reply, Alistair said that some of the listening positions were frequently very close to loudspeakers and it was necessary to ensure that the contributions from opposite side loudspeakers were actually zero. When asked whether acoustic treatment could be added,

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Friday 21 November

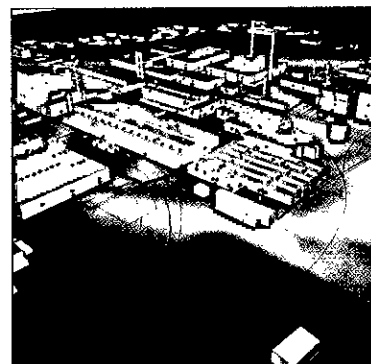


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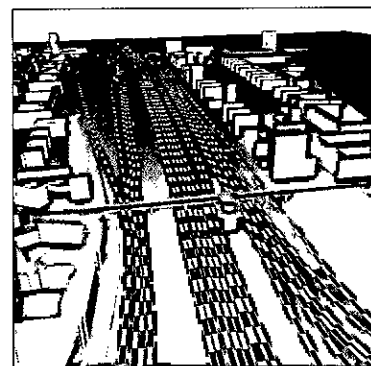
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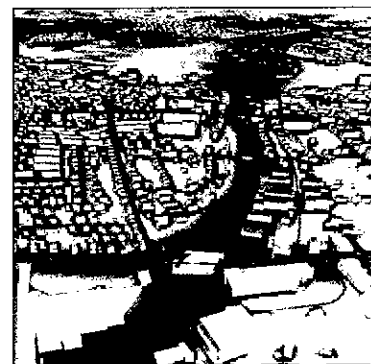
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Reproduced Sound 24 - continued from page 8

Alistair said that the rooms had to be used as found, with little or no time for preparation and that the equalisation would still have to be carried out.

The three papers were followed by an informal survey of delegate's preferences for conference locations. The committee chairman, Sam Wise, asked the audience to assist the committee in choosing the most favoured location. In the end, there was pronounced preference for a return to Brighton, though perhaps not the Old Ship, and a positive rejection of any return to the Lake District. It was followed by a coffee break in the exhibition area.

Session 6 Intelligibility:
Chairman - Glen Leembruggen

After the break, **Peter Mapp** (Peter Mapp Associates) presented *Assessing the potential intelligibility of deaf aid loop and other assistive audio systems*. He described how two million people in the UK presently use such systems and that potentially four to six million could benefit if they were more widely used. Systems based on infra-red, induction loop and radio-frequency transmission were all used. All of the delivery systems had potential for interference. Peter proposed a method for measuring the STI of the overall system and a minimum STI target of 0.7. However, because their inherent frequency response limitations removed some of the test frequencies, some current systems could barely achieve that figure even without additional degradations. A modified test method was needed. Peter also described his new proposed STI scale, with descriptors and tolerances. In the discussion, Paul Malpas asked what differences better modern hearing aids were having. Peter replied that some modern aids had separate controls for the different input sources.

In *Optimisation of speech intelligibility in multisource environments using delay spread optimisation*, **Evert Start** (Duran Audio) described a method for optimising time delays in large venues. The optimisation was based on the spread in arrival times and used simulated annealing. Any of several different cost functions could be used, for example STI (= 1 - STI), D_{50} , C_{50} , depending on the operator's preference and objectives. The system had originally been developed to assist system designers. It has been implemented in software and built into existing design tools. In simple cases, the optimised results were said to be close to the geometrically correct ones. In more complex cases, the optimisation had resulted in significantly better results than previous methods. The method had been tested by simulation in a European bank and a railway station. In the discussion, Peter Mapp asked whether there was any relationship between STI and the delay spread. Evert replied that he had done some tests and there was good correlation. Glenn Leembruggen asked whether any systems been built based on the approach. Evert said there had but that he had not had opportunity to visit them yet.

In the final paper before the lunch break, **Thomas Steinbrecher** (Bose Professional Systems) presented *Speech transmission index: too weak in time and frequency?* He began by showing that standard STI measurements were poor at accounting for discrete reflections and frequency response variations. He demonstrated how the cyclically repetitive nature of the modulation signals inevitably produced anomalous results and how, in the limit, a 100% reflection at 40s would theoretically produce a perfect STI result as all of the test components would come back into phase at that time delay. Thomas also presented calculated STI results for 350 and 400 ms delays, showing clear discrepancies between the predicted high STI values and the poor intelligibility. He went on to present a large number of audio samples to demonstrate the audibility of delayed reflections and compared then with the calculated STI. Reflections arriving earlier than 30ms tended to improve the STI.

The session was followed by a break for lunch in the hotel restaurant.

Session 7 Time and frequency measurement:
Chairman - Alan Mornington-West

After the lunch break, **Bob Walker** (consultant) presented *Early reflections in mobile control rooms*. This was an investigation of the effects of early reflections in two vehicles. It had been assumed that the poor stereophonic images in the first vehicle were the result of high amplitudes of early reflections within the range 0 to 5 ms and 0 to -5 dB. However, a second acoustically similar vehicle showed even higher early reflection amplitudes from the ceiling but had a much better stereophonic image quality. That appeared to be contrary to some existing hypotheses. Bob offered the possible explanation that lateral reflections were more disturbing to the virtual stereophonic image than 'in-line' reflections, ie those arrival directions that were at the same lateral angle

as the source. He said that this discovery had been very recent and that more work needed to be done on the effects of such very early reflections.

The next paper, *Three-dimensional room impulse response measurements in critical listening spaces* by **Bruno Fazenda** and **Julian Romero** (University of Huddersfield), was presented by Julian. He began by defining the limits of a 'small' room and described how the acoustics cannot be described as statistically uniform. The proposed measurement system used a multiple microphone array to derive and record apparent directionality during sound decays. The results were used to characterise the listening experience based on the time and direction of arrival of reflected energy. Subjective test had also been carried out to validate the measured results. In the discussion, David Griesinger remarked that he would have liked to see the results in separate frequency bands rather than as overall values.

In *Time-frequency analysis - comparison of popular transforms*, **John Shelton** (Acsoft) described how time-frequency measurements had been in use for over 20 years and how many different t-f distributions had been developed. Four had been in common use. They were the SFFT, the CSD, wavelet and the Wigner-Ville distribution. He described how all of the others could be derived from the W-V distribution by appropriate transformations. The presentation compared the merits and disadvantages of each and their use in assessing acoustic problems in rooms and loudspeakers. Examples were given of reflections, resonances, loose particles and 'rub' and 'buzz' defects in loudspeakers.

The presentation was followed by a break for tea in the exhibition room.

Session 8 Sound reinforcement and analysis:
Chairman - Simon Jackson

After the tea break, **Russell Mason**, **Chungeun Kim** and **Tim Brookes** (University of Surrey, Institute of Sound Recording) presented *Taking head movements into account in measurement of spatial attributes*. The paper was presented by Russell. He described how measurements are usually made with fixed receivers whereas humans typically make significant head movements when listening. A study had been made of typical listener head movements in various situations. It showed that significant movement was involved in judging spatial aspects but almost none in judging quality aspects such as timbre. A measurement detector based on a sphere with two microphones had been evaluated and correction methods for error reduction had been implemented. Finally, the two stages of the work had been combined to produce a multi-microphone sphere for the measurement of spatial attributes with head movements in a perceptually-relevant manner. In the discussion, David Griesinger asked what the signal source had been, how the IACC had been controlled and what the D/R ratio had been. Russell replied that the source had been a simple loudspeaker.

In his paper *Composing with waveholes and microsounds*, **Pere Villez** (University of Portsmouth) presented a paper on electronic composition, especially the sources of the basic sounds. He described one of the first such machines, built around 1900 and weighing over 200 tons! He said that his more modern approach was to use very short, 20 - 100 ms samples in rapid sequences to produce a synthesised sound. Pere presented many examples imitating human voice, pulsed rhythms and tones, 'pulsar masking', stochastic masks and elementary waves.

The final formal paper of the conference was *C'mon feel the noise (or how green is my sound?)* by **Stephen Jones** (Steve Jones Associates). Steve started by looking at the problems posed by test signals for real-world PA systems. The test signals are often specified by clients or relevant test standards but do not realistically represent the actual use of the system. A typical design procedure would start with a measurement of the background noise, then add 6dB to give 0.5 STI. The loudspeakers would then be selected so that every specified location will have sufficient sound pressure level to meet the requirements. The total amplifier power then came as the sum of all the individual requirements, plus 6dB for safety. That usually resulted in much more power being specified than was ever actually used in practice, apart from the qualification testing. That design method could have serious material and cost implications, especially for batteries if a UPS supply was also included. However, Steve admitted that how much the total could be reduced in practice remained an open question.

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A JOB WORTH DOING



One-day meeting

Andy McKenzie. Wind Turbine Noise 5

On Friday 16 January 2009 the Institute held the fifth in its series of one-day conferences on noise issues associated with wind turbines, which has been ongoing since 2005. This time the conference was held at the Aztec Hotel (and Spa!) at the Aztec West Business Park near Bristol. The subject has always attracted a large audience, with this meeting being no exception, and the conference was booked to capacity well in advance. The conference was chaired by Dr Andy McKenzie of the Hayes McKenzie Partnership Ltd of Salisbury and Machynlleth, and represented a slight change in direction, encompassing as it did noise from domestic micro-turbines, and underwater noise from offshore turbines and its effect on the marine environment.

The conference was opened by **Sylvia Broneske** of Hayes McKenzie who gave an overview of the sources of noise from different types of wind turbines and the means by which some of these sources could be controlled including the reduction of blade tip speed, improved blade design, and attention to maintenance details such as avoidance of damage to blades, dirt and splits in tapes applied to blades, to minimise noise from aerodynamic sources.

The second speaker was **Dr Andrew Bullmore** of Hoare Lea Acoustics who explained the reasons why the rate of change of wind speed with height was significantly greater at night than during the day and how this could affect the way wind turbine noise was assessed. He described different ways of taking this into account in noise assessments and the way innovative approaches were required in order to be able to determine the wind speed at hub height during baseline measurements. Dick Bowdler of New Acoustics then presented a discussion of the problem of amplitude modulation (or 'blade swish') allowing him to expand on his recent *Acoustics Bulletin* article and the reasons why this acoustic feature might be more prevalent at some sites than others, and why it might be more prevalent at some times than others.

After coffee **Mike Stigwood** of MAS Environmental explained some of the reservations he had about the applicability of the ETSU-R-97 assessment methodology to large turbines. He described the effects which started to occur for turbines with hub heights of around 80 metres or more, including the effects of wind shear previously described by Andrew Bullmore. He also referred to stratification effects in the atmosphere causing regions of varying wind speed and direction relative to that seen at the turbine hub and the effects this might have on noise output. He produced the results of measurements of noise carried out internally near one wind farm site where problems had been experienced, showing how the amplitude modulation



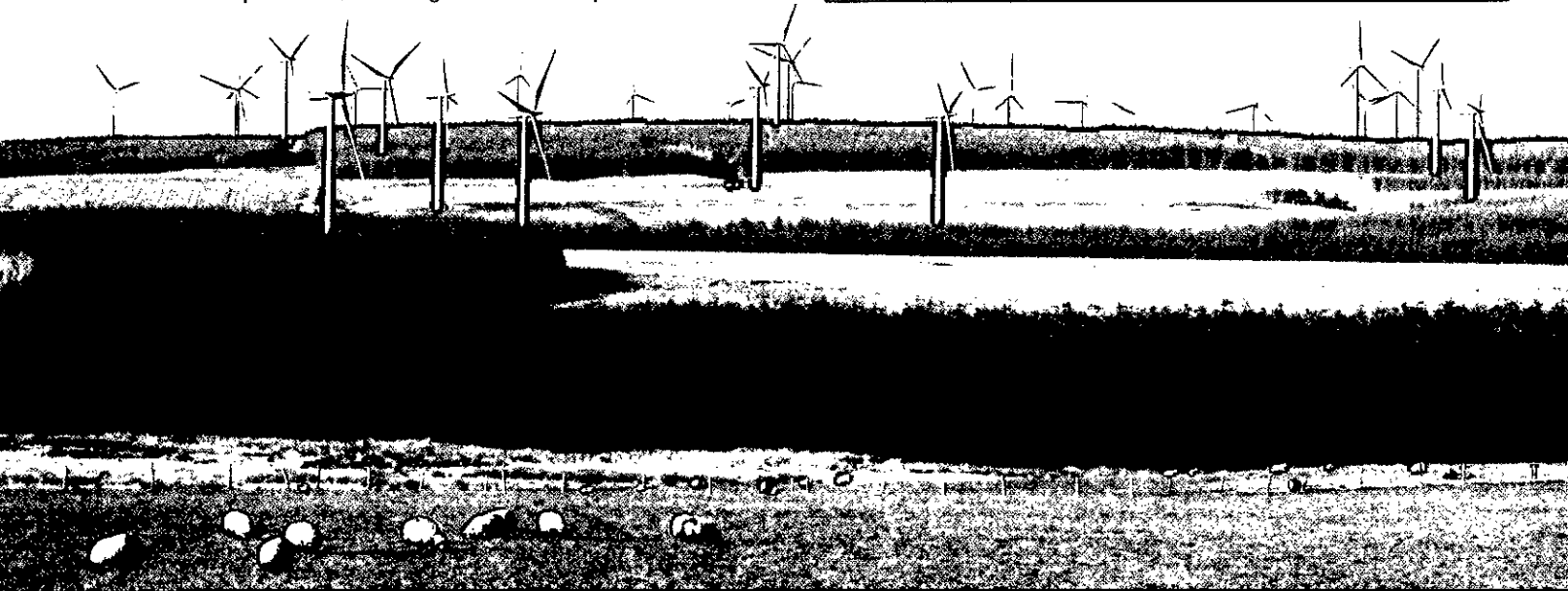
A packed house for the fifth wind turbine noise meeting

referred to earlier by Dick Bowdler was perceived internally in different frequency bands.

Alistair Mackinnon from TUV NEL followed this with a presentation on the regulation of noise from small and micro wind turbines. He started off by explaining that different standards were required for this type of turbine and briefly reviewed the mechanisms of the General Permitted Development Order (GPDO) designed to exempt certain types of installation from the requirement for planning consent. He described the modifications which have been made to IEC 61400-11 in the BWEA's small wind turbine performance and safety standard, to allow the methodology to be used for small and micro turbines which specifically took account of the generally higher and variable speed at which they operated, the greater dynamics in the yaw characteristics and the wider variety in the geometry of the designs used. He concluded with a graphic demonstration of the proposed certification label incorporating red, yellow and green guidance as to appropriate separation distance from nearby properties.

The first speaker after the lunch break was **Geoff Leventhall** who, with his many years of experience in the area of low frequency noise, provided an overview of the issues of 'Vibro-Acoustic Disease' (VAD)

continued on page 14





Sylvia Bruneske



Andrew Bullmore



Dick Bowdler



Mike Stigwood

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- Before each meeting there are regular technical presentations on the hot subjects of the day

Membership of the Association is open to all consultancy practices able to demonstrate, that the necessary professional and technical competence is available, that a satisfactory standard of continuity of service and staff is maintained and that there is no significant financial interest in acoustical products. Members are required to carry a minimum level of professional indemnity insurance, and to abide by the Association's Code of Ethics.

www.association-of-noise-consultants.co.uk

Wind Turbine Noise 5 - continued from page 12

and 'Wind Turbine Syndrome'. The term *vibro-acoustic disease* was originally coined to described physiological symptoms which were believed to be associated with high levels of noise (>90dB) in the frequency range of zero to 500 Hz. It was originally defined as problem for aircraft maintenance technicians exposed to levels of around 120 dB, but VAD had recently been attributed to levels of environmental infrasound and low frequency noise of between 50 and 60 dB, which was the level of typical urban infrasound (and typical level of infrasound from wind turbine sites). He described some of the anomalies in research linking VAD to noise from wind turbines including the fact that it would take one million years to get the same noise dose from 60dB as would have been received by the aircraft technicians in one year of exposure to 120dB. He also noted that the pressure magnitudes of low levels of infrasound, such as occur from wind turbine sites, were minuscule - of the order of the pressure produced by a 1 micron layer of water resting on the skin. He then went on to discuss 'wind turbine noise syndrome' and the fact that, strictly, in order to be called a 'syndrome' it should be something which was specific to wind turbines not just another example of a general effect such as annoyance by noise. He described the differing approaches used by medical professionals and those used for legislation, together with a typical noise dose curve whereby noise limits were often set at a level whereby 10% of the population were likely to be highly annoyed. He concluded with the view that wind turbine syndrome would probably be shown to be an effect of disturbance by fluctuating levels of noise (not infrasound and not normally low frequency noise) and not specific to wind turbines.

Matthew Cand of Hoare Lea followed this with a review of different approaches to noise modelling and noise prediction, and comparisons with data obtained during field measurements. He asked whether we should be assessing an absolute worst case, a typical worst case or average conditions. He described some typical worst case assumptions which are that turbine sound power level is that measured plus 2dB, all turbines see the same wind speed, any receiver is downwind of all turbines simultaneously, and all ground is hard, and the fact that all these conditions were unlikely to exist concurrently. The results of measurements concluded that such worst case assumptions were likely to overpredict noise by around 2dB, and that variation, although probably indistinguishable in practice, could make a considerable difference in generating capacity: say a 40% increase or reduction.

After tea, **Jeremy Nedwell** of Subacoustech Environmental Ltd posed some tricky questions like 'how does a herring hear' and introduced the concept of dB_{HT} which is the species-specific hearing threshold, whilst noting that different species of fish exhibited different responses for the same values of dB_{HT} . Generally, however, it could be observed that a level of $90dB_{HT}$ caused 100% avoidance of a given area. In this respect it was only the piling associated with offshore wind farms which was a cause for any concern, with noise from operational noise not causing any effects. Piling could cause fish to maintain a distance of 10 to 20 km from piling activity, but they were highly likely to return to an area once piling had been completed. Following a question from the floor he provided a fascinating description of how hearing thresholds of fish were determined and the dedication such a task required.

The conference finished with a discussion session hosted by **Dick Bowdler** of New Acoustics and **Andrew Bullmore** of Hoare Lea on the way cumulative effects from separate wind farms could be dealt with, particularly in the 'TAN8' areas in Wales where specific areas were designated for wind farm development, giving rise to a multitude of proposed developments in the same area. A graphic demonstration was presented of how co-operation between developers could lead to a maximisation of generation whilst meeting noise limits, but how a lack of such cooperation could reduce the total generation capacity significantly. Dick explained his standard approach for ensuring that the ETSU noise limits were not exceeded for areas where more than one site was proposed, incorporating a reduced limit for each individual site. This was followed by a discussion session both on this topic and other topics presented during the day.

mitted development for wind turbines

innon
td



Alistair Mackinnon



Geoff Leventhall



Matthew Cand



Jeremy Nedwell

Meeting report

Geoff Kerry.

The Improvement of the management of helicopter noise

In conjunction with the University of Salford, the North-west Branch held a one-day meeting on 6 February 2008 to support a project sponsored by DEFRA on 'Research into the improvement of the management of helicopter noise'. The purpose of the meeting was to provide an opportunity for the acoustics profession to contribute to the project, be it in the form of a formal paper or merely by being present and joining in the discussion on the day. The meeting fell at that difficult time of year when people worry about travel disruption, and when the run-up to the meeting, the invitations and call for papers were interrupted by the Christmas break.

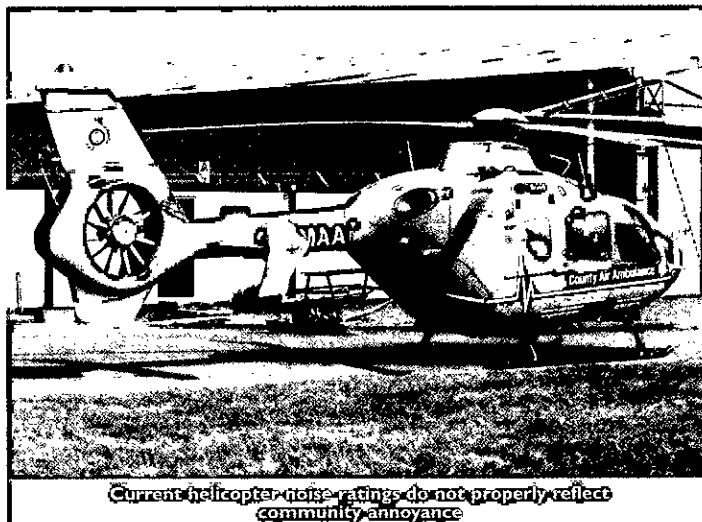
In the event the organisers had to rely on arm-twisting to persuade the speakers to join in but it was well worth the effort because that is what they all did: not only did they prepare and present a paper, they joined in the discussions and the post-meeting efforts to get the information down and correctly sorted. But they did more by volunteering to look at the final report either the whole or in part. Their comments have been taken on board and the final report* is very much stronger for it.

The meeting was chaired by Geoff Kerry, a past president of the Institute, who was co-investigator with the project manager at Salford, Dr David Waddington. Geoff introduced Parminder Dhillon from Defra who outlined their policy perspective before inviting **Rodger Munt** (representing Qinetiq) to give an introductory paper entitled 'Helicopter environmental noise modelling'. This confirmed that environmental noise modelling of helicopter noise footprints was now possible in real time with an option of feedback direct to the pilot not that far off.

