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The Institute of Acoustics was formed in 1974 through the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society and is the premier organisation in the United Kingdom concerned with acoustics. The present membership is in excess of two thousand and since 1977 it has been a fully professional Institute. The Institute has representation in many major research, educational, planning and industrial establishments covering all aspects of acoustics including aerodynamic noise, environmental, industrial and architectural acoustics, audiology, building acoustics, hearing, electroacoustics, infrasonics, ultrasonics, noise, physical acoustics, speech, transportation noise, underwater acoustics and vibration. The Institute is a Registered Charity no. 267026.

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*Dear Fellow Member*

*Since the last issue of Acoustics Bulletin there has been continuing activity on the part of Publications Committee and its Chairman, John Miller, in making sure that the transition to the 'new look' Bulletin takes place as smoothly as possible in the New Year. Roy Lawrence and Cathy Mackenzie are moving on from their years of editing and producing our internationally-respected flagship publication, though there will one more issue under their expert guidance after this one. This is yet another area for which we owe Cathy and Roy a considerable debt of gratitude.*

*As I mentioned in my last letter (July/August Acoustics Bulletin) it is becoming clear just how much the development of our subject, acoustics (with all its ramifications), relies on an implicit collaboration between scientists, engineers and practitioners. Just a few weeks ago, our Chief Examiner, Keith Attenborough, set up a meeting with officials of the Engineering and Physical Sciences Research Council to which Roy Bratby and I were invited. It quickly became clear that EPSRC is keen to consolidate their approach to acoustics and to build on the funding base which academic acousticians have enjoyed over the years. Academics always argue that this base is not as big as it might be – but EPSRC are looking forward to closer collaboration with the Institute in identifying and assisting those areas of research which need contintuing or enhanced funding. Of course, they are interested in the basic science, but they are especially committed to the collaboration I referred to earlier – and want to hear more about future expectations for our field.*

*Two developments have arisen*

- *Keith Attenborough has suggested staging a 'theme day' during which we showcase the whole range of acoustics to our own members and to EPSRC attendees. The funding agency has welcomed this and is keen to support this kind of activity.*
- *The Institute's Council is setting up a working group, under Keith's Chairmanship, to examine the flow of information about our subject both within the Institute and outside, and to look into the possibility of a more co-ordinated approach by our members to EPSRC and other funding authorities.*

*This, I stress quickly, is not something just for the academics amongst our membership – the idea is to emphasise the fruits (both scientific and other) of close collaboration not just between the different areas of acoustics but also between the different practitioners: scientists, consultants, etc. The aim is to enhance funding across the board, and to raise the profile of our subject not just within the scientific community but with government and the general public.*

*Council feels that with your help the Institute can play a major role here. So, repeating my earlier letter, let me, Roy Bratby (ioa@ioa.org.uk) or Keith Attenborough (k.attenborough@eng.hull.ac.uk) know your feelings.*

*Yours sincerely*

Mark Tatham

*Mark Tatham*

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# THE MILLENNIUM DOME – A SOUND INVESTMENT

Jim Griffiths FIOA & Angela Thompson MIOA

## Introduction

Whilst the Millennium Dome has been dogged by the media on political and financial issues since its conception, many technical, engineering, architectural and environmental advances and innovative designs have been developed in a brave attempt to create an unforgettable experience for the patrons. This article reviews the many inter-related sound, noise and acoustic issues which were addressed in detail during the design, development and operational stages of this Millennium Project.

Symonds Group Ltd were commissioned by The New Millennium Experience Company (NMEC) in June 1998 to carry out a far-reaching sound, noise and acoustics brief which extended to many of the construction, design and operational issues of the Millennium Experience Site (MES). In summary, the scope included:

- Architectural acoustics
- Environmental noise
- Workplace noise exposure
- Sound system and voice alarm design

On the face of it, this scope may not seem any different to any other commission. However, the scale of this ever-changing project, the deadline for which could not slip, together with the vast number of consultants, engineers, architects, contractors, designers, producers and artists with whom we had to liaise, made this project a unique challenge.

At the start of the acoustic commission, our appointment extended to the Millennium Dome and the Mini Dome (now called Skyscape).

This in itself was a major project, given that the Dome comprises 14 separate 'zones' (varied complex entertainment buildings), a central arena and show, numerous retail areas, 6 corporate buildings, numerous plant rooms and extensive walkways. Skyscape was also a significant project, with two large back-to-back cinemas, one doubling up for use as a concert venue.