The next paper entitled 'Psychological aspects of helicopter noise' was given by **Kath Sixsmith** who worked at the RAF Institute of Health before moving to the NHS. Kath had carried out an extensive survey of residents' reaction to noise around RAF Shawbury and brought considerable experience to the analysis of the results. The significant conclusion drawn was that before the rating of helicopter noise could be improved, a better understanding of annoyance and subsequent subjective response would be required.

The 'Management of environmental noise from helicopters - Local Authority perspective' was the subject of the paper presented by **Steve Mayner** and **Colin Stanbury** (Wandsworth Council). Wandsworth is the home of Battersea Heliport and Steve provided an outline of the way in which Wandsworth Council was tackling residents' concerns about noise. The conclusion was that better communication and contact was required between operators and the over-flown population, which should include feedback of complaints to pilots.

The final paper before the lunch break was given by Wing Commander **Tim Owens** and **Bob McLoughlin** from RAF Shawbury. Entitled 'Management of environmental noise from helicopters - RAF perspective' it covered the experience gained since the formation of the Joint Services Helicopter Flying Training School at RAF Shawbury. By considering all aspects of the flying programme and the reaction of local residents to the



Current helicopter noise ratings do not properly reflect community annoyance

noise, the RAF has proved that the effective use of available knowledge has minimised the impact of operations and reduced complaints.

After lunch **Jim Walker** gave the Civil Aviation Authority's view on the 'Management of environmental noise from helicopters' which led to the question 'should environmental aspects be given a higher profile in the CAA brief?'. **Paul Freeborn** of Bureau Veritas provided the view from the British Helicopter Advisory Board (BHAB) with a paper entitled 'Summary of helicopter operations in the UK'. His talk could be summarised as 'industry is doing what it can by providing guidelines for pilots, but there are cowboys!'

Tony Pike from Agusta Westland presented the final paper of the day entitled 'Helicopter noise - what is important from a community perspective', presenting an overview from the manufacturers. He asked the question whether we could alter helicopter noise characteristics to make them more acceptable, but commented that current noise ratings did not properly reflect helicopter noise annoyance.

To get the most out of the day a series of what were originally called 'structured sessions' were held during the breaks. In reality, they were anything but structured. Postgraduates currently studying acoustics at Salford and who had been briefed on the project were asked to join in the casual discussions taking place during the breaks, to make notes and to add them to notes they were taking of the presentations. This they did with gusto, so much so that the chairman ended up with far too many points to assimilate for the final summary session. He consequently decided to open it to the delegates as a general discussion. This proved to be quite lively with the postgraduates joining in with some of the comments they had picked up.

The researchers wish to acknowledge the significant input to the project provided by the speakers, for which they are most grateful.

* The final report entitled 'Research into the improvement of the management of helicopter noise' NANR235 is currently available on the Defra website at <http://www.defra.gov.uk/environment/noise/research/pdf/nanr235-project-report.pdf>

Meeting report: North-west Branch

The future of engineering

As a means of inspiring schoolchildren to consider engineering as a career path, the Joint Institutes of the North-west region organised five one-day careers events in 2008.

The Engineering Your Future (EYF) events were held during October and November in Bolton, Manchester, Sellafield, Burnley and Preston.

The Institute of Acoustics was one of the sponsors, together with the Institutions of Mechanical Engineers, Civil Engineers, Engineering and

Technology, and Chemical Engineers, plus the Nuclear Institute, the Institute of Physics and the British Computer Society. The EYF events were organised as workshops delivered by members of the engineering institutions who acted as enthusiastic role models for the pupils. The interactive and practical workshops were presented to local sixth-form colleges and secondary schools in each area.

These events are in their second year in the North-west and in their eighth year in London.

It is important to generate interest in future engineering, including acoustics, and these events are helping to achieve this.

Meeting report: London Branch

Ideas for Certificate of Competence in Building Acoustics floated

The application of Building Bulletin 93 in combination with the requirement to achieve BREEAM accreditation, as well as the use of Approved Document E as a means of ensuring that new and refurbished homes are built up to standard with regards to their sound insulation performance, has precipitated increasing numbers of building acoustics measurements. This has stimulated thoughts about the creation of a Certificate of Competence course for building acoustics measurements through the Institute of Acoustics.

Simon Kahn, Technical Director of RPS Group and an IOA distance learning tutor, gave an interesting presentation to the London Branch on 10 December 2008, during which he listed a number of possible subjects as well as ways structuring the course.

It was particularly important that this would not be a registration scheme but a course directed towards acousticians who had just started their career, or for others who would like to gain a basic knowledge on how to undertake building acoustics measurements with competence.

Undertaking building acoustics measurements may differ from site to site and from job to job, and the books and the standards may not be able to cover every eventuality. It should not be expected that the course would prepare students in all situations they faced, but it would cover most of them. It would teach them how to identify the acoustical performance of different construction elements, and whether or not they had been built according to the standards. The major subjects that were expected to be covered included building acoustics measurements, field measurements, standards and guidance, and how to develop competence. Laboratory measurements would be mentioned, but for comparison reasons only. A number of standards were also expected to be covered, mainly those related to building acoustics eg the ISO 140 group of standards.

Students should be able to identify the rationale of a test, which could vary: for example, was the purpose to identify the acoustical performance, to test for contractual compliance, to determine if standards had been met, or just to investigate. It was equally important that the student should be able to comprehend the concepts of sound insulation, reverberation time, background noise, services noise and speech intelligibility.

In some cases exceptions could be made and tests should not go ahead



Building acoustics measurements may vary from site to site

as the results might be contaminated (typically by elevated background noise levels), or because of the state of completion of the construction. The student should be able to judge when any such conditions applied, and that the tests should be aborted.

The student upon the course's completion would have developed competence by being able to identify the purpose of a test and the performance to be tested, by being aware of exceptions and all the conditions and equipment that were required for a test. The student should be able to conduct a test according to the relevant standards, record the results, analyse them and report them with competence.

The presentation was intended to encourage discussion, and a number of questions were raised. Was there a demand for the course? Should the course be theoretical as well as practical? Should it also include a review of the standards? Should it have a modular structure or not?

London Branch

Annual Dinner - Wednesday 12 November 2008

After last year's success the London Branch once again decided to hold its annual dinner at the Bleeding Heart, which has been described as arguably 'the finest French restaurant in the City'. The long-established and extremely popular restaurant, located near Hatton Gardens off Greville Street, offers superb food in historical surroundings. A private function room had been booked for the sole use of the IOA, where members were able to enjoy good food, good wine and good company, in atmospheric surroundings.

This year Jim Griffiths, Chairman of the London Branch, was invited as the guest after dinner speaker. Jim was the Director of Acoustics for Capita Symonds (formerly Symonds and Travers Morgan) between 1992 and 2006. He, in collaboration with other senior colleagues, formed a new company called Vanguardia Consulting in May 2006. Over the past 20 years, he has specialised in the entertainment, leisure and sport sector having managed the sound and acoustics for national projects such as Wembley Stadium.

Jim gave guests an insight into the concert, football and leisure business, with stories such as 'being in bed with Madonna', 'football with Gazza' and 'wearing a Spurs tie in the Arsenal boardroom'!

An enjoyable evening was had by all!

Erratum

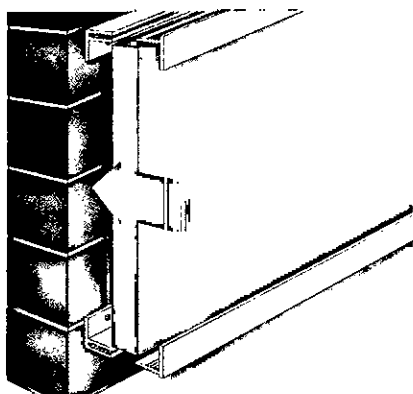
On page 8 of vol.34 no.1 (January/February 2009) of *Acoustics Bulletin*, the report on the 2008 Autumn Conference contained a factual error.

The audience participation workshop was in fact presented and demonstrated by Mark Allman-Ward of Sound Evaluations Ltd. Garry Dunne gave a paper just before this presentation on *New tools for better sounding cars*, in which he explained the manufacturers' need to create the quality perception of vehicles using sound before they went into prototype. Using the NVH simulator, they were able to set the sound criterion for the new vehicles to ensure they satisfied their target market and to differentiate their product from competitors, all before the prototype stage, saving time, resources and money.

Apologies are offered to both gentlemen for any embarrassment caused.

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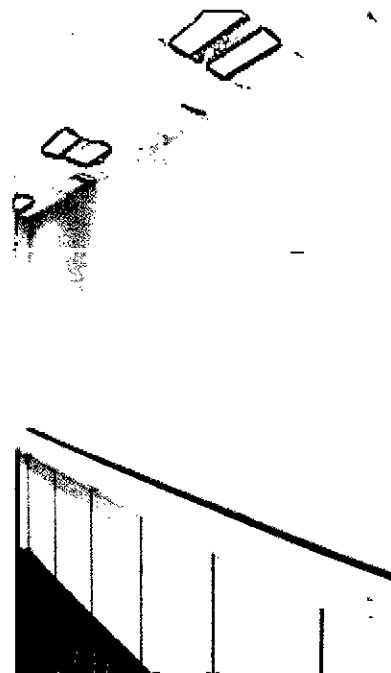


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Meet the committee

Publications Committee

The Publications Committee acts as the supervisory body for all Institute publications, ensuring a consistent format and relevancy to members. The committee is made up of members of the Institute and tries to reflect the broad range of employment and technical backgrounds of the membership.

The principal publications of the institute are

- *Acoustics Bulletin* (printed), bimonthly
- *Acoustics Update* (electronic), bimonthly alternating with *Acoustics Bulletin*

- www.ioa.org.uk web site

The primary purpose of these publications is to keep members up to date with the affairs of the Institute and to report on its meetings and activities. *Acoustics Bulletin* also provides a range of technical content reflecting the range of members' activities. *Acoustics Update* aims to bring relevant news items to the attention of members.

The committee also has responsibility for the Institute's other publications including conference proceedings, the annual Register of Members, education and careers information, meeting notices and other publications. It also oversees the Institute's library at St Albans, and the acoustics archive at Southampton.

For more information contact Adam Lawrence, chairman, email adam.lawrence@atkinsglobal.com

News from St Albans

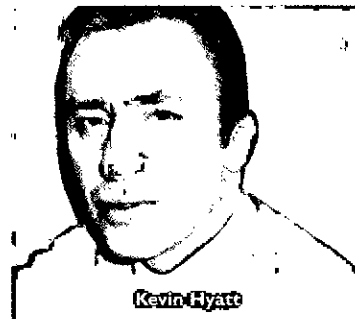
Institute appoints new publicity and information officer

The Institute of Acoustics has appointed Kevin Hyatt as Publicity and Information Officer. Kevin, who has a varied career in publishing and journalism, will be based at the St Albans head office and his responsibilities will include internal and external communications. He will handle media enquiries and manage the Institute's internet site, other e-media, publications, marketing and promotional material.

His background includes working for a number of publishers and international organisations including the John Laing Group and Waitrose. The 47 year-old was involved in promoting projects such as the Cardiff Millennium Stadium, World Cargo Centre, the Millennium Dome and a number of other key Laing projects in the late 1990s.

Kevin has also worked for a number of membership-based associations including the Royal Institution of Naval Architects and Federation of Master Builders, where he was assistant editor of *Masterbuilder*, the FMB's monthly journal. He holds an NCTJ certificate in sub-editing, gained through the Harlow College.

As well as his journalism background, Kevin has also been involved in design and production and has a keen interest in photography. A keen cricketer he also holds an ECB Level 1 cricket coaching certificate.



Kevin Hyatt

Dr Gerry McCullagh Memorial Lecture

Sam Bell. Pop Concerts - Sound Management and Control

In recognition of the time and effort that Dr Gerry McCullagh put into the promotion and education of acoustics throughout Northern Ireland and the Republic of Ireland, the Irish Branch of the Institute holds an annual lecture to which an eminent acoustician is invited to present a talk on their area of expertise. As Gerry always wanted to move out into the regions this event was planned for Armagh tending to help attendees from the west and south.

This was the third lecture and it was a pleasure that Jim Griffiths of Vanguardia Consulting accepted the offer to present this paper, on 27 November 2008.

The vice-chairman Gary Duffy opened the evening at the Armagh City Hotel, Northern Ireland, by welcoming Mrs Rita McCullagh and Gerry's mother Mrs Jean McCullagh to the lecture. Gary also offered congratulations to Mrs Jean McCullagh who would be celebrating her 94th birthday on the following Saturday.

Gary welcomed the speaker for the evening, Jim Griffiths, and also welcomed the Chief Executive Kevin Macan-Lind and his wife Linda.

Jim began by recounting the times when he had met Gerry at the Windermere conferences and spoke of the good recollections of those times. He said he was honoured to be asked to speak at this lecture.

He recounted his career beginning with the Live Aid concert in 1985 and the work he had done since at the O₂ arena and Wembley Stadium to cover some 600 music events. The list also included Kenwood House and Leeds Castle and, since 1991, many all-night dance parties.

Jim was on the working party for the original Noise Council Code of Practice on Environmental Noise Control at Concerts, published in 1995, and is now on the working party refreshing this document. He gave details of the guidelines regarding the venue category and also the number of events proposed per annum and how this in turn gave the criteria to be used to establish control procedures for each event. He described how a low frequency limit was considered, to limit the 63Hz or 125Hz frequencies and how this helped to protect residents at distances of 2km and beyond.

Jim spoke of the efforts to control concert noise by positioning of the main concert loudspeakers and delay tower speakers and how typical pop concerts were controlled in practice. A typical event would be organised well in advance by producing noise management plans, noise predictions and contour diagrams, designing mitigation measures and carrying out sound propagation tests the evening before the event. The control procedures during the event were also described along with the use of wireless sound logging.

It was necessary for all parties to work together for a successful event and this included the artist, their sound engineers, promoter, venue management, the local authority and local residents.

Following the lecture there were many questions showing the interest the topic had provoked. Gary offered his thanks to Jim and introduced David Cawley who was this year's top Diploma Student from the island of Ireland.

Mrs Jean McCullagh was pleased to present David with his Certificate.

Finally Gary thanked all the visitors and members for attending the event.



Jim Griffiths delivering the Gerry McCullagh Memorial Lecture with Gary Duffy, vice-chairman Irish Branch



Jim Griffiths receiving a certificate on behalf of the Irish Branch from Gary Duffy



Mrs Jean McCullagh presenting a certificate to David Cawley, 2008 top Diploma student in Ireland



Chief executive Kevin Macan-Lind, Jean McCullagh, Rita McCullagh and Linda Macan-Lind

'Sound' advice on engineering day

Acoustic Ambassadors at Knights Templar School

Schoolchildren were given the chance to experience the life of an Acoustics engineer in a fun experiment at an engineering day at a school in Hertfordshire. In a drive to show the pupils that engineering can be an interesting, challenging and rewarding career and raise the profile of acoustic engineering, workshops were run by members of the Institute of Acoustics at Knights Templar School in Baldock, Hertfordshire.

The Year 9 pupils were given the task of creating a soundproof rehearsal room for a fictitious band they had created. The day was organised by Acoustic Ambassadors from local companies, who joined forces with Setpoint Hertfordshire, an educational charity aimed at inspiring young people about science, engineering and technology.

The youngsters were given a metal frame representing their room and a budget to purchase a number of materials, including wood, metal and foam with which to cut out airborne noise and impact noise. Appropriate noise was created using an mp3 player acting as a bass guitar and a percussive device to simulate a drum kit. A noise measurement was taken on each group's 'room' at a number of stages to determine the level of noise being emitted with points awarded for the quietest and cheapest rooms, with bonus points also awarded.

Richard Collman, from Acoustical Control Engineers, has developed a test rig for students to find out which materials can best deaden airborne and structureborne sound. This is part of a 1½ hour practical project in which a fictitious band is allowed to rehearse without disturbing the neighbours. The idea is that by using various materials provided they learn the basics of sound insulation and absorption. Students also have to work out costs. Once completed the box is tested and a winning team found. Since the

initial pilot in May 2007, the activity has been taken up by Tring School, Hertfordshire, Knights Templar School in Bedfordshire and Chauncy School in Hertfordshire.

Acoustics represented just part of the day at the school, which also included workshop sessions involving engineering projects, such as building a paper tower, making a satellite using paper, card and an egg, and designing an alarm system for 'gold bars'.

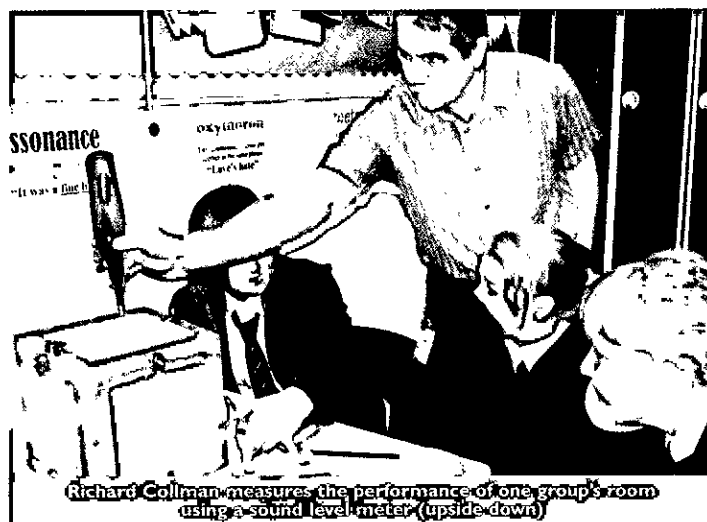
The unique nature of this project enables small companies such as Richard's to be involved in a school and has potential benefits for this industry sector.



Pupils discuss how best to soundproof the room



Year 9 pupils from Knights Templar School in Baldock take part in the acoustics project



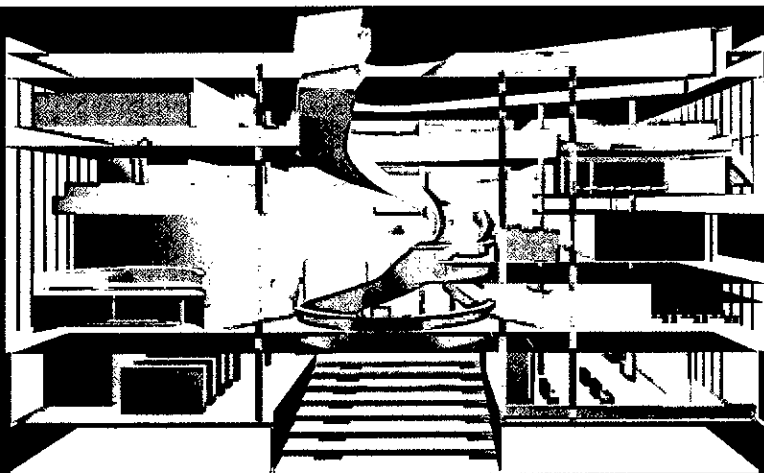
Richard Collman measures the performance of one group's room using a sound level meter (upside down)



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- Speed of calculations
- Reliability of results
- Transmission between rooms
- Quality of auralisation

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Instrumentation corner - continued from page 20

corrections are required. Class 1/C and Class 2/C calibrators must be supplied with an appropriate barometer to enable these corrections to be readily made.

In general, all types of pistonphone will require corrections for the prevailing atmospheric pressure. Some older electronic calibrators also have pressure effects similar in magnitude to pistonphones, and must be suitably compensated, but many modern electronic calibrators operate on a principle that reduces the effects of changes in atmospheric pressure to within the limits allowed in the Standard.

Adaptors

Although by far the most popular size for a microphone is a nominal diameter of $\frac{1}{2}$ " (actually 13.2 mm), many calibrators have opening cavities for nominal 1" diameter microphones and require an adaptor to be fitted for the $\frac{1}{2}$ " size, and for $\frac{1}{4}$ " microphones an adaptor is universally required. These small items, usually plastic, are often a key element in the level produced by the calibrator, and it is vital that the correct part is used to marry calibrator and microphone together. The mix-and-match of manufacturer A's calibrator with manufacturer B's adaptor for calibrating manufacturer C's microphone/sound level meter is a recipe for error on a grand scale and should **never** be employed! In most cases, there is an O-ring rubber seal at the microphone/adaptor joint, (as there usually is in the main cavity of the calibrator as well), and this should be maintained carefully to ensure an airtight seal exists between them. An occasional very light smear of silicone grease on the O-ring prolongs its life and usually improves its fit as well.

Pressure to equivalent free-field corrections

This is a number that is fixed for a given calibrator (plus adaptor) and microphone model. It is not necessarily the same for any two makes or models of microphone and must be added to the calibrator's pressure level if the sound level meter is to be used as a free-field measuring device.

If the microphone is not a free-field type, or the meter has been set to a random incidence or diffuse field correction, there will normally be no microphone correction factor required if the microphone is on an extension cable. There may be a correction factor for the shape of the case of the meter if the microphone is mounted on a preamplifier that is part of the main instrument. The pressure to free-field correction may also include this effect, in which case it is possible that a different correction factor will apply if the microphone is on an extension cable. This may also be true when an accessory such as a windshield is used. The correction data supplied needs to be clear about the conditions to which it applies.

Settling time

As most calibrators form a fairly airtight seal around the microphone when correctly positioned, the insertion of the microphone acts a little like a pump on the air inside the calibrator. This effect is usually dissipated via small air passages in both the microphone and the calibrator, but these do take time to return the air inside the calibrator to atmospheric pressure. The time taken can in part be offset by inserting the microphone (and removing it) only slowly.

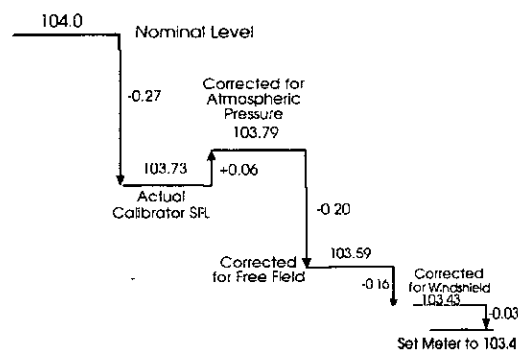
Applying the calibrator to instrumentation

With a knowledge of the 'true' level of your calibrator, you are in a position to work out the correct level to which your sound level meter should be set. For a typical calibration using a calibrator with a known pressure level and a free field microphone, this can be mostly summarised as follows.

- Take the certified pressure level of the calibrator
- Add or subtract any relevant correction factors for adaptors in use (if not included in the level stated above)
- If the calibrator is sensitive to temperature, humidity or atmospheric pressure, measure the parameter(s) of influence and

Correct For :-

Environmental Conditions
Free-Field Use
Windshield



add or subtract their effects using data provided by the manufacture of the calibrator

- Add or subtract the pressure to free-field correction for the microphone/calibrator combination (if applicable)
- If a windshield or other accessory is to be used, add or subtract its effect at the calibration frequency
- Round the answer to the nearest level displayed by the meter and adjust accordingly.

The result will be the correct and most accurate setting for your sound level meter.

Richard Tyler FIOA is with AV Calibration Ltd, Shefford, Bedfordshire SG17 5HQ and is chairman of the Measurement and Instrumentation group of the IOA.

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 Institute of
Acoustics

Institute Diploma Examination 2008

Prof K Attenborough

The number of candidates gaining merits (M), passes (P) or fails (F) in each module are shown for each centre in the table of results. This includes the results of appeals. Note that the 'fail' grade numbers include those who were absent from the written examinations. This year 178 candidates entered for the General Principles of Acoustics (GPA) written paper (167 entered in 2007, 216 entered in 2006, 135 entered in 2005, 140 entered in 2004, 121 entered in 2003, 154 entered in 2002, 129 entered in 2001 and 150 entered in 2000). Ten candidates were absent or withdrew before the examinations. There were 62 candidates for Law and Administration (L&A), 137 for Noise Control Engineering (NCE), 114 for Architectural and Building Acoustics (ABA), 29 for Transportation Noise (TN), 10 for Vibration Control (VC), 6 for Sound Reproduction (SR) and 7 for Measurement (M). There were 41 candidates who deferred their projects until November and 15 have still not completed their projects. Candidates who have not submitted their project reports are shown as failed in the Table.

This year the overall GPA conflated mean was the highest since 2000 - higher even than last year which itself was a record. Questions on workplace noise exposure and hearing disorder, noise barriers, basic definitions and absorption and reverberation were most popular and resulted in high mean scores. Questions on wave motion, instrumentation and vibration isolation were least popular, except for Direct Learning (DL) St Albans candidates. Apart from those at NESOT and Derby, the relatively few candidates who answered the vibration isolation question obtained high scores. Over all centres the performances of DL students (Scotland, St Albans and Bristol) on GPA were better than at other centres.

As in the previous three years, a merit threshold of 70% was applied to the written paper and the conflated GPA mark. The examination scripts of candidates satisfying the conflated mark threshold but gaining between 67%

and 69% on the written paper were examined at moderation, re-marked where appropriate, and judged individually as 'pass' or 'merit'. However, even if these criteria were satisfied, a merit was not awarded if the assignment mark was carried over from a previous year.

Concern was expressed by candidates and tutors about this year's ABA examination: indeed, the mean raw ABA exam score was out of line with other specialist module results and with previous years' moderation and there was relatively high failure rate. After considering scripts with raw marks of between 35% and 30%, it was agreed to raise the mean exam mark by 5% at moderation. Also after noting that the mean CW mark was less than the mean exam mark for NCE, at moderation it was agreed to increase the mean CW mark by 5%. For a merit grade on the specialist modules candidates were required to have a conflated mark of at least 75% plus a mark of at least 70% in the written exam. No merit was awarded if it depended on a deferred score.

Twelve appeals were received (two about more than one result) following the 2008 examinations and five were successful.

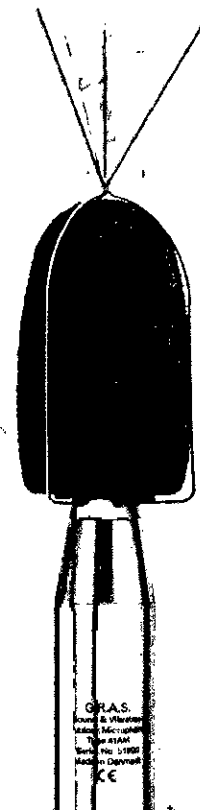
The IOA Diploma prize for best overall performance (four merits including project) was awarded to Michael McKane (DL St Albans). A remarkable number of special commendations (15) for achieving three merits (including project) have been sent to Adam Baker, Iain Paterson-Stephens, Michael Jenkins (Derby), David Fernleigh, Richard Ward, Angela Kourik (NESOT), George Gibbs, Eulalia Peris (Salford), David Cawley (Ulster), Nicholas Durup (Colchester), Charandeep Gill, Paul Herwin, Paul Hopwood, Michael Lotinga, James Mackay, Catherine Stevenson (DL St Albans) and Jamie Hogg (DL Bristol).

continued on page 24

Microphones for outdoor use

G.R.A.S. Sound & Vibration offers a wide range of out-door microphone solutions for permanent as well as temporary monitoring of environmental (airport, traffic and community) noise.

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Institute Diploma Examination 2008 - continued from page 23

The ANC prize for the best Diploma project has been awarded to Tony Clayton (Salford).

Diploma Project Titles 2007-08
Colchester

Reverberation time and absorption effects within an office

Study of motorcycle exhaust system

Investigation into test procedures of ISO 140

Properties of sound reducing mat (Building Regulations Approved Document E)

Music rehearsal studio design

Control of Noise at Work Regulations 2005: assessment in a club

Sound from motocross and attenuation methods

Proposed relocation of Basildon rifle and pistol club

Design of new test facility

Derby

Occupational noise exposure of manual car wash operatives

Noise exposure of employees in pubs and clubs

Reverberation times in sound insulation testing

The acoustic characteristics of three classes of train

Noise impact of wind turbines

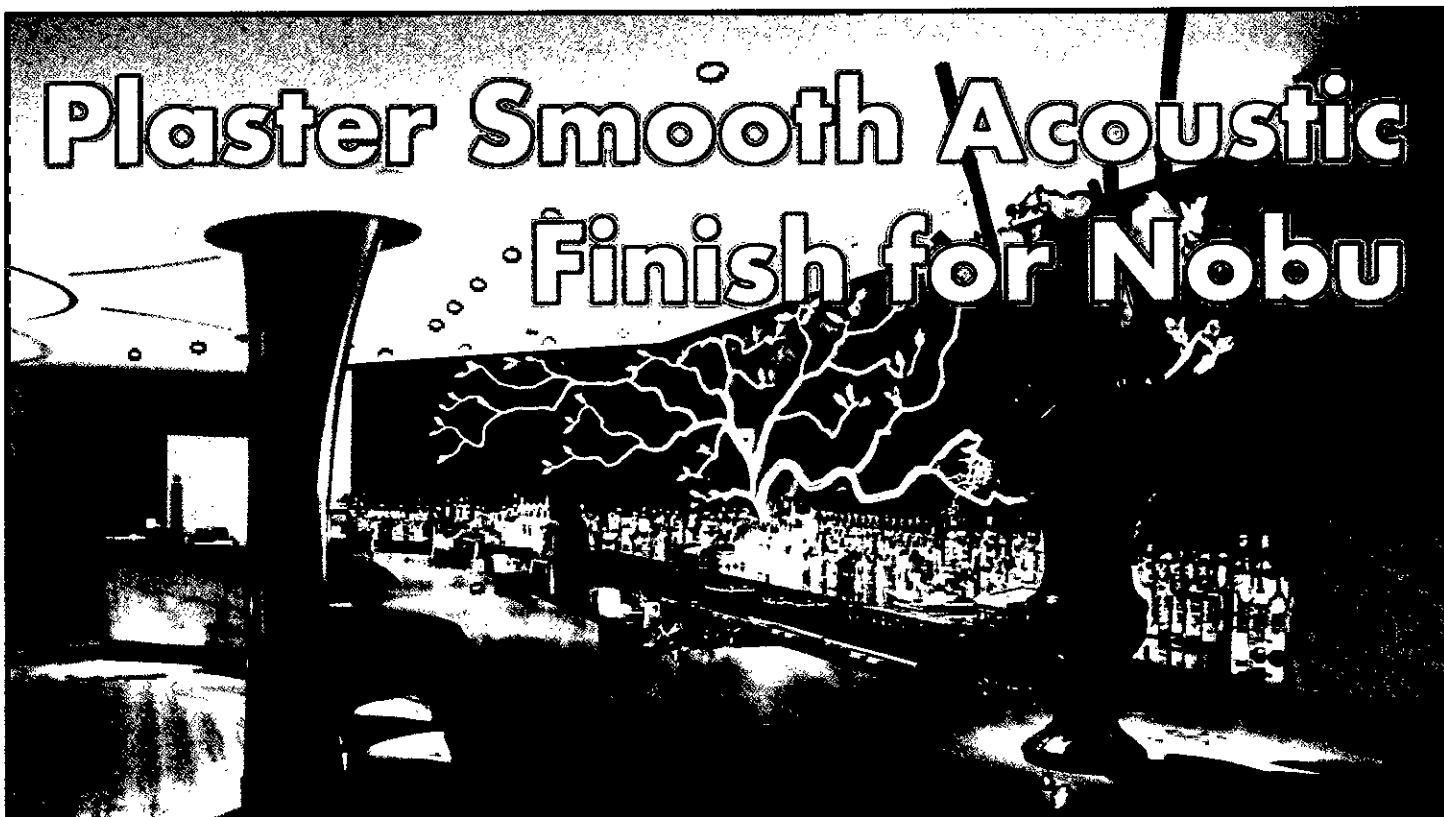
Noise assessment of proposed smoking shelter terrace

continued on page 26

IOA Diploma results 2008

Centre name	Grade	GPA	Project	ABA	M	L&A	NCE	TN	VC	SR
Colchester Institute	merit	3	2	0	0	0	2	0	0	0
	pass	6	7	0	0	5	6	0	2	0
	fail	0	0	0	0	3	1	0	1	0
University of Derby	merit	10	5	1	0	2	5	1	0	0
	pass	15	19	13	0	10	15	9	0	0
	fail	2	1	1	0	0	3	1	0	0
Distance Learning (Bristol)	merit	4	0	0	0	0	2	1	0	1
	pass	2	9	8	0	0	4	0	0	0
	fail	0	0	0	0	0	0	0	0	0
Distance Learning (Edinburgh)	merit	5	2	0	0	0	4	1	0	0
	pass	2	4	6	1	0	3	0	0	0
	fail	2	5	2	0	0	1	2	1	0
Distance Learning (NZ)	merit	0	1	1	0	0	0	0	0	0
	pass	1	0	0	1	0	0	0	0	0
	fail	0	0	0	0	0	0	0	0	0
Distance Learning (St Albans)	merit	12	5	1	3	0	3	1	1	1
	pass	4	11	13	2	0	4	0	4	3
	fail	2	4	2	0	0	1	1	0	0
Leeds Metropolitan University	merit	5	2	0	0	1	2	0	0	0
	pass	8	10	11	0	6	6	1	0	1
	fail	0	2	1	0	0	1	0	0	0
Liverpool University	merit	0	0	0	0	0	0	0	0	0
	pass	0	0	0	0	0	1	0	0	0
	fail	0	0	0	0	0	0	0	0	0
NESCOT	merit	7	5	1	0	0	10	1	0	0
	pass	11	14	9	0	8	6	5	0	0
	fail	6	7	1	0	3	6	1	0	0
Salford University	merit	7	3	0	0	0	8	0	0	0
	pass	14	15	22	0	0	10	0	0	0
	fail	4	5	6	0	0	5	0	0	0
University of Ulster	merit	5	3	1	0	1	2	0	0	0
	pass	5	7	3	0	5	8	0	0	0
	fail	0	0	0	0	0	0	0	0	0
UWE Bristol	merit	5	0	0	0	0	1	0	0	0
	pass	6	11	0	0	3	2	0	0	0
	fail	0	0	0	0	1	1	0	0	0
Totals	merit	63	28	5	3	4	39	5	1	2
	pass	74	107	85	4	37	65	15	6	4
	fail	16	24	13	0	7	19	5	2	0

Plaster Smooth Acoustic Finish for Nobu



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ACOUSTICS

Institute Diploma Examination 2008 - continued from page 24

Level of noise spectators are subjected to on open ranges
 Impact of music from in-car audio systems on hearing of young people
 Risk of noise induced hearing loss from an mp3 player
 Affect of design modifications on roll-cage noise
 Are commercials and trailers too loud in cinemas?
 Affordable housing and noise control
 Noise exposure of a semi-professional drummer
 The noise exposure of night clubbers
 Absorptive material density and silencer performance
 Planning guidance and environmental noise
 Assessment of noise emitted from landfill gas flares
 Acoustical qualities of electric guitar strings
 Acoustic performance of ventilation duct bends
 Speech intelligibility measurements in lecture theatres
 Critical assessment of hearing protection devices
 Sound insulation contribution offered by various thickness of mineral wool
 Guidelines for measurements and reporting of noise levels from wind farms in the UK
 Reverberation times in sound insulation testing
 Noise impact assessment of an external TV screen

Distance Learning (Edinburgh)

The effect of ground conditions on sound attenuation with distance
 To assess the impact of the smoking ban in Scotland and noise complaints by residents
 Noise from within an NHS orthopaedic operating theatre
 Subjective acceptability of permitted noise levels under Antisocial behaviour etc (Scotland) Act 2004
 Performance of a test regulation for impact sound insulation
 Baseline noise survey and construction works assessment
 Effects of ground conditions on sound attenuation distance
 The effect of rainfall on background noise levels for assessment of noise from wind farms
 Significance of using the larger volume room as source room in sound insulation tests
 The accuracy of acoustic models in predicting reverberation time

Distance Learning (Bristol)

Noise exposure of staff in the music and entertainment sectors
 An investigation comparing measured and predicted noise break-in from road traffic
 An investigation into the factors that drive speech intelligibility
 Study of the reliability of scaled models for the measurements of noise attenuation provided by a screened window
 The reproducibility of sound insulation testing
 Insertion loss test rig - Qualification for comparative measurements
 Relative accuracies of the harmonised CRTN prediction models
 BS.4142: When and 'weather' to measure during the night in rural areas
 Determination and comparison of sound power levels of various models of vacuum cleaner

Distance Learning (St Albans)

The study of principles of enclosures
 An investigation into the factors that drive speech intelligibility

Determination comparison of sound power levels of various models of vacuum cleaners
 The variation in speed and direction between two measurement locations at a modern wind farm site
 The acoustics measures required for the conversion of a disused barn into residential dwelling
 An investigation comparing measured and predicted noise break-in from road traffic
 A problem of a quiet office environment
 The validation of the acoustic performance of the internal walls of an administration building and its HVAC systems
 Characterisation of a novel flat panel loudspeaker
 Ending the noise from the endless pool
 Impact sound reproduction system with directional realism
 A study into the repeatability of accepted methods of airborne sound insulation testing
 Equalisation curves as a product of room response
 Insertion loss of an acoustic enclosure for a metal cutting machine
 Critical review of concert venues and procedures within the Wembley complex

Leeds Metropolitan

Silencers and flow noise
 Assessment and modification of a Leeds Metropolitan University lecture theatre
 Acoustics of rooms in Gateshead Civic Centre
 The acoustics of a small venue
 Dodecahedron speaker
 The effect of HP on compliance with CNWR in the entertainment industry
 Benchmarking of prediction software
 Traffic noise in Newcastle
 Comparison of predicted and measured sound insulation
 Design of attenuation equipment for a university laboratory
 Wind farm noise
 Reactive silencer design
 Noise impact of air quality monitoring sites
 Open plan office
 Comparison of actual and predicted railway noise
 Consistency in assessing nuisance
 Sound insulation of building elements
 Assessment of noise exposure of staff at Manchester music venues
 A comparison of actual noise levels produced by two GE 1.5MW wind turbines with the predicted noise levels
 An assessment of room mark revelation time prediction and lecture theatre modifications
 Acoustic properties of rooms in Gateshead Civic Centre

Nescot

Noise emitted by a dairy operating in a mixed residential and industrial area
 Investigation into the accuracy of noise mapping with regards to road traffic noise
 The Biggin Hill into air fair 2008 - noise disturbance at a nearby residential dwelling
 Validation study of M3 acoustic barrier attenuation
 Measurement and prediction of RT in double height reaching spaces

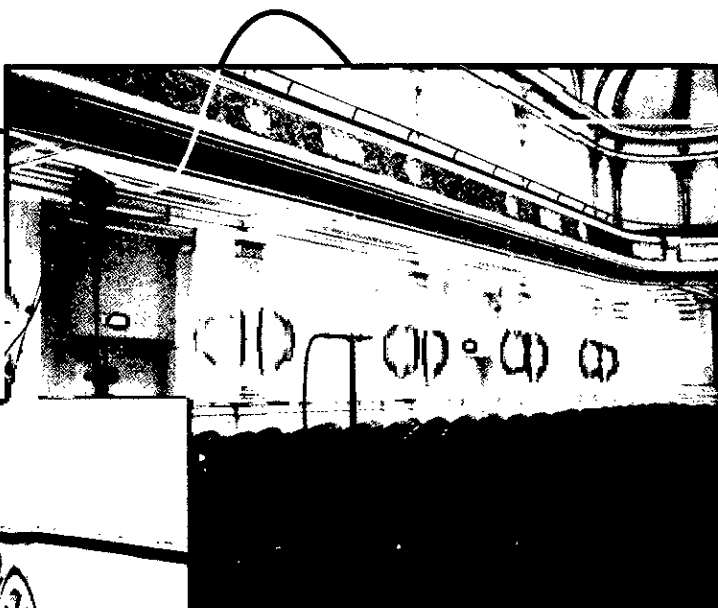
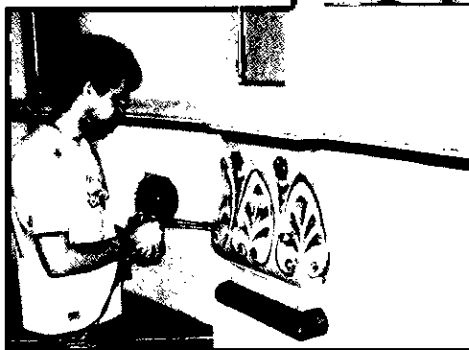
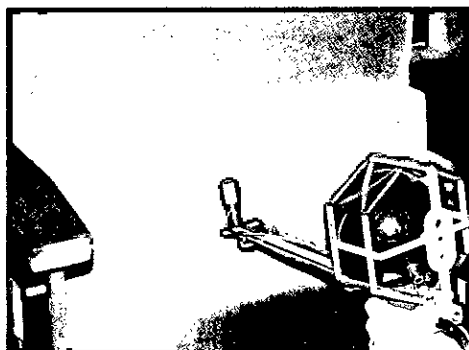
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Microflow Technologies

 Charting sound fields

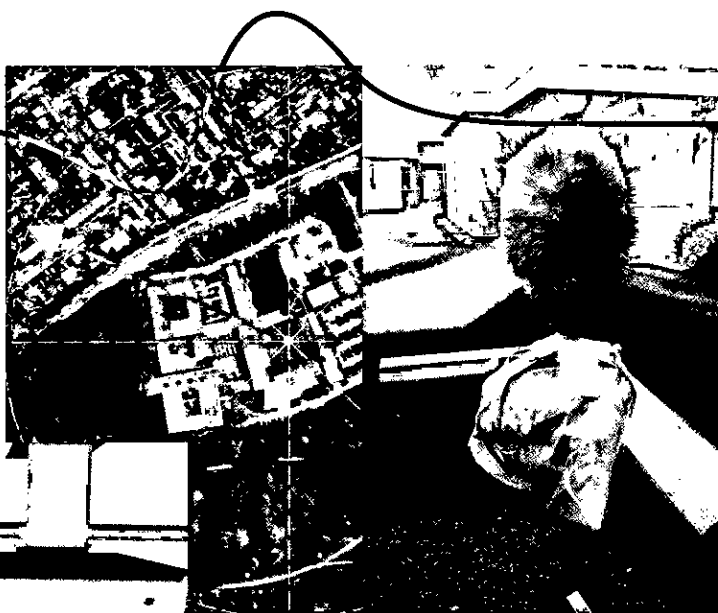
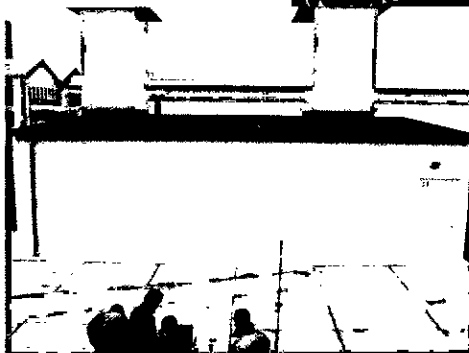
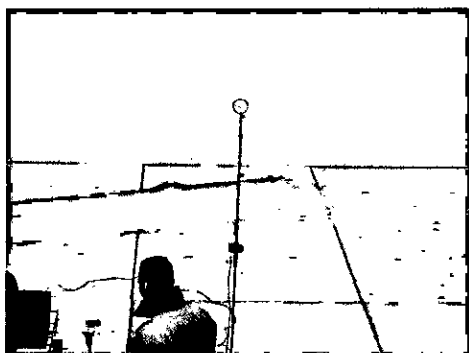
Architectural acoustics