Our brief was extended throughout the project to most operational areas on the MES, including areas such as Schoolscape, The Round facility, Greenwich Pavilion, Starship (a tented structure recently introduced for corporate events) and the Blackwall Tunnel ventilation system. Figure 1 provides an illustration of the main areas within the Dome.

## Sound and Acoustic Criteria

Following a month of briefing meetings with the various design teams, two main objectives were identified:

- To advise on acoustic designs, treatment and control procedures to enable an effective form of entertainment/experience to successfully operate in an area, whilst not unduly affecting other areas, either inside or outside the Dome. External areas include other visitor areas on the MES and residential areas in the London Boroughs of Greenwich, Tower Hamlets and Newham.
- To design an intelligible Public Address Voice Alarm (VA) system for internal public spaces.

To start to meet these acoustic objectives, a set of acoustic design criteria were proposed. These were based on a balance between published criteria and research [1,2,3] for given activities/environment and the typical sound levels likely to be generated in the space. It was predicted that ambient levels in the Dome generated by the patrons themselves would be around 70 dBA. It was apparent, therefore, that most areas within the Dome would be far from quiet (unless acoustic measures were undertaken)

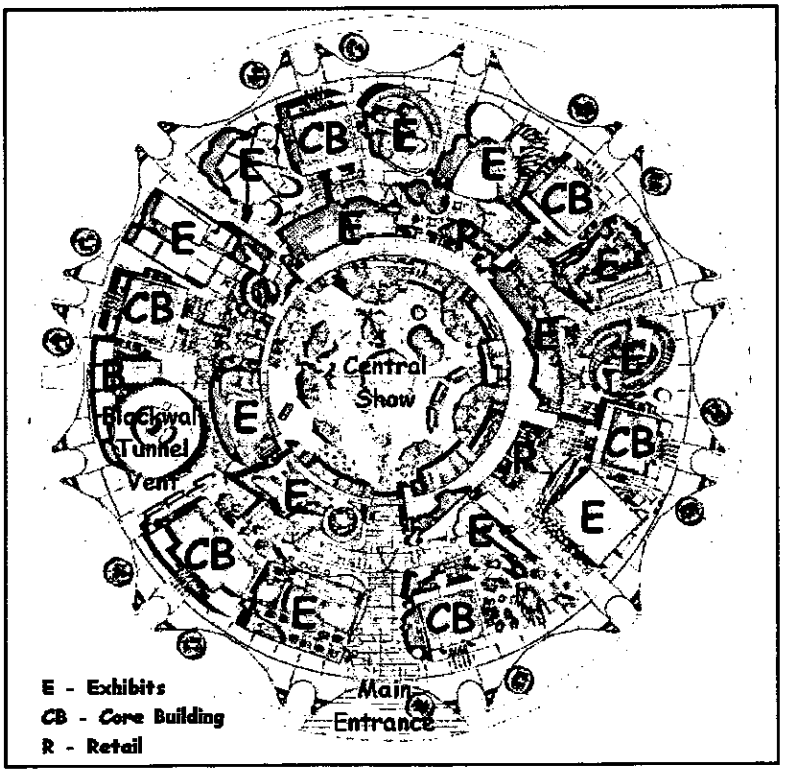


Fig. 1. Layout of internal areas within the Dome

| | | Acoustic Design Criteria | | |
|---|---|---|---|---|
| **Area/Activity** | **Typical Source Levels/dBA** | **Plant Affecting General Areas** | **Other Sources Affecting General Areas** | **Any Source Affecting Special Acoustic Areas** |
| **Central Show** | | NR40 | NR50 | – |
| Music Performance | 95 (90) | | | |
| People in Dome | 70 (73) | | | |
| **Exhibition Areas** | | NR40 | NR50 | NR30 |
| Low level music | 70-75 | | | |
| People in Dome | 70 (73) | | | |
| Video games | 85 (80) | | | |
| Theatrical | 80 (78) | | | |
| **Catering** | | NR40 | NR50-55 | NR35 |
| People in Dome | 70 (73) | | | |
| Background music | 65 | | | |
| Music for effect | 75 | | | |
| **Retail** | | NR40 | NR45-NR55 | – |
| People in Dome | 70 (73) | | | |
| Background music | 65 | | | |
| **Mini Dome (Skyscape)** | | NR40 | NR50 | NR30 |
| Cinema | 80 (79) | | | |
| Pop concert | 100 (102) | | | |
| **Environmental Noise** | | 07.00-23.00 hours - regular events - activity $L_{Aeq} \leq L_{A90}$ | | |
| Aircraft on site | 70 – 75 dB | 07.00-23.00 hours - 1 to 12 concerts/year - music $L_{Aeq} \leq L_{A90} + 15$ dB | | |
| Blackwall ventilation | 61 – 69 dBA at 25 metres | 23.00-07.00 hours - occasional event - activity $L_{Aeq} \leq 45$ dB$L_{A90}$ | | |
| | | 23.00-07.00 hours - regular event - activity $L_{Aeq} \leq L_{A90} - 10$dB | | |

*Bracketed figures under 'Typical Source Levels' are the measured levels experienced during the operational year.*

Table 1 - Estimated (and measured) source sound levels and tentative acoustic design criteria

and in some cases, the specified criteria could be relaxed from the generally accepted guidelines.