- ✓ 3D impulse response
- ✓ True energy based 3D reverberation time measurement
- ✓ In situ absorption measurement



Environmental noise monitoring

- ✓ Vector sensor based
- ✓ Broad banded 1Hz - 10kHz
- ✓ Multiple sound source separation
- ✓ Bearing and triangulation
- ✓ Source finding in 3D / no ghosts



Institute Diploma Examination 2008 - continued from page 26

Noise exposure at a kennel

The use of L_{eq} to define aircraft noise airborne sound insulation between separating floors

Objective methods for assessing statutory noise nuisance

An investigation of the effect of open area on the absorption efficient of acoustic panels

Football stadium - noise issues - safety and nuisance

Investigation of noise from a recycling site

A school extension in accordance with BB93

Redevelopment of a site according to PPG24 and BS.4142

Analysis of the sound characteristic of demon tic lawn mowers

Noise levels under flight path in Ealing during easterly operations

Noise from CAMRA festival in Reading

Attenuator testing - static and dynamic insertion losses

Noise from a newly installed air-handling unit according to BS.4142

Suitability of a proposed residential development close to a railway crossing

Wind generated whistling noise from a multi-storey building

Effectiveness of a finite absorptive acoustic barrier

Salford

Road traffic noise: A comparative study

Traffic speed reduction techniques and road noise reduction

Vocal effort and Lombard effect

Glazing and road traffic noise - Specifying appropriate constructions

Noise emissions from two standby diesel generators

William Blythe Ltd church works noise complaints

Impact of the Control of Noise at Work Regulations 2005 on pubs and clubs in Merseyside, and methods of control

Noise emission from portable hydraulic fans used by HRS services

Acoustic barriers

Study of noise induced hearing loss due to excessive use of mp3 players

Noise exposure of swimming instructors at Levenshulme swimming pool

Investigation into noise from water treatment works

Assessment of noise exposure of staff at Manchester music venues

Field measurements of airborne sound insulation between rooms

Noise mapping: identifying quiet areas

Effect of road surface and tyre noise

Comparing the standards and the procedures used in the judgement for a low-frequency industrial noise

Vocal effort level variation and statistics in the Spanish language

Assessment of PACE interview room

Assessment of the acoustics of Chadderton Town Hall Ballroom

Ulster

Effect of road traffic noise on a proposed housing development

Noise impact of construction phase of a mine waste management facility

Attenuation to reduce crosstalk in an office ventilation system

Effect of acoustic treatment in a multi-purpose hall

Staff noise exposure in places of entertainment

Assessment and attenuation of shot blasting noise

Effect of PA loudspeaker distribution in a night club setting

FFT analysis of microphones

Privacy between consulting rooms in a health centre

Evaluation of noise exposure and assessment of risk in part-time bar staff from amplified music

Assessment of reverberation time in a church hall and specification of mitigation

UWE Bristol

Investigation into sound produced by hammer drill

Do foam ear plugs perform in accordance with the manufacturers specifications?

Investigation of sound power levels of small domestic wind turbines

Comparison of reverberation times in an office with windows open and closed

Skate park noise - measurement, assessment and evaluation

Investigation into the effect of hearing protection over a range of frequencies and how effectiveness varies with incorrect fitting

An investigation into the predicted and measured effect of absorption on the insertion loss of an enclosure

A quantitative analysis comparing the effects of road surface on the interior noise levels in passenger cars

An investigation into the effectiveness of wind deflectors for cyclists

The use of straw bales as acoustic screens to prevent noise nuisance from small generators

An investigation into the effect of measurement period on background residual noise measurement

Diploma in Acoustics and Noise Control Successful Candidates 2007-08
Colchester Institute

Banks C J

Bearman L

Bradley L R

Durup N D

Shearman A J

Speakman P D

Swiejkowski K M

Watkins R J

Millar K A

Miller N P

Newton D

Paterson-Stephens I

Sarton B S

Sissons D L

Tomkins K J T

Walker J A

Distance Learning (Bristol)

Borak C

Chilvers J D

Dufaud J C E

Hampton R J

Hannan S

Hitchens M R

Hogg J W

Pitt S L

Smith L

Terrington J

Wright K

University of Derby

Baker A D

Baker D T

Biggs C J

Billin H L

Boot M J

Bryan A M

Bull F

Davis C M

Dennis M J

Dennis S J

Durn C J

Emery K J

Evans M R

Hargreaves J L

Harper A M

Hopley M R

Jenkins M S B

Jones D

Last D

Longdon C D

March N R

Distance Learning (Edinburgh)

Clark D

Devlin C

Eynon R L

Leggate G J

Lothian S J

Mackay J D

Distance Learning (New Zealand)

Schmid G

**Distance Learning
(St Albans)**

Gill C S
Hatch A
Herwin P N
Hopwood P D
Horwood C J
Khan I
Lotinga M J
McKane M J
Medley A P
Moule M W
Nesbit J E
Rice G J C
Shield T
Singh M
Singleton J E
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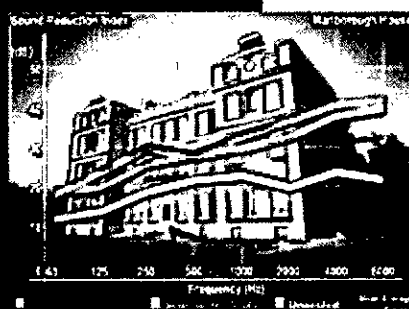
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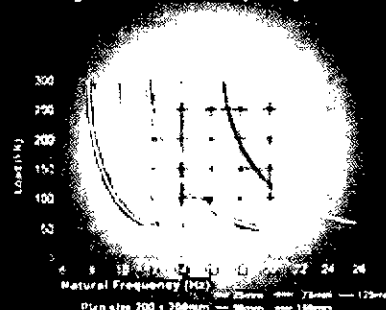
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The Combination of Workplace and Recreational Noise Exposure

Warwick Williams and Marion Burgess

There are many noisy recreational activities undertaken by individuals during their leisure activities. How significant is noise exposure during recreational activities compared to noise exposure in the workplace? This article reviews noise levels from common recreation activities. Comparisons are then made between possible noise exposures arising from work situations in combination with noise exposure from recreation activities. The findings indicate that the care taken to reduce noise exposure in the workplace can be swiftly negated with recreation noise dominating the overall exposure when recreation noise levels continue unchecked. If individuals are to maintain their hearing health they need to be more aware of the problems from exposure to excessive noise and to take preventative action similar to that used in the workplace.

Introduction

There are two criteria for occupation noise exposure applicable in Australia and New Zealand [NOHSC (1007): 2000; HSER: 1995]; one for continuous noise and the other for impulse noise. For continuous noise, the eight hour A weighted equivalent, continuous sound exposure, $L_{Aeq,8h}$, must not exceed 85 dB. This is the steady noise level that would, in the course of an eight-hour period, represent the same sound energy as that due to typical workplace noise, which usually varies over time. Noise exposures for shorter or longer periods must be normalised to an 8 hour period for the assessment and an equal energy concept is assumed where for an increase in level of 3 dB a halving of the exposure time must be applied and vice versa. For any impulse noise exposure, the C weighted peak sound pressure level, LC_{peak} , must not exceed 140 dB. This criterion is usually only exceeded during exposure to high impulse noise such as that from firearms, explosives or high powered impact tools.

It is important to understand that the exposure criteria values are not set at values that represent a 'safe' exposure, at which no one would be expected to suffer harmful effects. Rather, they are set at values that represent a level of 'acceptable risk' for the general working community. For example, it is estimated [ISO 1999:1990; AS/NZS 1269.4:2005] that when noise exposure in terms of $L_{Aeq,8h}$ is limited to 85 dB for a working life of 40 years, 74% of an exposed otologically normal male population would on average suffer a 6% hearing loss - sufficient to lodge a successful hearing compensation claim in many jurisdictions.

The exposure criterion for $L_{Aeq,8h}$ is based on the assumption that, after the working day, the remainder of the 24 hours and the weekend are spent in a quiet environment (less than 75 dB). In order to compensate for any reduction in recovery time for long work shifts the assessment method [AS/NZS 1269.1:2005] includes an adjustment (shift loading) which is added to the worker's $L_{Aeq,8h}$ before comparison with the criterion, i.e. for a shift length of between 10 to 14 hours the adjustment is +1 dB; for 14 to 20 hours, +2 dB; and for 20 to 24 hours, +3 dB.

While noise is conventionally defined as 'unwanted sound', it is generally accepted that excessive 'wanted sound', such as music or sporty cars, will also cause hearing loss [Chassin: 1996]. With this in mind no distinction in this paper is made between what can be considered as the psychological difference between noise and sound. It is also assumed that the sound energy associated with recreation activity noise has the same effect on hearing as does the sound energy produced by workplace noise.

Noise levels for recreation activities

While there may be a system in place for managing excess noise in the workplace, many people inadvertently (or deliberately) expose themselves to high levels of noise during recreational activities. The

noise levels experienced during some common recreational activities are discussed in the following sections. This is not a comprehensive review but rather aims to provide an indication of the range of noise levels possible from various recreational activities.

Amplified music in clubs, concerts

Concerns have been expressed about the high levels of noise experienced in clubs, pubs, concerts and other venues with music. While there has been some discussion about the effect on the patrons, most research has been directed toward assessing the risk for the workers at such venues [Sadhra, Jackson, Ryder & Brown: 2002; Groothoff: 1999; Guo & Gunn: 2005].

As part of their 'Don't lose the music' campaign, the Royal National Institute for the Deaf (RNID) in the UK published noise level data from three nightclubs in each of five UK cities. The clubs in each city were chosen on the basis of music style to ensure the samples included one house style, one pop style and one drum, bass, dance style. In terms of L_{Aeq} , the average noise level on the dance floor ranged between 90 and 110 dB. Even in 'chill out' areas the average noise level was found to be 92dB. A recent study by Guo and Gunn (2006) in Western Australia that focused on the noise exposure levels ($L_{Aeq,8h}$) for a range of employees in clubs and pubs found that, in general, noise levels at music entertainment venues are "excessively high". They found that the exposure levels for workers ranged from 85dB for a security person in a bar with only recorded music to 98dB for a glass collector and manager in a venue with a live band.

Noise level measurements taken at a Sydney 'pub' venue on a typical week night with a live band showed that the L_{Aeq} amongst the audience typically ranged from 102 to 107 dB and hovered around 94dB on the outside footpath (Williams: 2006). With recorded music as the background between live performances the level was maintained around 83dB inside the venue.

Figure 1 [Hall: 2007] plots the noise level in the audience for an annual, large outdoor concert. This particular event usually lasts for about four days and the sound systems are set up so that the level is fairly constant over the main audience area.

Amplified sound in cinemas

Concerns have been expressed in the media about increasing noise levels in cinemas. Films which rely on special effects are more likely to have the higher noise levels with average levels of 78dB(A) over three hours being reported for such movies [Hear-it: 2007]. With the increase in availability of home cinema and associated high quality sound systems it is possible that there could be more regular exposure to these or higher noise levels during recreation times at home.

Personal music systems

There has been considerable media coverage of the potential damage to hearing from long term use of personal music systems such as mp3 players, tape players, etc. Typical of these is the warning by the RNID about potential hearing loss from use of personal players, including comments from users about use over long hours and at high sound levels [RNID: 2006]. However, much of the concern focuses on the maximum output level and there have been few studies of the noise exposure for typical users. A study by Williams (2004) measured the exposure levels of 55 randomly selected subjects who were using their personal players in noisy public areas in central Melbourne and Sydney. These devices were mainly being used during commuting where the range of background (L_{Aeq}) noise was 71 to 76 dB. The equivalent free field 'at-ear' noise level from the player was measured over a two-minute sampling period using the level that each subject was listening to immediately before selection. The sound levels ranged from 74 to

110 dB with a mean of 86dB and reported listening times ranging from 40 minutes to 13 hours per day. From these values the $L_{Aeq,8h}$ were calculated to range from 66dB to 104dB while the mean exposure level was 79.8dB. Twenty five percent of listeners exceeded the 85dB workplace noise criterion.

Motor sports

The noise from motor sport activities often draws considerable media attention, usually related to the noise emanating from the venue or race track into the surrounding area, i.e. concern about community/environmental noise. The patrons at the venue can be exposed to noise from general revving, racing, specialist high power vehicles, dynamometer testing and amplified music. Drivers and support crew may well have modern communication helmets that sometimes include hearing protection. On the other hand, patrons are subject to the noise from the output of the vehicle and are often located close to the track to ensure best views.

Specialised high performance vehicles currently have no output noise limits. For other motor sports vehicles the limiting values have been set with a view to minimising environmental noise impact. In Australia these limits are 95dB for cars [CAMS: 2004] at 30m, i.e. at the edge of the spectator areas, and 102dB for motorcycles at 0.5m from the exhaust [Motorcycling Australia: 2007] under full acceleration. Figure 2 [Burgess: 2002] shows the noise level variation at the edge of the track during a major event for V8 supercars. The levels, in terms of $L_{Aeq,5sec}$, were in the 80 to 90 dB range for much of the day.

While acknowledging that some spectators may be exposed to higher levels, it is reasonable to assume that a spectator at a range of motor sports activities could be exposed to an L_{Aeq} of around 90dB over the time of the event.

Car stereo systems

While the engine noise level inside modern cars has been considerably reduced, custom-built stereo systems are becoming common in many vehicles. These usually have very high power and have been found to produce L_{Aeq} up to 104dB (driver's window open) and are often set well above 80dB when travelling. L_{Cpeak} levels easily exceed 132dB with many of the low frequency enhancements in use [Williams: 2006].

Home workshop and garden

Many power tools available for use in the home workshop and garden produce high noise levels and can often be used for long periods. Tools such as portable saws, routers, belt sanders, rotary hammer drills, grinders, chain saws and leaf blowers typically produce noise levels (L_{Aeq}) around 100dB at the operator ear, while more specialised devices such as staplers and nail guns, utilising impulsive forces, can produce impulse noise levels with a peak (L_{Cpeak}) in excess of 140dB.

It is very difficult to estimate an typical noise level for home workshop exposure as it is dependent on the tool, the material and the task but it would not be unreasonable to assume an exposure level of at least 85dB during a couple of hours of activity. For example, the use of a circular saw with an L_{Aeq} of 100dB for only 15 minutes is equivalent to an exposure level ($L_{Aeq,8h}$) of 85dB.

Overall exposure from a combination of work and recreation noise

In the previous section, common recreation activities have been shown to have high noise levels. The length of time people are exposed to

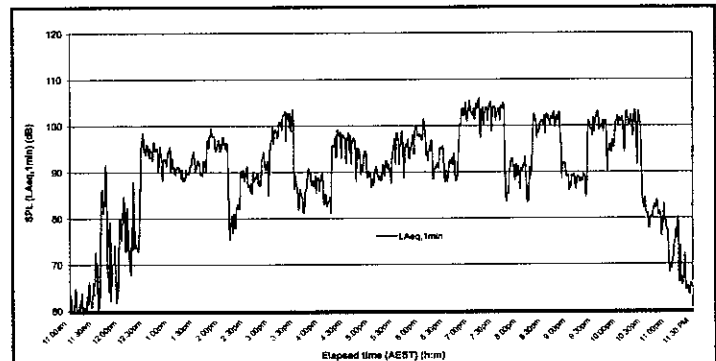


Figure 1

Measured noise levels at a typical outdoor concert over a twelve and a half hour period (Hall: 2007)

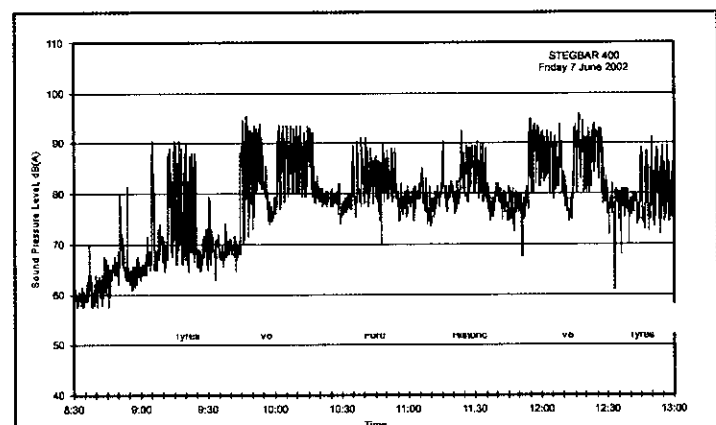


Figure 2

Measured noise levels at the trackside spectator area at a V8 supercar event over a four and a half hour period (Burgess: 2002)

these recreation noises varies significantly. If the approach as for occupational noise exposure assessment is used to assess the recreation noise exposure, in many cases the $L_{Aeq,8h}$ would be in excess of the recommended 85dB. If the total noise exposure from the combined workplace noise and subsequent recreation activity noise were assessed, the overall exposure for the individual could be well in excess of the occupational noise exposure criterion.

Two models are presented to investigate the effect of the combination of noisy recreation activities with workplace noise exposure. As there is a requirement to manage the noise in the workplace, these models are based on the noise exposure during the work day not exceeding the exposure standard for $L_{Aeq,8h}$ of 85dB. The models consider the overall noise exposure from a combination of eight hours of noise exposure below this limiting level plus varying hours for recreational noise at several noise levels. The adjustments from AS/NZS 1269.1:2005 for extended work shifts have been included and hence

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IOA and ANC

Consultancy spotlight

As part of the ongoing improvements in communication and collaboration between the two bodies, the ANC has committed to provide a report to each edition of the bulletin on our bi-monthly meetings and other activity. The following meeting report is intended to give a light-hearted précis of ANC goings on, followed by a more level headed description of a current technical debate.

ANC meeting report

The 25th meeting of the Association of Noise Consultants was held at the now-traditional venue of Old Sessions House on Clerkenwell Green, London. Some readers may not be aware, however, that although these meetings have been held every other month for the last four years by the ANC as a company limited by guarantee, meeting number 1 in this series followed on from the 161st meeting of the ANC under its previous incarnation, and without formal legal status. Assuming the same meeting schedule and using some disappointingly linear arithmetic, I estimate that the first meeting must have been held at the beginning of 1978, and invite any readers to confirm the precise date and location!

The meeting welcomed three new members: Accon UK, Norman, Disney & Young, and Wight Noise, and went through the normal processes of reports from the board, committees and working parties (ADE committee, membership committee, vibration & BS.6472, and consultations) before proceeding to the issues of the day in the 'technical forum'.

The technical forum was introduced as a new initiative by our chairman, Adrian James, and has proved to be very successful element of ANC meetings, at which topics of current relevance are discussed in a cordial open session. No minutes of this session are recorded, encouraging more lively and open debate, so the only way to benefit from them is to come along! A number of existing ANC member organisations do not extract the full benefit of their membership from regular meetings attendance, and there are a number of consultancy practices within the IOA who have not pursued ANC membership. At the risk of seeming overly evangelical, we would welcome all of our old friends back to the fold and invite all those who love the decibel to come and worship with us.

The Rev James' sermon on this occasion was a topic very close to his heart - acoustics in schools, as written in the BB93 testament. The forthcoming review of this document is being arranged on a very short timescale, and the debate was helpful in preparation for the joint IOA/ANC event on 24 February (which will, we hope, have been a roaring success by the time this goes to print).

The next ANC meeting will be held at Old Sessions House on 16 March 2009, following which I shall provide another summary for the next *Acoustics Bulletin*.

Ed Clarke

ANC Technical Discussion

Recent years have seen a great number of applications to the ANC, which are assessed by review of sample reports and by interview. Many of these applications are of a very high standard, but some highlight significant misinterpretations of guidance or calculations, or differences in interpretation. It was felt that this experience of pitfalls which had been stumbled upon by a cross-section of practising acousticians was very valuable in helping to improve standards, and ought to be brought to a wider audience.

In each of these ANC reports we shall summarise one of these common areas of disagreement, in the hope of encouraging a wider debate in the acoustics community.

Common source of disagreement no.1: BS.8233 - can the L_{Amax} value be ignored?

The use of BS.8233:1999 'Sound insulation and noise reduction for buildings - Code of practice' is not mandatory. It is often referred to in a planning context in consideration of prospective residential development sites following PPG24 'categorisation', using the internal levels quoted in Table 5 as design targets for facade sound insulation design.

The last element of this table relates to residential conditions, in which designing to the L_{Amax} figure is generally the most onerous requirement. A number of interpretations of this have been encountered, one being the assertion that as it is expedient for the client (developer) to overlook this element, the consultant has a duty to do so whenever he possibly can. Another is a differentiation between traffic noise, which is not the kind of source we consider against L_{Amax} , and train noise (for example), which is. Yet another view is that it is up to the planners to decide what to accept, and if they do not mention L_{Amax} , why bring it up?

Others see the L_{Amax} requirement as paramount, and to be observed in all cases. This raises a secondary issue: on which measured L_{Amax} value do you then base this assessment? If one takes the highest level measured, does this lead to over-design? Was this level representative, or could an even higher level occur on other days, not captured during the survey? Perhaps we need a sensible method for establish which L_{Amax} is typical - the mean, or perhaps the mode (but probably not the median. I have also heard an argument that it takes 13 noisy events above a certain level to cause sleep disturbance, so on order to choose the design case L_{Amax} the events should be ranked in order and number 13 selected as the input level.

With such a range of interpretations and views, very different results can be obtained from assessments based on the same survey data. This has led us to some conclusions.

1. There is a need for best practice guidance in this field. A handful of ANC members have expressed an interest in forming a working party to look into the topic with a view to publishing guidance in the same vein as the 'red book' on vibration and the 'Guidelines in noise measurement in buildings', and more volunteers would be welcome.
2. There is a clear imperative, whatever the interpretation of the guidance, to be clear and concise in reporting, and to present this work to give decision makers the information to assess the case, rather than be accused of deliberate obfuscation.

Table 5 — Indoor ambient noise levels in spaces when they are unoccupied

Criterion	Typical situations	Design range $L_{Aeq,T}$ dB	
		Good	Reasonable
Reasonable industrial working conditions	Heavy engineering	70	80
	Light engineering	65	75
	Garages, warehouses	65	75
Reasonable speech or telephone communications	Department store	50	55
	Cafeteria, canteen, kitchen	50	55
	Washroom, toilet	45	55
	Corridor	45	55
Reasonable conditions for study and work requiring concentration	Library, cellular office, museum	40	50
	Staff room	35	45
	Meeting room, executive office	35	40
Reasonable listening conditions	Classroom	35	40
	Church, lecture theatre, cinema	30	35
	Concert hall, theatre	25	30
	Recording studio	20	25
Reasonable resting/sleeping conditions	Living rooms	30	40
	Bedrooms*	30	35

* For a reasonable standard in bedrooms at night, individual noise events (measured with P time-weighting) should not normally exceed 45 dB L_{Amax} .

Table 6

Extracted from BS.8233:1999

Prediction and assessment of wind turbine noise

Agreement about relevant factors for noise assessment from wind energy projects

1. Introduction

There are continuing disputes about the factors to be taken into account when assessing noise from wind turbines, and the weight to be given to these factors. These differences are regularly introduced when planning applications are made to local authorities and at public inquiries. Those listed at the end of this document have agreed on the following statement, based on their current knowledge and experience to date. It concerns some aspects of the assessment of noise from wind turbines, explains a number of preferred procedures, and sets out the form in which some information should be presented to support an environmental noise assessment for a proposed wind farm development. The recommendations are not exhaustive but we believe that they may enhance the quality of wind farm noise assessments and usefully limit areas of disagreement between parties acting for developers and those acting for objectors.

We address the following issues:

- The acquisition of baseline noise data at 'receptor' locations, and the analysis of this data, to take account of site-specific wind shear.
- The prediction of wind turbine noise, at receptor locations ('noise immission levels')
- The significance of low-frequency noise, infrasound and ground-borne vibration from wind farms

2. Acquisition and analysis of background noise data

The procedures set out in ETSU-R-97 are universally adopted. A data set of $L_{A90,10m}$ background noise levels is acquired at each survey location, correlated with simultaneous measurements of '10 metres height' mean wind speeds on the wind turbine site (existing or proposed). A subsequent stage of the noise assessment involves comparing the predicted wind turbine noise immission levels with the background noise levels at local receptors (most commonly dwellings). The wind turbine noise immission levels at the receptors are predicted based on standardised data provided for wind turbine source sound

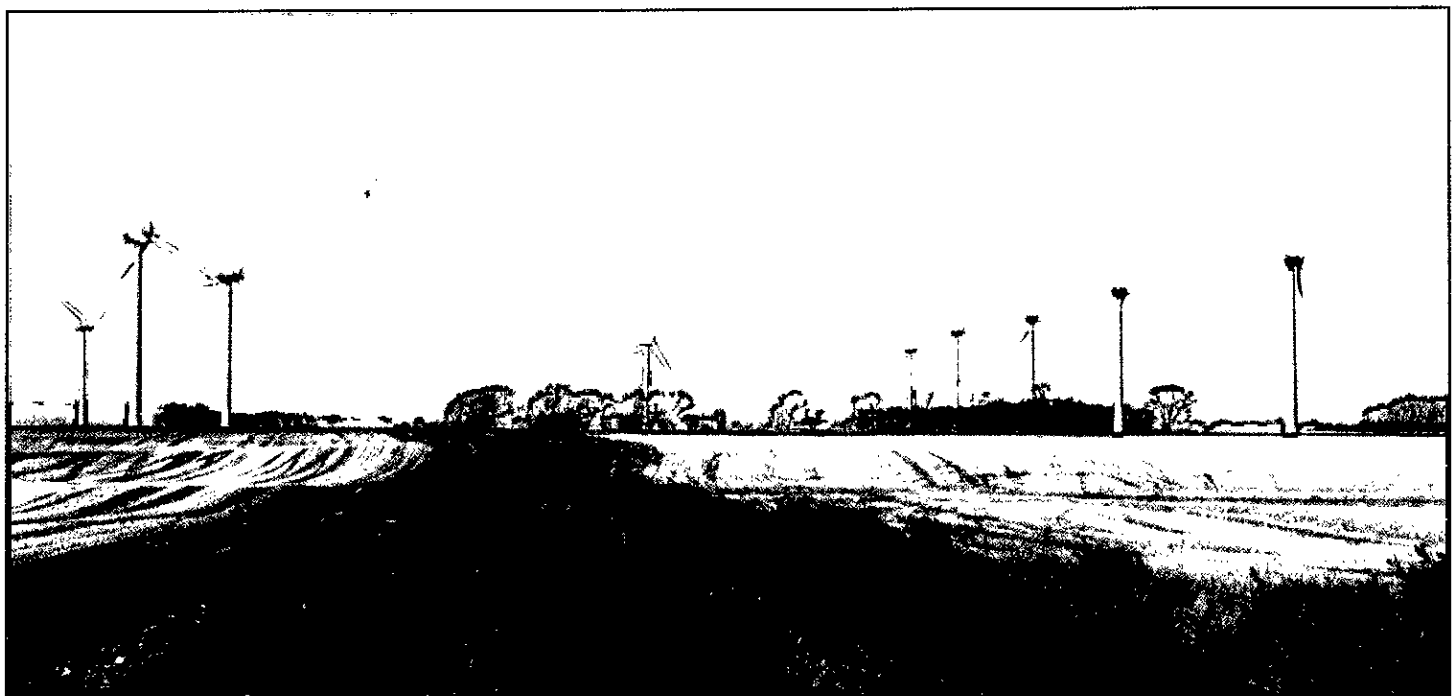
power levels for a range of '10 metres height wind speeds'. This 10 metres is the reference wind speed measurement height when wind turbine sound power levels are measured in accordance with the current Second Edition of IEC 61400-11. Thus both the background noise levels and the wind turbine noise immission levels are referenced to the '10 metres height wind speed'.

However, there is a potential mismatch between the reference wind speeds used for baseline noise measurements and wind turbine 'source' noise levels, unless site-specific wind shear is taken into account. This is because the relationship between wind speed at different heights above the ground (the wind shear), and in particular between the actual hub-height wind speed (which generally determines the wind turbine sound power level) and the actual wind speed that would be measured at 10 metres height, varies from site-to-site and in different weather conditions. This mismatch can result in significant errors when the comparisons are made between background noise levels and wind turbine noise immission levels.

To overcome this problem, we recommend that background noise levels are correlated with **derived** (not **measured**) 10 metres height wind speeds, arrived at using the following procedure. Effectively, the result of adopting this procedure is to reference all noise levels (both background levels and immission levels) to the wind speed at turbine hub-height, although the results are stated in terms of the derived 10 metres height wind speed for consistency with IEC 61400-11 and ETSU-R-97. The preferred procedure is as follows:

- For the duration of baseline surveys wind speeds should be measured on the wind farm site at two heights H_1 and H_2 , H_1 being not less than 60% of the proposed turbine hub height and H_2 being between 40% and 50% of proposed hub height. Generally, this would require the installation of a meteorological mast approximately 50 metres in height based on current typical hub heights.
- For each ten minute period the mean wind speed measured at height H_1 should be corrected to hub height using the wind shear

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Realistic estimates are required of the noise at receptor locations

Prediction and assessment of wind turbine noise - continued from page 35

exponent 'm' derived from the mean wind speeds U_1 and U_2 at heights H_1 and H_2 , using the following standard equation:

$$m = \frac{\log\left(\frac{U_1}{U_2}\right)}{\log\left(\frac{H_1}{H_2}\right)}$$

Where:-

- m** The shear exponent to be calculated
- U_1** The wind speed measured at the lower height
- U_2** The wind speed measured at the upper height
- H_1** The height of the lower wind speed measurement
- H_2** The height of the upper wind speed measurement

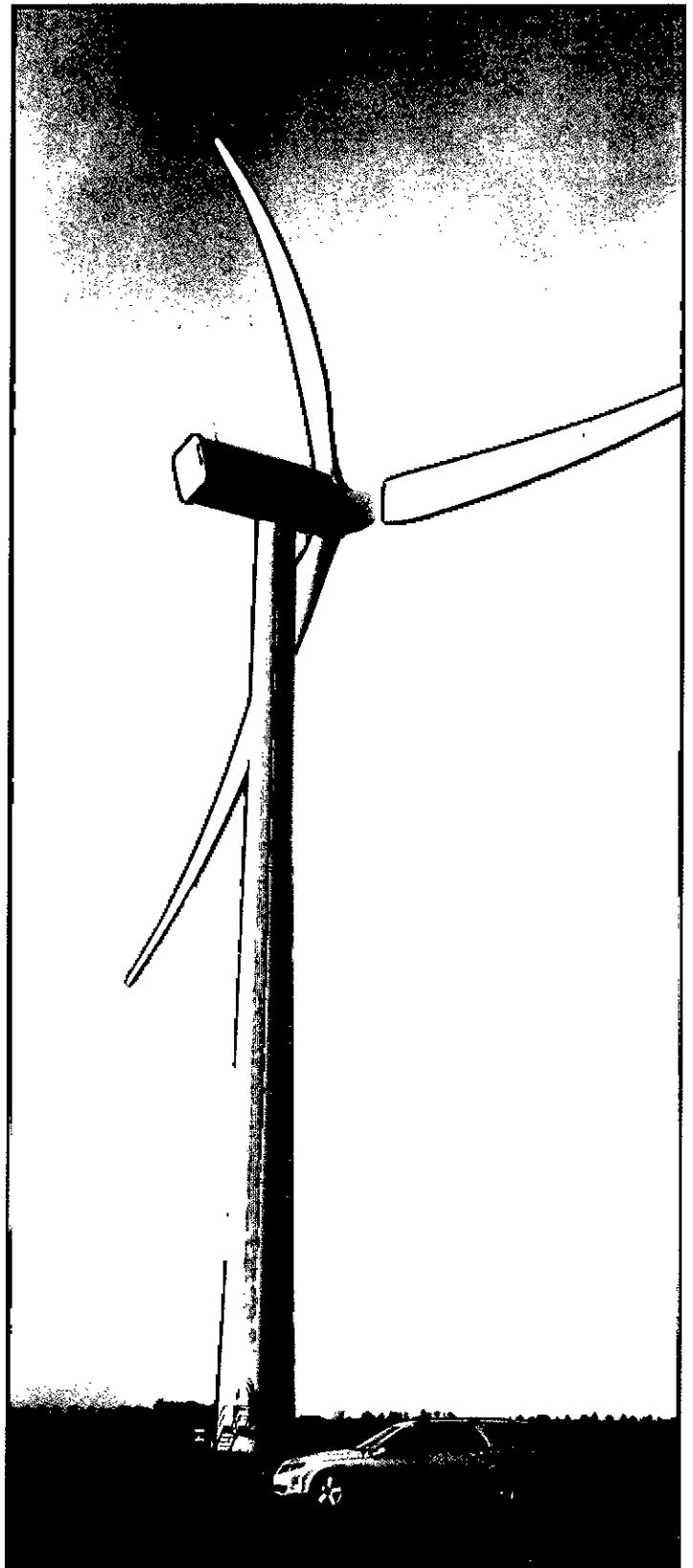
- The mean hub height wind speed (U_{hh}) calculated as above should then be corrected to 10 metres height using the standard reference ground roughness length of 0.05 metres.
- Background noise levels should be correlated against this 'derived' 10 metres height wind speed. Use of the derived 10 metres wind speed provides consistency between wind turbine manufacturers' sound power level test data and the baseline noise measurements at receptors and takes account of site-specific wind shear.
- On some sites and in some wind conditions the situation may arise that the wind speed U_1 (at the greater height H_1) is equal to or lower than the wind speed U_2 at the lower height H_2 . In this situation, the wind shear calculation specified above should not be performed and our suggestion at this time is that the hub height wind speed should be assumed to be the same as the wind speed at the upper height H_1 .

If the noise assessment for a specific site follows the above procedure, the same principle should be adopted when measuring wind turbine noise levels at receptors close to that site (eg for determining compliance with noise limits in planning conditions). Measured noise immission levels should be referenced to derived 10 metres height wind speeds - hub height wind speeds corrected to 10 metres height using the reference roughness length of 0.05 metres. The hub height wind speed may be measured directly (either directly with an anemometer or derived from the turbine power output using the wind turbine wind speed/power curve) or calculated from a measurement at another height using the actual measured wind shear during the ten minute measurement period. Planning conditions should clearly define the procedure to be followed and provide consistency of approach between assessment of compliance and the environmental impact assessment.

Where background noise surveys are carried out for sites where wind speeds can only be measured at 10 metres height, then the noise assessment (the comparisons between background noise levels and predicted immission levels at receptors) should take account of the wind shear variations using a method which should be clearly explained. This correction could be applied either to the background noise levels or to the noise immission levels at receptors. However, reliance on 10 metres measured wind speeds should be avoided where possible: the procedure in 2.3 above is preferred. Where noise assessments are based solely on measured 10 metres height wind speeds, then noise limits in planning conditions must also refer to measured 10 metres height wind speeds, measured at the same (or equivalent) location as that adopted for the background noise surveys.

3. Prediction of wind turbine Noise Immission Levels

The preferred method of calculating wind turbine noise immission levels (i.e. noise levels to be experienced at receptor locations in the surrounding area) is the octave band prediction method of International Standard ISO9613-2. The output from an ISO9613 2 prediction model depends on the model input parameters. Specialists working in this field adopt different combinations of input parameters, many of which lead to effectively identical results. In the interests of clarity we recommend that the results of wind turbine noise predictions should be qualified by a statement of the all model inputs



Reference all noise levels to the wind speed at turbine hub height

used. In particular, the following should be specified:

- *The turbine sound power levels used as input.* These should be supported by documentation from the vendor where appropriate. The status of the input sound power levels should be stated eg are they test levels, test levels with an addition for test uncertainty, warranted levels, or 'generic' levels derived from data for a number of potential candidate turbines.

- The atmospheric conditions (temperature and RH) assumed: 10°C and 70% RH are the preferred conditions.
- The ground factors G_s , G_m , G_r assumed. On the evidence available, we consider that ISO 9613-2 calculations using either $G = 0$ or $G = 0.5$ ($G_s = G_m = G_r$) will lead to appropriate prediction of noise immission levels at typical receptor locations, depending on the input values of other parameters. The use of either (a) $G = 0$ together with measured (IEC 61400-11 test) sound power levels or (b) $G = 0.5$ (with a 4 metres receptor height) together with vendor's warranted sound power levels (or measured turbine sound power levels plus an allowance for measurement uncertainty), will generally result in realistic estimates of noise immission levels at receptor locations downwind of wind turbines. Noise immission levels calculated using these combinations of parameters can generally be relied on for the purposes of noise assessment. The assumption of 'soft' ground ($G = 1$) should not be made.
- The effects of barriers. Barrier attenuation calculated using the method within ISO9613-2 should not be included within predictions. Generally, no account should be taken of barrier attenuation by the landform unless there is no line-of-sight between the receptor and the highest point on the rotor, when a barrier attenuation of 2dB(A) should generally be assumed. A higher barrier attenuation may be appropriate in cases where a landform 'barrier' is very close to the receptor but the assumption of a barrier attenuation greater than 2dB(A) requires to be fully justified in the noise assessment.

Calculations based on IEC 61400-11 test data result in noise immission levels in dB $L_{Aeq,T}$. The ETSU-R-97 procedures adopt the $L_{A90,10m}$ noise index. From the information currently available our view is that the relationship between L_{A90} and L_{Aeq} for wind turbines stated in ETSU-R-97 ($L_{A90,10m} = L_{Aeq,10m} - 2$ dB) remains valid.

4. Vibration and low frequency noise

Infrasound is the term generally used to describe sound at frequencies below 20Hz. At separation distances from wind turbines which are typical of residential locations the levels of infrasound from wind turbines are well below the human perception level. Infrasound from wind turbines is often at levels below that of the noise generated by wind around buildings and other obstacles. Sounds at frequencies from about 20Hz to 200Hz are conventionally referred to as low-frequency sounds. A report for the DTI in 2006 by Hayes McKenzie¹ concluded that neither infrasound nor low frequency noise was a significant factor at the separation distances at which people lived. This was confirmed by a peer review by a number of consultants working in this field. We concur with this view.

A Portuguese group has been researching 'Vibro-acoustic Disease' (VAD) for about 25 years. Their research initially focussed on aircraft technicians who were exposed to very high overall noise levels, typically over 120dB. A range of health problems has been described for the technicians, which the researchers linked to high levels of low frequency noise exposure. However other research has not confirmed this. Wind farms expose people to sound pressure levels orders of magnitude less than the noise levels to which the aircraft technicians were exposed. The Portuguese VAD group has not produced evidence to support their new hypothesis that infrasound and low frequency noise from wind turbines causes similar health effects to those experienced by the aircraft technicians.

Keele University undertook an assessment of the likely impact of ground-borne vibrations from wind turbines on the seismic array at Eskdalemuir². Whilst the testing shows that vibration can be detected several kilometres from wind turbines Keele University clarified the context of their results:

'The levels of vibration from wind turbines are so small that only the most sophisticated instrumentation and data processing can reveal their presence, and they are almost impossible to detect. The Dunlaw study was designed to measure effects of extremely low level vibration on one of the quietest sites (Eskdalemuir) in the world, and one which houses one of the most sensitive seismic installations in the world. Vibrations at this level and in

this frequency range will be available from all kinds of sources such as traffic and background''.

Scientific instruments are far more sensitive detectors than the human body, which is subject to internally generated noise and vibration.

From examination of reports of the studies referred to above, and other reports widely available on internet sites, we conclude that there is no robust evidence that low frequency noise (including 'infrasound') or ground-borne vibration from wind farms, generally has adverse effects on wind farm neighbours.

Dick Bowdler, Andrew Bullmore, Bob Davis, Malcolm Hayes, Mark Jiggins, Geoff Leventhall (Section 4), **Andy McKenzie**

The authors were the independent noise consultants who sat on the DTI/BERR Noise Working Group on wind farm noise in 2006/2007

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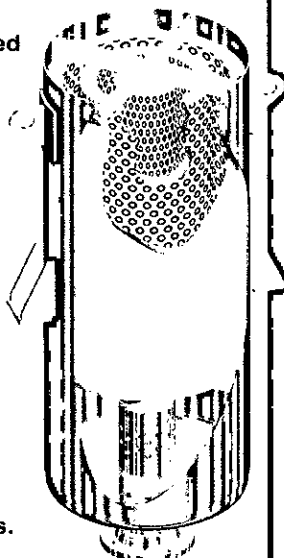
Bob Davis BSc(Eng) MIOA is with Robert Davis Associates, Hampshire

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A graduate's tale

Adam Mottershead. Faber Maunsell

I graduated in August 2007 with an honours degree in acoustics. For reasons of circumstance I had declined the chance to spend a year in industry and so I was entering the job market at an apparent disadvantage. However, after two very positive interviews I was offered a job as a graduate acoustical engineer at Faber Maunsell and with a structured programme for graduate learning, the job was perfect for someone like me. On 12 November 2007 I arrived on time to embark on my new career.

Working for a large multi-disciplinary firm provides great opportunities to gain experience on projects large and small alike. In the infant months of my employment I would be invited along whenever a colleague went out on a survey or a site visit. Undertaking noise surveys and airborne sound insulation testing would be the first major step in my working education. These formative times are where you learn the life and death skills of being a consultant: how not to be scared of the dark, how to wrap up warm, and how to be manly on a building site. As a graduate I greatly enjoyed, and still do enjoy, the grass roots experience of survey work and it has taken me to many places around the country. In particular I have gained valuable site experience working on a number of schools projects throughout Scotland.

My first taste of real responsibility came in the form of a large residential redevelopment project in Liverpool. I was allowed to work independently on this project, seeking guidance and support as and when required. I found this to be a challenging yet greatly effective way of learning and it provided me with great experience. In particular, it was an opportunity to interact with the key people on these types of projects such as architects and planning officers, and for the first time, on a direct basis.

As a member of the Faber Maunsell acoustics team I was encouraged and supported in joining the IOA as an associate member. The IOA organises a great number of events and provides many opportunities for acousticians of all calibres to learn and broaden their scope of knowledge. I have also found that Institute events provide a wonderful opportunity to meet with old friends from university where we can discuss how our careers are progressing.

I am now firmly settled in to my position as an acoustical engineer although there is still much to learn and new lessons arrive daily. With greater experience I have seen an increase in the level of responsibility I am given and for this reason some of my recent projects have been great to work on. One project in particular is a new business school



Adam Mottershead

for Manchester Metropolitan University. We are working with award-winning architects on this project which is a unique chance for a graduate like myself. In working on this project I have been presented with unique challenges where a good understanding of the working role of an acoustical engineer has been critical. I did not always get this right but a helping hand was never far away. Again, the freedom to work individually on this project has been priceless.

In the summer of 2008 I attended my first Faber Maunsell Acoustics conference staged at the Bridgewater Hall in Manchester. This event consisted of a wide variety of presentations and forums on various topics. I was asked to give a short presentation at this event, which I based on a set of unusual noise measurements I had taken. Giving presentations is a daunting thing and I welcomed the support and encouragement I received. I look forward to next year's conference, especially the compulsory social gatherings which ensue.

My work offers me experience in both environmental and building acoustics. The high point of my environmental experience so far was in the summer of 2008 when I spent three days undertaking noise at work assessments on a number of quarries in Scotland. The general conditions were noisy, dirty and rife with hazards, but working in those quarries was great fun, and an experience I will not easily forget. As a graduate it is good to work on projects concerning the different disciplines of acoustics and this helps to develop a broad base of knowledge and experience.

On a more personal level, Faber Maunsell works actively to promote and subsidise numerous sporting and social activities and I have recently started to get involved. This has added a new dimension to working life and provides the chance to better understand and appreciate my colleagues. There is a seven-a-side football match every Tuesday evening, and a squash league where games are played at the local sports centre during our lunch hour. It is interesting how these sporting activities bring out traits in a person that you might not usually see.

In a single fast-paced year I have witnessed great changes in the structure and ambitions of the Faber Maunsell Acoustics group. There are promising developments in the Middle East and European markets and I am very optimistic about the opportunities these ventures will bring. Faber Maunsell is proactive in encouraging its staff to join the sister companies abroad, which would afford a person like me a great chance to experience work in foreign countries while still developing a career in acoustics.

The first year of my career in acoustics has offered more than I would have hoped for and I look forward to those to come. It is a good job I arrived on time.



We all have to look in the book sometimes!



Great opportunities to gain experience

New BBC concert hall

Inaugural broadcast performance

The inaugural concert of Cardiff's impressive new concert studio was broadcast on BBC Radio 3 on 23 January 2009. The new BBC concert studio, which forms the second phase of the Wales Millennium Centre at Cardiff Bay, was completed in September 2008 and handed over to BBC Wales for fitting out. The result of a collaboration between Sir Robert McAlpine Developments and Arup, the global firm of design, engineering and business consultants, the new BBC Hoddinott Hall features a 350-seat auditorium, rehearsal rooms and office space. The building will be the new home of the BBC National Orchestra of Wales and the BBC National Chorus of Wales and is named after the late Welsh composer Alun Hoddinott, who died last year. BBC Hoddinott Hall is a direct replacement for Studio 1 at Llandaff, Cardiff, which the orchestra has progressively outgrown since the late 1960s.

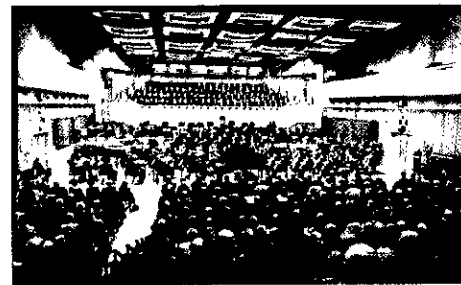
Ian Knowles, the project director for Arup Acoustics, said that his firm had successfully delivered a new home for the BBC Scottish Symphony Orchestra at Glasgow City Halls and the new broadcasting headquarters for BBC Scotland at Pacific Quay, and so was well placed to work on this new orchestral studio. The team worked alongside Sir Robert McAlpine and architects Capita Architecture right at the

beginning of the design process, so that the key acoustic elements could be integrated from the outset. Their job was to optimise potential space, given the constraints of the site, achieving the necessary 400m² area for the orchestra to rehearse, record, broadcast and perform in, supported by an additional 230m² for audience and chorus seating.

With the auditorium to be used for rehearsals, studio recordings and public concerts, the BBC wanted a consistent reverberant sound quality for the hall regardless of whether or not an audience was present. To achieve the right reverberance, sliding acoustic panels were designed and installed at high level to form an acoustic 'duvet', controllable with a hand-held remote unit. These panels provide very powerful acoustic absorption: as Knowles explained, curtains or drapes would not have done the job because they do not provide a sufficient quantifiable change in low frequency absorption.

Acoustic reflectors can also be raised and lowered from the ceiling, both to adjust the sound for the benefit of the orchestra and to change the performance lighting embedded within them.

BBC Hoddinott Hall bucks the traditional fan shape of orchestra performance platforms, instead maximising the available playing space by having a parallel walls with a zig-zag 'sawtooth' profile to simulate the acoustical properties of a fan shape.



The BBC Hoddinott Hall, Cardiff

Timber battens of different thickness were attached vertically to provide sound diffusion, more densely at the stage end, less so at the audience end.

The hall and five rehearsal spaces are a box-in-box construction, with the entire frame resting on isolating rubber pads, thereby controlling external noise intrusion from any local building works or the underground car park. The inner box is made from precast concrete panels for speed of construction.

Based on computer modelling, it was known in advance that the sound quality in the studio would be excellent. Once everything was installed, the BBC orchestra visited for a series of tests. This test concert, including Verdi's *Requiem*, was also recorded for use in Arup's SoundLab, where its acoustic timbre will be used to compare with recordings from the world's best concert halls and opera houses.

CMS Acoustics

brings sound science to Langley Academy

Kinetics Wave Baffles from CMS Acoustics have been installed in the main entrance hub and teaching wings of the £23 million Langley Academy building in Slough, to absorb nuisance noise generated by the footfall and activities of pupils.

Specialising in science, sustainability and sports, the academy building is designed as a model of sustainable architecture, forming an active tool in helping to educate students about the environment in which they live. Community links with local museums have also enabled the Langley Academy to add an innovative dimension to the learning experience for its 1150 pupils.

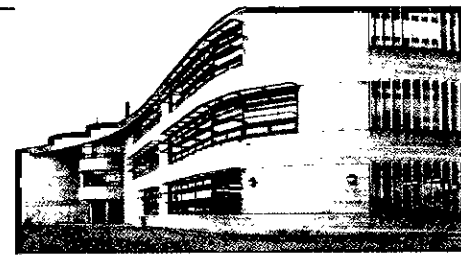
The open-plan design of the entrance hub and adjoining teaching wings at the academy meant that a reverberation solution needed to be incorporated into the architectural designs. CMS

Acoustics recommended Kinetics Wave Baffles to reduce reverberation times in these high volume areas.

Installed to complement artefacts from the Henley Rowing Museum suspended in the main atrium at the academy, the baffles were hung horizontally in a wave-like form between the exhibits. In total, approximately 60 baffles, 3m in length and finished in a black sailcloth fabric, were installed by Advanced Interiors throughout the ceiling areas of both the entrance hub and teaching wings to absorb reflected sound.

Kelly Overall, director, Advanced Interiors, commented that the Langley Academy was a challenging project, both in terms of the programme time and the logistics of working at height. CMS Acoustics streamlined the whole process, providing excellent advice and ensuring the specification of Kinetics Wave Baffles met the exact demands of the project.

Providing excellent sound absorption in the 125Hz - 4kHz range, Kinetics Wave Baffles consist of a fibreglass blanket encapsulated in a sewn sailcloth



Langley Academy, Slough

fabric. Designed for horizontal suspension from ceiling areas, the product is ideal for the educational environment as the baffles are positioned out of the reach of pupils, preventing impact damage to the panels, while maintaining the space available for lessons.

Available exclusively in the UK from CMS Acoustics, Kinetics Wave Baffles can also be face-finished on both sides in a broad choice of colours and hung vertically as a banner.

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0296

Hearing matters

New RNID campaign

In January 2009, RNID, the largest charity working for the nine million people in the UK who are deaf or hard of hearing, launched its *Hearing Matters* campaign. The campaign aims to encourage people to value their hearing and to make it easier for hearing loss in adults to be detected and addressed.

The campaign has been launched to tackle the fact that it can take people up to 15 years to address a hearing loss. During this time, people can become isolated from friends, family and their local community and can struggle at work. People also find it easier to adapt to the use of hearing aids the earlier the stage of their hearing loss they receive them.

RNID's hearing checks

RNID has run a telephone hearing check for the past three years. In that time over 400,000 people have used it to check their hearing. This is the first national telephone hearing check in English and is based on a Dutch language version used in the Netherlands. It has been scientifically validated at a number of universities within the UK, and a Welsh language version of the check will soon be launched. January 2009 was the launch of an Internet version of the check, which has already been used by over 2,000 people.

The hearing checks are aimed at providing people who are concerned about their hearing with a quick and convenient way to help them decide if they should visit their GP with their concerns. People are encouraged to take the check if they often experience a feeling that people are mumbling or talking softly, or if they find themselves asking people to repeat themselves, find it difficult to follow conversations in crowded places, or if they are consciously bothered or irritated by background noises when they are with other people.

The hearing checks are 'speech-in-noise' checks. They assess a person's ability to hear someone speaking in the presence of background noise, imitating the effect of a crowded room, thereby checking hearing ability in a real-life way.

Both the online and telephone hearing checks take about five minutes. During the telephone hearing check, a caller listens to a recording explaining how the hearing check works. Similar instructions appear on the opening page of the internet check.

Once the check begins, the participant hears a voice saying three randomly generated numbers. The digits are played over varying levels of background noise so it can become hard to identify the digits. The caller or internet user types in the digits heard using the keypad of the phone, or the computer keyboard.

On completion of the check there are three possible results: the hearing is within normal range, the hearing may be below normal, or the hearing is below normal. If someone's hearing is found to be in normal range and they are still concerned, it is recommended that they repeat the check once a year. They are also signposted to information and resources produced by the RNID, which includes details of how people can protect their hearing.

If someone's hearing may be below normal, they are encouraged to raise it with their GP during their next visit so that they may ask for a more detailed assessment of their hearing. If someone's hearing is identified as being below normal they are recommended to make an appointment with their GP to get a referral to an audiologist, to have their hearing assessed in more detail.

The Hearing Matters campaign

Whilst the hearing checks provide a valuable tool to check hearing, the RNID says that more needs to be done to make it commonplace for people to look after their hearing and to make audiology services more accessible to the public. This is particularly true for older people. One in five people aged between 55 and 74 has some difficulty in hearing, and one in eight has a hearing problem that causes moderate or severe worry, annoyance or upset. Nevertheless, only six or seven per cent of people in this age group actually have hearing aids.

This undiagnosed and untreated hearing loss has a substantial impact on individuals and on wider society. Older hearing-impaired people who do not use hearing aids are more likely to report less social activity than their peers who have addressed a hearing loss and are using hearing aids. Studies have also demonstrated that addressing a hearing loss can have a positive impact on health and wellbeing, particularly mental health.

The introduction of hearing screening for people over 55 would dramatically reduce the level of untreated hearing loss. There are two key reasons for the high level of untreated hearing loss in the UK: stigma and problems of access to audiological services. People are embarrassed to admit to a hearing loss, feeling that it is an inevitable indication that they are getting older, and refuse to recognise that their hearing loss is either permanent or degenerative. Screening would bypass an individual's personal feelings towards their hearing loss, helping many to overcome their fears and take advantage of the available interventions much earlier.

The current audiology system fails some people who do seek help. Recent research by Prof Adrian Davis, director of the Medical Research Council hearing and communication

The **co-operative**
charity of the year

RNID ○)))

Changing the world for deaf
and hard of hearing people

group at the University of Manchester, showed that among people reporting hearing problems and attending a hearing clinic, 45% had talked previously to their GPs, but had not been referred into the audiology system. This clearly meant that people with a hearing loss would experience a lower quality of life for longer, and may have the effect of discouraging those who do raise the issue of hearing loss from doing so again.

RNID's *Hearing Matters* campaign calls on the government to introduce a hearing screening programme for people aged over 55 to identify and address hearing loss in a systematic way. Simple-to-use hand-held technology already exists that could be used by staff in GP surgeries to screen for hearing loss in this group. Introducing such a system would benefit both the public and audiology services as by seeing a patient at an earlier stage of hearing loss, interventions would be more effective and more likely to be fully used by the patient.

The level of participation in RNID's hearing checks shows that there is a growing appetite for the public to value their hearing more. This is backed up by research commissioned by RNID revealing that 91% of the public believe that everyone over 55 should be offered the chance to have their hearing tested free on the NHS, rather than the current system requiring an individual to request a test based on their concerns about their hearing.

RNID is committed to working with health professionals, national screening bodies, governments, politicians and stakeholders to create a system that benefits everyone who needs a hearing aid now and in the future. The organisation seeks to ensure that deafness and hearing loss are not barriers to continuing to lead a full professional and social life, as well as maintaining an active role in the community.

For more information about RNID's *Hearing Matters* campaign and to check your hearing online, visit www.rnid.org.uk/hearingmatters.

To check your hearing over the phone call **0844 800 3838***

For more information about RNID visit www.rnid.org.uk

Information line telephone **0808 808 0123**,
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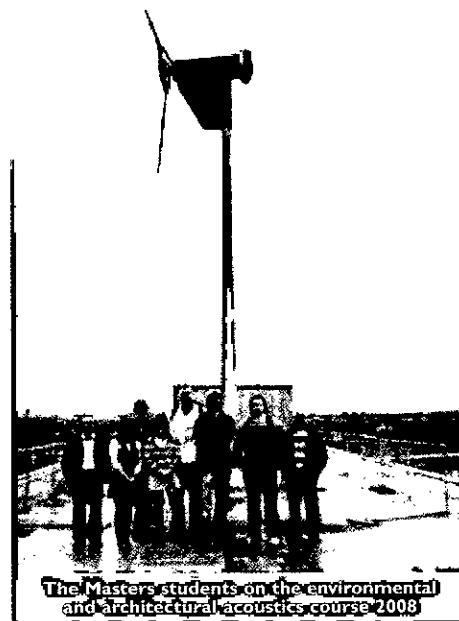
MSc course at London South Bank University

New entry option for holders of IOA Diploma

The entry requirements for the Masters course in environmental and architectural acoustics at London South Bank University have been changed to allow accelerated entry for those students who hold an Institute of Acoustics postgraduate Diploma. Depending on the specialist modules studied on the Diploma course, students may be exempt from some of the acoustics units on the MSc course. This means that students may be able to complete the taught component of the course in one year of part-time study.

This change will assist Institute members who are seeking Engineering Council registration as a Chartered Engineer via the IOA. Graduates who started their undergraduate course after 1999 now need further learning at Masters level to satisfy the EC education requirement for CEng status.

Anyone requiring further information about the MSc should contact the course director Dr Stephen Dance on **020 7815 7672** or email dances@lsbu.ac.uk



The Masters students on the environmental and architectural acoustics course 2008

Recticel UK

Dyson listening room

Dyson is known for technological innovation and outperforming the competition. In order to maintain a competitive edge the company says it needs to improve in all areas of performance and usability. One of the major areas of usability is product acoustics. No one wants to use a machine that sounds unpleasant, but unpleasant does not necessarily mean loud.

Today's lifestyle means that this is an increasingly important consideration, as people work longer hours and do housework in the evenings, and furnishing styles are leading to more reverberant, less absorbent environments. These factors coupled with modern building methods mean residents are now less acoustically insulated from their neighbours.

Dyson has a large anechoic chamber at the Malmesbury site in which acoustic tests are carried out to the relevant standards to establish the sound power of a product and analyse the specific frequencies that contribute to that figure. However, at Dyson the philosophy is that invention is all part of experimentation and discovery, so to help investigate sound quality further, a project was commissioned to enable the design engineers themselves to establish what could be done to rate different products according to sound quality.

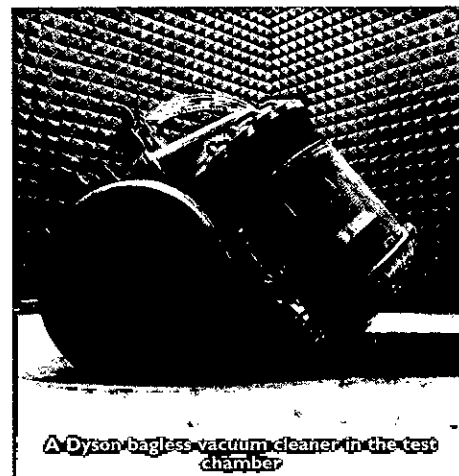
In order to provide basic measurement and analysis of the various product modifications a special separate listening room was required. This was built and commissioned in late 2008. The room was constructed using

acoustically reinforced roof and walls all lined with acoustic treatment.

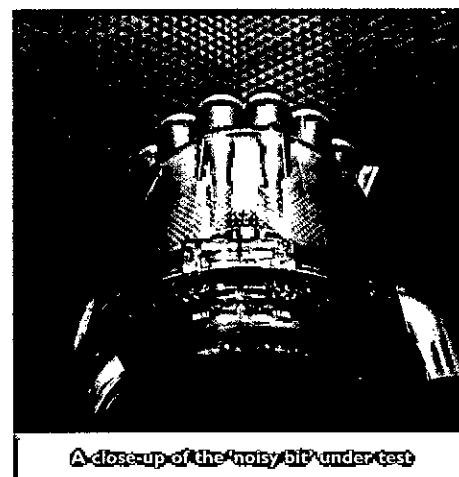
The treatment, supplied by the ANS (Anti Noise Systems) division of Recticel UK, consisted of robust highly sound absorbent acoustic foam combined with a high level of fire resistance. This was done not only to achieve the relevant acoustical environment within the room but also in order to meet the stringent requirements of health and safety. The foam had to be robust enough to withstand the daily knocks and scrapes inflicted by engineers carrying various test rigs and products.

The listening room works well, according to Gregory Heath, Dyson's acoustician, and should raise people's awareness of sound quality and how design affects it, as a valuable part of the engineering and product development process. This would in turn provide a product that not only functioned as it should, but had a good sound quality.

Recticel is a manufacturer and supplier of technical foams to a wide range of industries supplying a range of foams which cover the acoustical, industrial, retail automotive and filtration markets. The company has established itself as an innovative market leader with a heavy focus on research and development.



A Dyson bagless vacuum cleaner in the test chamber



A close-up of the 'noisy bit' under test



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CMS Acoustics Rocks at Navigation Road

Regupol 7210C

Construction group Rok Harrison has used Regupol 7210C, a high performing acoustical underscreed material, to exceed impact and airborne sound requirements for Part E compliance at the new £11 million Navigation Road student accommodation development in York.

Constructed on the derelict site of a former bus depot, Navigation Road contains 272 rooms in three blocks. As a high-quality development, an acoustical treatment needed to be identified for the pre-cast concrete plank subfloors used in two of the blocks, to control impact sound generated from footfall and to help reduce the transmission of airborne sound. Regupol 7210C was used to cover a total floor area of approximately 17,000m² in more than 90 rooms, over all three storeys of the two accommodation blocks. On-site testing confirmed that the product helped to deliver exceptional sound insulation levels of 44dB (impact transmission) and 55dB (airborne insulation), comfortably meeting the Part E requirements of 62dB (maximum) and 45dB (minimum) respectively.

Darren Hannar, project manager for Rok Harrison, commented that as Regupol did not require separate perimeter strips to isolate the interface between the floor and wall, the material could be applied very quickly and efficiently, achieving complete insulation for excellent performance levels. This ease of use reduced the preparation time for the flooring

elements and enabled the team to complete the development ahead of the new student term.

Manufactured from recycled rubber granulate, Regupol 7210C is supplied in standard sheet sizes of 2300mm x 1150mm, with a guaranteed material thickness of 5mm. Available exclusively in the UK through CMS Acoustic Solutions, the material was compatible with all types of floor screed. At the Navigation Road development, a

40mm Gylvon flowing screed was applied directly on top of the material.

Paul Absolon, technical director of CMS Acoustics, concluded that at just 5mm thick, Regupol provides superior sound insulation levels without affecting the construction height of the floor. Ideal for new build projects such as Navigation Road, minimal creep was expected even under high loads, thus maintaining a high performance over the lifetime of the installation.

CMS Acoustic Solutions Ltd, Warrington,
tel: **01925 577711**,
email: enquiries@cmsacoustics.co.uk,
web site: www.cmsacoustics.co.uk



Navigation Road provides 272 rooms in three blocks

Environmental Protection UK

Noise Action Week 2009

Noise Action Week is an annual initiative coordinated by Environmental Protection UK (formerly NSCA) that aims to raise awareness of the problems caused by neighbour noise and the solutions available to tackle it. It provides an opportunity for local authorities, housing providers, mediation services and all those involved in neighbour noise management to raise awareness of services available and promote practical solutions.

Noise Action Week 2009 (18 to 22 May 2009) provides the perfect opportunity to:

- Promote practical solutions to everyday noise problems
- Promote communication and consideration between neighbours
- Encourage local authorities and mediation services to inform the public of services available
- Educate and inform noise makers and noise sufferers about noise reduction
- Encourage everyone to take a quiet

moment to consider the noises they make and the noise that affects them - and what can be done to reduce the impact.

Noise Action Week gives everyone involved in managing noise problems the opportunity to focus public and media attention on the difficulties excessive noise can cause for us all, at home, at work, at study and at leisure. Each year hundreds of organisations across the UK coordinate local activities as part of Noise Action Week, including local authorities, housing associations, mediation services, community groups, schools and police. Many organisations work together to combine resources and to increase the impact of their activities.

Noise problems are frequently solved by encouraging communication between neighbours, promoting noise management services to the public, and with simple, practical solutions. Noise Action Week 2009 provides the perfect opportunity to raise awareness of traffic noise and its impact on



quality of life, tackle noise from licensed premises, and work with schools and universities. Promoting practical solutions to noise problems is an enjoyable way to work towards a quieter, healthier world. Organisations across the UK carry out a wide range of valuable and enjoyable initiatives and events during Noise Action Week.

To keep up to date with activities and new materials, and to get involved, telephone **01273 878770** or visit www.environmental-protection.org.uk/noiseactionweek/about/.

Parliamentary reports

From Hansard

17 October 2008: Roads

Mrs Villiers: To ask the Secretary of State for Transport what estimate he has made of the number of people adversely affected by noise pollution from the strategic road network in the last eight years.

Paul Clark: The Highways Agency has not detailed undertaken work to estimate the likely number of people adversely affected by noise arising from the use of the strategic road network over the last eight years.

The Environmental Noise (England) Regulations 2006 (as amended) include provisions to improve the information available to the public about noise and its effect. The regulations require the preparation of strategic noise maps for urban areas, major roads, major railways and major airports. Following the completion of mapping, an action plan is to be drawn up to manage noise and reduce it where possible. His action plan will include an estimate of numbers of people affected by traffic noise from major roads, which includes a majority of the strategic road network.

Mapping and action plans are to be prepared

on a five year cycle. All mapping for this current cycle has been completed and is available to view on the internet at www.defra.gov.uk/noisemapping. The Department for Environment, Food and Rural Affairs plans to prepare and consult on drafting action plans later this year.

20 November 2008: Noise pollution

Robert Key: To ask the Secretary of State for Communities and Local Government what assessment she has made of noise levels attributable to micro-wind turbines under permitted development consents; and if she will make a statement.

Iain Wright: This Department has not made any assessment of noise levels attributable to micro-wind turbines under permitted development as micro-wind turbines do not currently have permitted development rights. However, this Department is considering what an appropriate noise limit on permitted development would be. Our aim is to ensure that what would be permitted would have little or no adverse impact on others.

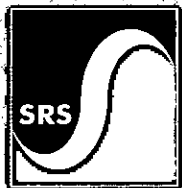
Work is being undertaken by the Department of Energy and Climate Change's microgeneration certification scheme to put in place a methodology that would predict the likely noise level arising from the installation of a turbine on a site-specific basis.

20 November 2008: Aviation

Justine Greening: To ask the Secretary of State for Transport what the meaning is of the term bear down used in the Air Transport White Paper 2003 in relation to aircraft noise; and what the policy of bearing down on aircraft noise entails in relation to aircraft noise across the UK and in the vicinity of each UK airport.

Jim Fitzpatrick [holding answer 19 November 2008]: The 2003 The Future of Air Transport White Paper recognised that noise from aircraft operations at night was widely regarded as the least acceptable aspect of aircraft operations and gave a commitment to bear down on night noise accordingly. However the White Paper stated that a fair

continued on page 44



Acoustic Flooring Underlay System

The GREEN, economical, quick and easy acoustic solution



Improves airborne sound insulation



Reduces impact noise



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Parliamentary reports - continued from page 43

balance needed to be struck between local disturbance, the limits of social acceptability and the economic benefits of night flights. This should be done on a case-by-case basis.

The policy to bear down on night noise was expressed in general terms as were the other broad aims for night restrictions including 'to strike a fair balance between the protection of local communities from excessive aircraft noise levels at night and the provision of air services at night where they are of benefit of the national regional or local economy'.

The Government considers the term to be self-explanatory. As part of the recent court action brought by the London boroughs of Wandsworth and Richmond, the claimants argued that the 2006 night restrictions regime did not bear down on noise. The judge found against this argument.

Outside the three London designated airports where the Secretary of State has direct responsibility for noise abatement measures, the Government consider that local issues such as any noise impacts of a regional airport's operations are best discussed locally. This recognises the wide variation in operational circumstances at individual UK airports. Accordingly airport operators are expected to consult locally to help achieve a reasonable balance between the local environmental impacts, the limits of social acceptability and the economic benefits of the flights.

Justine Greening: To ask the Secretary of State for Transport what the Government's policy is on reducing aircraft noise from daytime, night-time and early morning flights to and from Heathrow airport.

Jim Fitzpatrick [holding answer 19 November 2008]: The 2003 *The Future of Air Transport* White Paper set out the Government's basic aim to limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise.

Heathrow airport is designated under section 80 for the purposes of section 78 of the 1982 Civil Aviation Act. This means that the Secretary of State has direct responsibility for noise abatement measures at the airport. Current measures include noise limits, noise preferential routes, monitoring of aircraft noise and track keeping, and powers for the airport to charge by reference to noise. The airport also operates a number of operational procedures to mitigate against aircraft noise such as runway alternation.

As regards night flights, the Government recognise that noise from aircraft operations at night is widely regarded as the least acceptable aspect of aircraft operations and gave a commitment to bear down on night noise accordingly. However the White Paper stated that a fair balance needed to be

struck between local disturbance, the limits of social acceptability and the economic benefits of night flights. This should be done on a case-by-case basis.

Accordingly there have been restrictions on the operation of night flights at Heathrow for many years. The current restrictions, which took effect from October 2006, recognise both a night period, (23.00 - 07.00), and a night quota period, (23.30 - 06.00). During the whole of the night period, the noisiest types of aircraft (classified as QC/8 or QC/16) may not be scheduled to land or to take off and they are effectively banned from doing so (other than in the most exceptional circumstances) in the night quota period. The next noisiest types (QC/4) may also no longer be scheduled to operate in the night quota period. In addition, during the night quota period movements by most other types of aircraft (including the new QC/0.25 category) will be restricted by a movements limit and a noise quota, which are set for each season. The seasons change with the clocks.

The current restrictions take account of environmental objectives and specific noise abatement objectives for Heathrow. These objectives were set out in the Night Flying Restrictions at Heathrow, Gatwick and Stansted decision document of 6 June 2006 which announced the night noise arrangements for Heathrow, Gatwick and Stansted airports from October 2006 to October 2012.

10 December 2008: Seas and oceans

Roger Williams: To ask the Secretary of State for Environment, Food and Rural Affairs what assessment he has made of the effects of shipping noise on whales, dolphins, porpoises and other aquatic animals, and if he will bring forward proposals to designate ocean noise a pollutant for the purposes of the forthcoming Marine Bill.

Huw Irranca-Davies: The UK Government are concerned about the potential impact of undersea noise on cetaceans (whales, dolphins and porpoises) and the wider marine environment, and have taken action on a number of issues in this respect.

In October 2004, DEFRA commissioned research assessing the feasibility of examining the ears of stranded dead cetaceans to determine whether they show any signs of damage due to marine noise. A report on the findings of this research was published in November 2006 and showed that of the three sets of cetacean ears examined in detail, none had evidence of acoustic trauma. It went on to outline the technical problems associated with examining cetacean ears for the effects of marine noise. A copy of the report is available on the Science pages of the DEFRA website at www.defra.gov.uk.

In November 2005, the UK supported the

Convention on Migratory Species (CMS) Resolution 8.22 on adverse human induced impacts on cetaceans, which included requesting the CMS Secretariat and Scientific Council to review the extent to which CMS and CMS cetacean-related agreements are addressing various human induced impacts, including marine noise.

DEFRA was also part of an inter-agency committee on Marine Science and Technology (IACMST) working group on *Underwater Sound and Marine Life*. This working group prepared a report detailing what steps were needed in light of present information, in order to achieve a regulatory framework for the control of sound in the marine environment. This report can be found on the IACMST website at www.marine.gov.uk.

More recently, the Government have provided funding towards work on cetacean distribution and abundance in European Atlantic offshore waters. The information collected as part of this project is intended to assist in making an assessment of the different threats to cetaceans, including seismic activity. We anticipate the final report to be available by early 2009, and we hope that it will help to inform what mitigation measures may be required for the protection of cetaceans.

In order to improve our understanding of the scale and impacts of human derived noise occurring in the marine environment, the Department also intends to complete a call for research proposals in early 2009. This call will be to identify and take forward research on assessing the current status of marine noise occurring in the marine environment, including shipping, and assessing what the impacts are on marine life.

DEFRA, in line with its commitments under both ASCOBANS (*Agreement on the conservation of small cetaceans of the Baltic, North East Atlantic, Irish and North Seas*) and the Habitats Directive (*Conservation of natural habitats and of wild fauna and flora, Council Directive 92/43/EEC*), also supports a long running contract with the Natural History Museum examining causes of mortality in stranded cetaceans and marine turtles around the UK. This research helps to inform what factors, eg disease, malnutrition, may be affecting the populations of cetaceans in UK waters.

In addition, the Department for Business, Enterprise and Regulatory Reform (BERR) is funding two projects by consultants, Subacoustech Ltd: estimating, measuring and controlling the environmental effects of man-made noise on the marine environment, and a feasibility and demonstration study on the active and passive detection of marine mammals.

Using powers contained in the Marine and Coastal Access Bill, the Government plans to designate Marine Conservation Zones

(MCZs) which will form part of an ecological coherent network of marine protected areas around the UK. MCZs will be designated to protect habitats and species of national importance and will be protected through new duties being placed on public authorities. Where the achievement of the conservation objectives for an MCZ requires marine noise to be controlled, the competent authority will have duties to that effect.

The impacts of marine noise on the wider environment will also be taken into account through decisions made using the new marine planning system and licensing process as proposed in the Bill, and as required under section 40 of the Natural Environment and Rural Communities Act 2006. The Government considers that the proposals contained in the Bill, together with existing legislation, will provide the necessary powers to control marine noise where it poses a risk to valuable marine wildlife.

I am pleased to confirm that the Government introduced the Marine and Coastal Access Bill into the House of Lords on 4 December 2008.

16 December 2008: Airports

Jo Swinson: To ask the Secretary of State for Transport what level of noise pollution is permitted from each major airport in the UK.

Jim Fitzpatrick [holding answer 15 December 2008]: In 2003, *The Future of Air Transport* White Paper set out a strategic framework for the development of airport capacity in the United Kingdom over the next 30 years. In it we said that our basic aim is to limit and where possible reduce the number of people in the UK significantly affected by aircraft noise.

Prior to entry into service, the noise levels generated by any aircraft design are measured by the applicant/manufacture and then approved by a certificating authority. With regard to the UK, the approving authority is the European Aviation Safety Organisation (EASA), except for light propeller aircraft and microlights where the UK Civil Aviation Authority (CAA) retains responsibility. Certification noise limits are set by the International Civil Aviation Organisation (ICAO). The most recent 'Chapter 4' noise limits for large aircraft were introduced on the 1 January 2006.

The Department for Transport is responsible for specific noise mitigation measures at Heathrow, Gatwick and Stansted airports. These include noise preferential departure routes, noise departure limits for both day and night with, additionally, strict limits of movements and a quota system (to encourage use of quieter aircraft) at night.

At other UK airports, noise restrictions may

be imposed voluntarily by the airport operator or by local planning conditions/agreements and these will vary depending on local circumstances.

In terms of measuring noise, aircraft noise contours for Heathrow, Gatwick and Stansted using the Leq metric are produced annually for the Department by the CAA. Elsewhere in the UK, it is the responsibility of airports to produce aircraft noise contours as appropriate.

Under the European Environmental Noise Directive 2002/49/EC, all major airports in the UK have been required to produce noise maps for 2006, based on the L_{den} metric. The directive also requires airports to publish action plans designed to manage noise issues and effects arising from aircraft departing from and arriving at their airport, including noise reduction if necessary. Implementation of the Directive in England is a matter for the Department for Environment, Food and Rural Affairs (DEFRA) and in Scotland, Wales and Northern Ireland it is the responsibility of the devolved administrations.

Given the difference in parameters, caution should be exercised in attempting any comparison between L_{eq} aircraft noise contour maps and aircraft noise contour maps produced in accordance with the Environmental Noise Directive.

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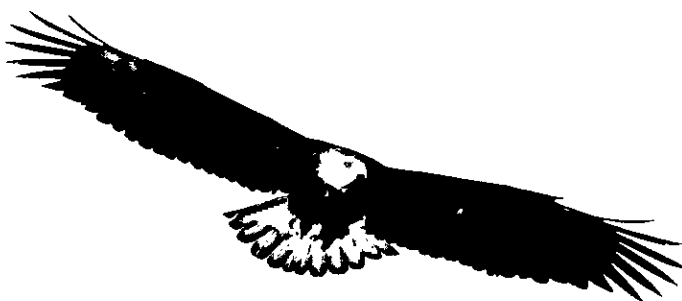
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TEMPLE

Vanguardia grows

with David Trevor-Jones and London Office

Acoustical specialists Vanguardia Consulting has announced that the leading environmental acoustics expert David Trevor-Jones has joined its management team, headed by Jim Griffiths and John Staunton. The enlarged firm also opened a London office near London Bridge on 1 November 2008.

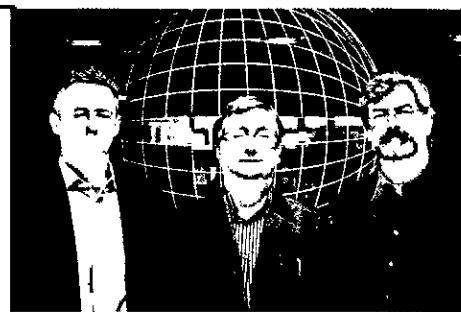
Vanguardia, whose Oxted, Surrey premises will continue to be its administrative base, has grown continuously since its launch in May 2006, with veteran U2 sound engineer Joe O'Herlihy being the first addition to the team later that year. The fast-growing role and importance of environmental acoustics has driven up demand for the company's services - and made the new, combined operation a logical step.

Jim Griffiths says that David, John and he have kept in close contact since they worked together on local authority noise research projects at the GLC's scientific branch in the late 1980s and early 1990s. With their clients and projects becoming steadily more specialised, and

environmental noise being more in the public eye than ever, David's immense knowledge and his reputation as an expert witness at planning enquiries and Parliamentary Select Committees made him a great addition to the team.

He also brought with him a long list of clients, many of them London based like a good number of Vanguardia's own, and including many of the capital's leading venues. It made great sense to open the firm's first London office at the same time. It was an exciting partnership because it maintained the confidence clients had in the quality of expertise, while building on it to offer a broader and deeper service.

David Trevor-Jones commented that after working in the field for 25 years, and independently for the last 15, he had developed a huge case load, in particular for legal witness work, and it reached a point where he had to reappraise how best to handle the growth. A conversation with Jim and John about combining their operations and resources



(left to right) Vanguardia Consulting's John Staunton, Jim Griffiths and David Trevor-Jones

made a great deal of sense for all concerned. It also allowed him to pass on his experience to a new generation, which included contributions to some of the most widely used British Standards in this field, and gave him time to develop his own interests in new areas of acoustics. The latter included the application of soundscape analysis in planning - a fascinating field not yet being fully explored - and environmental impact assessment.

The firm's Surrey office (Jim Griffiths and John Staunton) is on 01883 718690, email info@vanguardiaconsulting.co.uk, web site www.vanguardiaconsulting.co.uk. The London office (David Trevor-Jones) is on 020 7922 8861.

New blood

at Robin Mackenzie Partnership

Celebrating its fortieth anniversary in 2009, RMP Acoustics is cementing its position as one of the UK's leading acoustic consultancy firms by welcoming two new staff members to the consultancy team.

Mark Irish has joined as senior acoustical consultant. Mark has over seven years' experience in the industrial and building acoustics field, including a senior consultancy role in the building acoustics group at Heggies in Australia.

Following completion of her Master of Engineering with first class honours from École Nationale Supérieure d'Ingénieurs du Mans-ENSIM in 2007, Juliette Paris took a six-month placement at an acoustical research division within the University of Edinburgh. She then worked as a graduate consultant for Mott MacDonald in Glasgow until she joined RMP in September 2008.

Richard Mackenzie, principal consultant, commented that by increasing the consulting team to 16 RMP was in an excellent position to increase its nationwide consulting and research activity.



Juliette Paris

Mark Irish

Faber Maunsell/AECOM acoustics group

Matthew Harrison and Jason Clouston join

As part of the development of its global business lines, the acoustics group at Faber Maunsell/AECOM is pleased to welcome Matthew Harrison on secondment from Maunsell in Australia. Matthew, who managed the Sydney office of Maunsell Acoustics, will work out of the St Albans and London offices for the next 12 months.

As well as providing technical expertise on projects and helping to generate new project opportunities, Matthew's presence in the UK will help foster closer links with the Australian arm of the firm. With a total of over 80 acoustical engineers together with smaller units in North America and Asia, it is one of the largest groups specialising in noise and vibration in the world. Matthew's past project involvement includes television stations, studio developments, very large retail-led mixed use developments, vibration isolation of buildings over railway tunnels and isolation of railway tracks running through buildings.

Matthew commented that he was glad to be back in the AECOM family, and to have the opportunity of working with such enthusiastic and talented people. He looked forward to sharing his knowledge of how things were done Down Under.

Jason Clouston joins Faber Maunsell from

W S Atkins where he was undertaking various environmental and building acoustics projects with an emphasis on schools and education buildings. Jason will be using his skills within the building acoustics team based in St Albans expanding the acoustics group at Faber Maunsell to more than 30.

Jason said that many factors attracted him to Faber Maunsell: their technical approach to acoustics, an interesting range of projects and clients, and the acoustic team's skills, management and organisation were all key factors as well as the general 'human' feel for such a large company.



Jason Clouston

Matthew Harrison

NDCS gets it wrong on school acoustics

The National Deaf Children's Society (NDCS) has got it wrong with its call for the government to enforce legislation and build new schools in line with BB93 regulations. We should not be lobbying the government to enforce its own standards.

In contrast with the mandatory on-site sound testing for residential dwellings (Document E, 2003), BB93 only 'strongly recommends' that it is carried out. The consequences are potentially poor reverberation times and inadequate sound insulation, conditions which will only be revealed once the new school is occupied.

But the problem does not lie in school design. The design may well demonstrate compliance with BB93 standards which are clearly discussed within the document as the minimum acceptable, however the building which leaves the desks and computers of the design team can often be compromised by value engineering, specification substitution and our old foes product quality control and construction supervision. All too often the final

performance of the detailed design can come down to the lowest common denominator who may not be aware, sufficiently trained or even care about the need for accurate detailing and high levels of installation workmanship.

While best practice is to retain an acoustical consultant to conduct site inspections and provide snagging reports during critical phases and commit to on-site testing pre-completion, it is not mandatory. BREEAM points are available for a commitment to post-construction testing and in order to achieve an 'excellent' rating there is an increasing demand to see the project all the way through. This, in our opinion, is encouraging the delivery a better standard of building than those projects left at design stage, which is the ultimate aim of the BREEAM scheme.

The NDCS has claimed that ensuring schools are built in line with BB93 regulations is absolutely essential and requires immediate corrective action, a view with which we concur. Where the

NDCS gets it wrong, however, is that we should not be lobbying the government to enforce a different set of acoustical standards. What we need is simply a change to the guidance already available, and worked with nationwide, better to protect the acoustical designs that are BB93 compliant. Revisions to BB93 are currently being discussed which in our opinion should see the removal of 'strongly recommended' from the completion test clause. There is a suggested scope of testing throughout a school project and the question should not be whether or not to test, it should simply be a case of ensuring the mandatory testing is carried out by suitably qualified test bodies. Only then will a safeguard be created which ensures that the billions of pounds being invested in education will not be wasted by the creation of poor learning conditions.

Martin Jones

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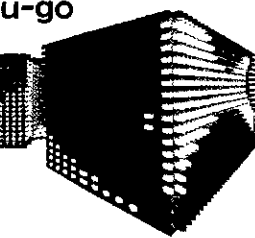
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ANV Measurement Systems

New NA-28 sound analyser-based nuisance recorder from Rion

The Rion NA-28 Class I sound analyser is now available in nuisance recorder format. The Rion NA-28 analyser is exceptionally quick and easy to use. It can be switched instantly between broad-band and octave or third octave measurements, its superb backlit colour display is clearly visible in all lighting conditions, and it measures broadband, octave and third octave bands simultaneously.

The nuisance recorder is supplied with an outer pilot's case and a compact, rugged inner case for discrete and secure deployment. Deploying the instrument on site is quick and easy. Setting up and starting the NA-28 takes seconds, not minutes, and to set the instrument storing only requires the pressing of one button - the one clearly marked 'store'.

The wired handset has large buttons with LEDs which clearly show when the meter is storing audio. All Rion/ANV Measurement Systems nuisance recorders are additionally

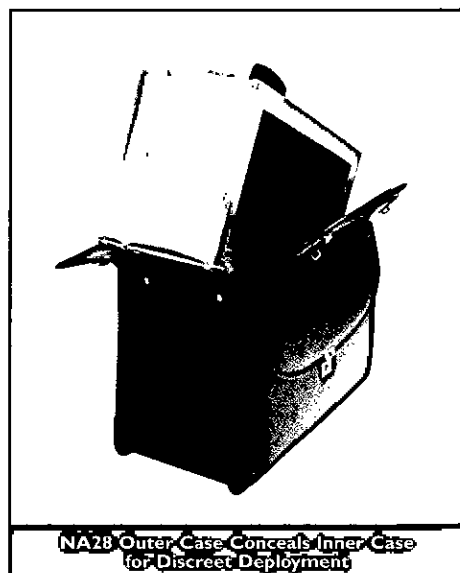
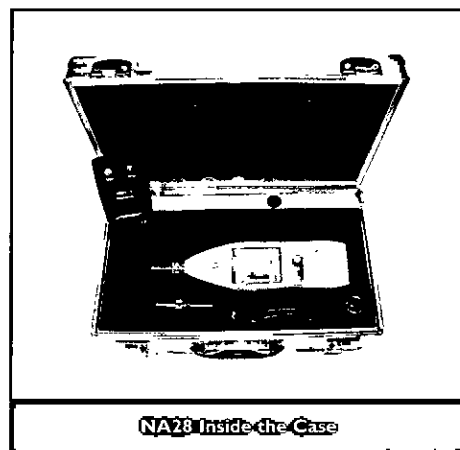
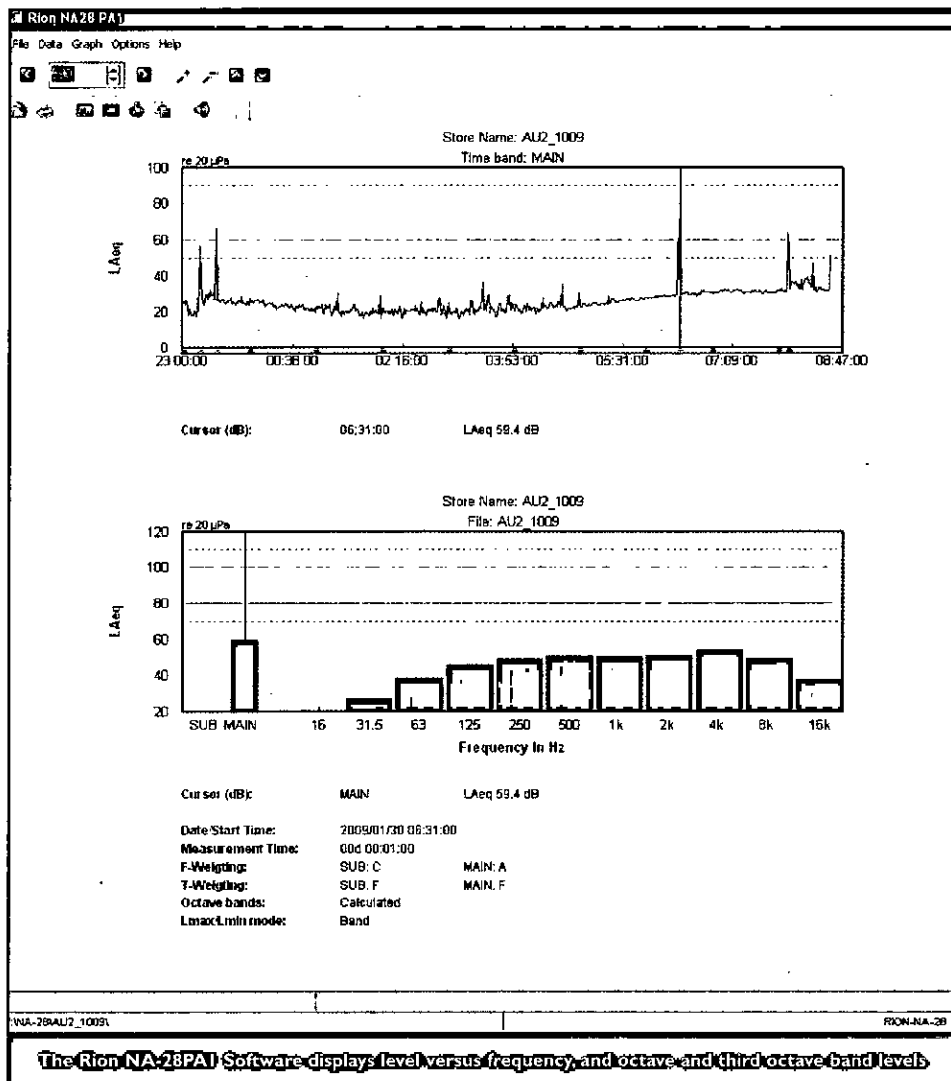
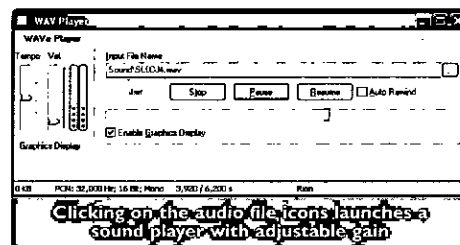
supplied with a wireless remote which the complainant can carry with them. This avoids the potential risks associated with infirm complaints rushing to get to a wired handset when the noise starts.

The NA-28 stores the sound level data (overall levels and/or octave and/or third octave band levels) into standard comma delimited text files onto a compact flash card. The audio files are stored in standard calibrated uncompressed wav file format. This means that the sound level data can be imported directly into Excel, the audio recordings played back using a standard media player, and the calibrated wav files post-processed should a more detailed analysis be required. The data and audio recordings can always be taken directly from the NA-28 without recourse to specialist download leads or software.

The unit is supplied with the new Rion NA-28PAI data management software. This rapidly imports the data and synchronises it

with the audio recordings. The data is shown as a level versus time plot with the synchronised audio recordings shown as icons below the time axis. The audio files are replayed by simply clicking on the icons below the time axis. The playback software incorporates a software gain function which is especially useful when listening to low level recordings. Clicking on any individual point on the level versus time graph brings up the octave and third octave band levels for that measurement, if these have been measured on the instrument.

The Rion NA-28-based nuisance recorder and NA-28PAI data management software are available from ANV Measurement Systems (tel 01908 642846, email info@noise-and-vibration.co.uk).



Sound Reduction Systems

New Acoustilay

Acoustic insulation innovator, Sound Reduction Systems, is proud to announce revolutionary new changes to the market-leading acoustical underlay product, Acoustilay. Years of research and development have resulted in the creation of a product that is both 100% recyclable and manufactured entirely in the UK, yet maintains all of the acoustical performance and characteristic properties of the previous product, at the same cost to the customer.

The issue of sustainability in buildings has long been a major factor for specifiers when considering products for their projects. However, houses can also be awarded 'points' for their acoustical and thermal insulation properties. Sound Reduction Systems has now combined both acoustical and environmental properties within the Acoustilay range, ensuring peace of mind in terms of acoustical performance and environmental impact for both specifier and end user.

The product is manufactured entirely in the UK, reducing the carbon footprint associated with imported goods. The barrier mat

material, used to give Acoustilay mass, can be manufactured from pre, mixed and post industrial waste sources and is 100% recyclable at the end of its life. The unique PVC free material, which is exclusively available to SRS Ltd, has a proprietary polymer structure which ensures it is one of the least polluting plastics, and does not emit any toxic compounds when it burns. The new product will be green in colour so specifiers, contractors and clients can be sure that the material on site is the new Acoustilay.

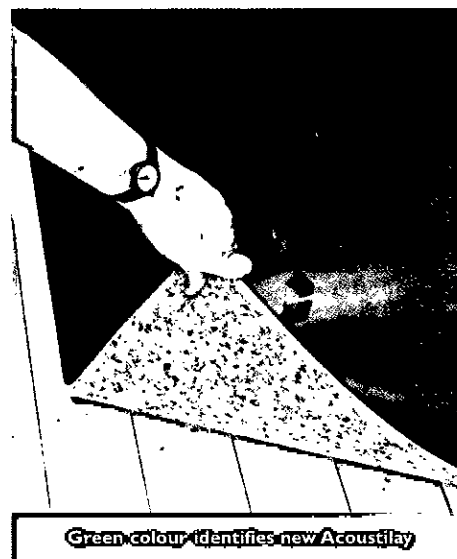
Acoustilay has long been a firm favorite with specifiers and end users because of its high acoustical performance and ease of installation, and it is often used to meet the requirements of Building Regulations Approved Document E in flat conversions. However, the product is also widely used by people upgrading the sound insulation of floors in their own properties for personal comfort.

Sound Reduction Systems has long maintained a commitment to provide free professional advice on any acoustical problems to specifiers and end users alike, along with

unique, high performance acoustic insulation materials for buildings. Their latest commitment is ensure that all their products and activities are as environmental friendly and sustainable as possible.

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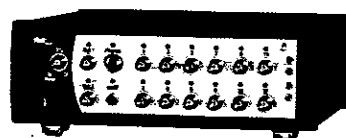
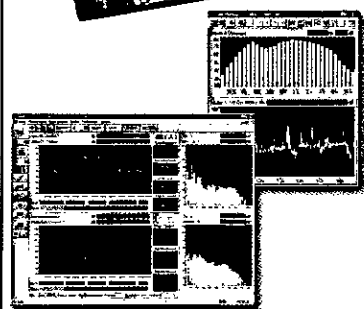
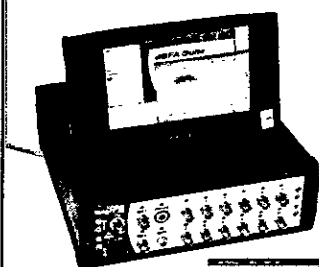
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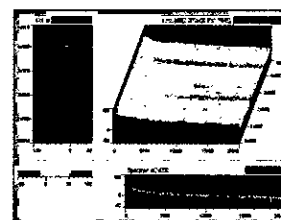
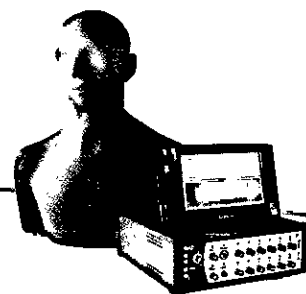


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Committee meetings 2009

DAY	DATE	TIME	MEETING
Thursday	5 March	10.30	Engineering Division
Tuesday	10 March	10.30	Diploma Examiners
Thursday	12 March	11.30	Council
Tuesday	7 April	11.00	Research Co-ordination
Thursday	16 April	10.00	Meetings
Tuesday	21 April	10.30	CCWPNA Examiners
Tuesday	21 April	1.30	CCWPNA Committee
Thursday	7 May	10.30	Membership
Thursday	21 May	11.00	Publications
Tuesday	2 June	10.30	CMOHAV Examiners
Tuesday	2 June	1.30	CMOHAV Committee
Thursday	18 June	9.00	Executive
Thursday	18 June	1.00	Council
Thursday	25 June	10.30	Distance Learning Tutors WG
Thursday	25 June	1.30	Education
Wednesday	1 July	10.30	CCENM Examiners
Wednesday	1 July	1.30	CCENM Committee
Thursday	2 July	10.30	Engineering Division
Tuesday	7 July	10.30	ASBA Examiners
Tuesday	7 July	1.30	ASBA Committee
Thursday	9 July	10.00	Meetings
Tuesday	4 August	10.30	Diploma Moderators Meeting
Thursday	3 September	10.30	Membership
Thursday	10 September	11.00	Medals & Awards
Thursday	10 September	1.30	Executive
Thursday	17 September	11.00	Publications
Thursday	24 September	11.30	Council
Thursday	1 October	10.30	Diploma Tutors and Examiners
Thursday	1 October	1.30	Education
Thursday	8 October	11.00	Research Co-ordination
Thursday	15 October	10.30	Engineering Division
Thursday	5 November	10.30	Membership
Tuesday	10 November	10.30	ASBA Examiners
Tuesday	10 November	1.30	ASBA Committee
Thursday	12 November	10.00	Meetings
Tuesday	17 November	10.30	CMOHAV Examiners
Tuesday	17 November	1.30	CMOHAV Committee
Thursday	19 November	11.00	Executive
Wednesday	25 November	10.30	CCENM Examiners
Wednesday	25 November	1.30	CCENM Committee
Thursday	26 November	11.00	Publications
Thursday	3 December	11.30	Council
Tuesday	8 December	10.30	CCWPNA Examiners
Tuesday	8 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.

Conferences and meetings:

Diary 2009

31 March - 1 April
Underwater Acoustics group
Fifth International
Conference on Bio-acoustics
Loughborough

28 April - 29 April
Environmental Noise group
Spring Conference 2009 -
Environmental noise
management in a sustainable
society
Rugby

21 May
North-west branch
Environmental noise update
Salford

3 June
Building Acoustics group
Acoustics in healthcare
Manchester

23 June
Instrumentation and
Measurement group

Did you hear that? Concepts
of audibility and inaudibility
London

8 July
Noise and Vibration
Engineering group
The assessment and
mitigation of noise from
sustainable sources
Oxford

26 - 28 October
EURONOISE 2009 -
Action on noise in Europe
Edinburgh

19 - 20 November
Electroacoustics group
Reproduced Sound 25
Brighton

Further details can be obtained from Linda Canty
at the Institute of Acoustics Tel.: **01727 848195**
or on the IOA website: **www.ioa.org.uk**

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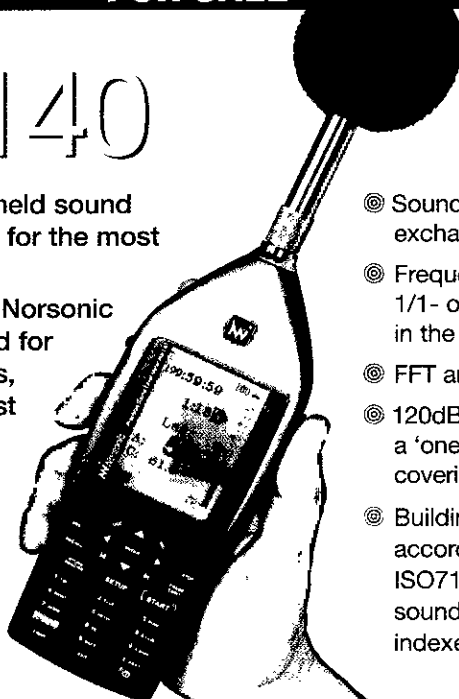
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A precision hand-held sound analyser designed for the most demanding users.

With this analyser Norsonic set a new standard for sound level meters, covering the widest range of applications.



Product specification subject to change.

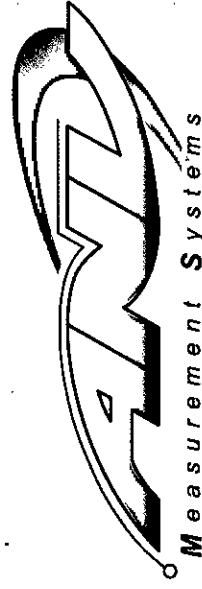
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- ⊗ Noise generator
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- ⊗ RPM input
- ⊗ Small, compact and rugged – designed for field use with connectors covered and protected
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Rion NA-28

The **Rion NA-28** Class 1 Sound Analyser is ready to use in seconds... not minutes!

It is a fully-functional analyser; measures and logs overall & 1/3 octave bands simultaneously.

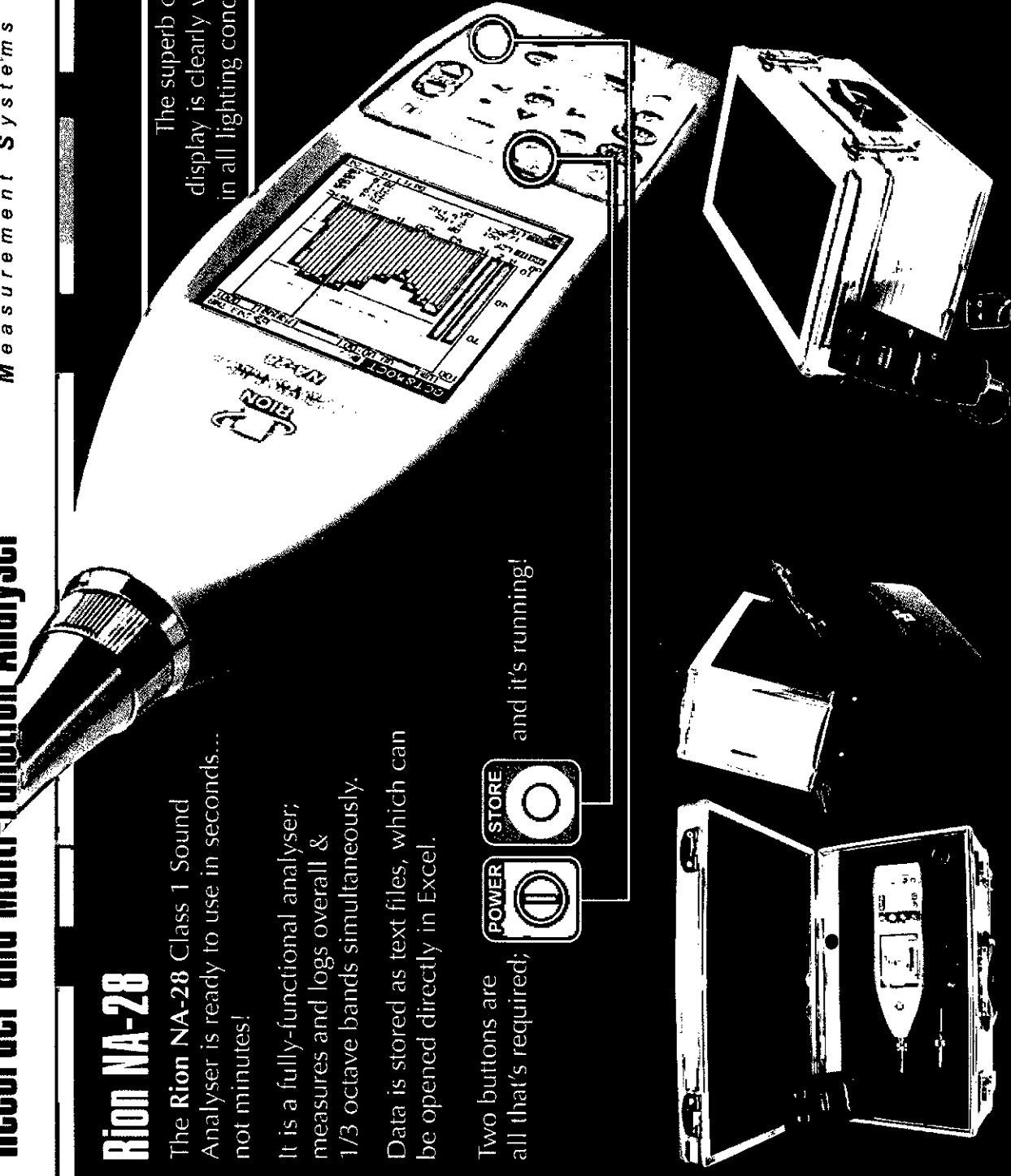
Data is stored as text files, which can be opened directly in Excel.

Two buttons are all that's required;



and it's running!

The superb colour display is clearly visible in all lighting conditions



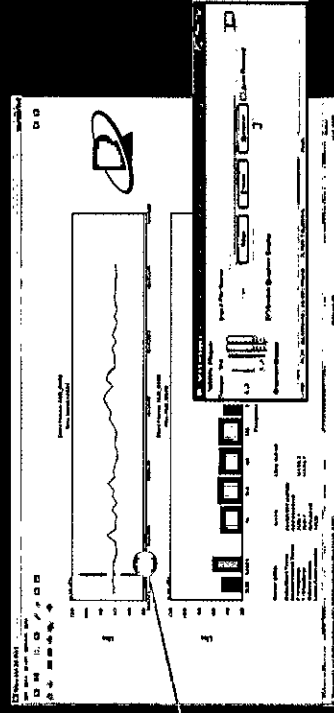
The Noise Nuisance Recorder system is wired up and 'Ready to Go' inside the lockable, rugged case. An outer pilots case is supplied to enable 'Discreet Deployment'.

A handset with illuminated buttons clearly shows when audio is being recorded. A separate wireless remote control is supplied as standard.

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The **Rion NA-28PA1 Software** quickly downloads and synchronises the NA-28's stored data and audio files. Level vs. time and 1/1 octave & 1/3 octave frequency data are displayed simultaneously.

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