Furthermore, at the beginning of the project limited information was available regarding many of the activities in the Dome, and, therefore, tentative criteria had to be established for two broad categories: 'general' areas and 'special acoustic' areas (broadcast studios, cinemas etc). Other noise sources with the potential to affect certain activities were also considered, such as the Blackwell Tunnel vents located within the MES and the noise from over-flying aircraft from London City airport. Table 1 shows the assumed noise level in each area, the typical measured noise levels now that the Dome is operational and the acoustic criteria for plant and other sources affecting the two area types. Environmental noise criteria are also shown, which were subsequently agreed with the Planning Authority.

## Architectural Acoustics – The Main Structures

There were two fundamental issues associated with the structure of the Dome:

- The potential for environmental noise impact given the lightweight nature of the roof (which is a non-conventional polytetraflouroethylene (PTFE) glass fibre skin)
- The likely presence of acoustic defects within the space, brought about by the curvature of the structure itself.

These issues were investigated at an early stage in our involvement, by carrying out tests employing a large sound system inside the space (which at that stage was structurally complete, save for the internal structures). These tests are mentioned again later on in this article, since they were combined with tests to determine the

likely environmental impact of the Dome. The conclusions of the tests were provided in an early report [10] but are summarised as follows:

- The sound insulation tests indicated that there was a minimal amount of sound reduction through the skin at low frequencies, but that it increased fairly linearly with frequency, rising to around 10 dBA at 500 Hz and 28 dBA at 8 kHz. Conversely, conclusions could be drawn from these results regarding the likely absorption coefficients of the skin as a surface, used in the analysis of the internal acoustic properties of the space.
- In terms of the internal acoustic properties of the main Dome space, it was observed and backed up by measurements that there is an inherent imbalance in the frequency response of the space, such that most of the reverberant energy is at the higher frequencies.
- It was apparent from the impulse response results that the side walls to the main structure produced significant late reflections within the main arena. Whilst it was recognised that the internal structures, once built, would help to break up any reflections caused by the side walls, the likelihood of late reflections due to the structures themselves was raised as a concern. This led to a further investigation into the effect of the BT exhibit, which was to be situated at the edge of the central arena and was to feature large, flat vertical surfaces.

On the basis of the findings of the initial tests, we were able to use the measured data within our acoustic model of the main Dome, which was built using the Raynoise prediction software. This model was used for a number of purposes during the project, but primarily to predict the environmental noise impact during the central show, check for potential conflicts between internal areas and also test the performance of the central sound system. The overall acoustic model is shown in Figure 2.

In addition to the main Dome, we were also asked to provide advice relating to the construction of Skyscape. Unlike the Dome skin, the material for the tent had not yet been selected, and our advice was requested as to what the material should be. Since it was intended to hold concerts within the space, it was important that the performance specified would be both effective, whilst being realistic within the loading and other constraints relating to the temporary structure. Our advice was to achieve $R_w = 30$ dB.

Advice for this specification was provided to Edwin Shirley Staging, who worked with Landrells, Fleming & Barron and The Noise Control Centre to develop the material for the Skyscape ceiling. The outcome of this work was a 50 mm Noisco Hush Quilt Panel, which comprises a 4 mm thick flexible polymeric barrier sewn into a quilt of non-woven tissue, fibreglass and an outer coating of E-glass woven scrim (overall mass = 10 kg/m$^2$). Tests were undertaken as part of the development process, and the final design was found to achieve an $R_w$ of 30, thereby achieving the required criteria.

Symonds also undertook tests once the Skyscape structure had almost been completed and the in-house sound system had been installed (again, these tests are described later with respect to environmental noise). Pink noise excitation was used to assess the sound insulation properties between the cinema, foyer and theatre. These set the limit to which simultaneous events can be held within the venue without the disturbance from cross-talk noise between rooms.

Impulse response measurements were also made in the Skyscape cinema using both traditional gunshot excitation and maximum length sequence signal analysis.

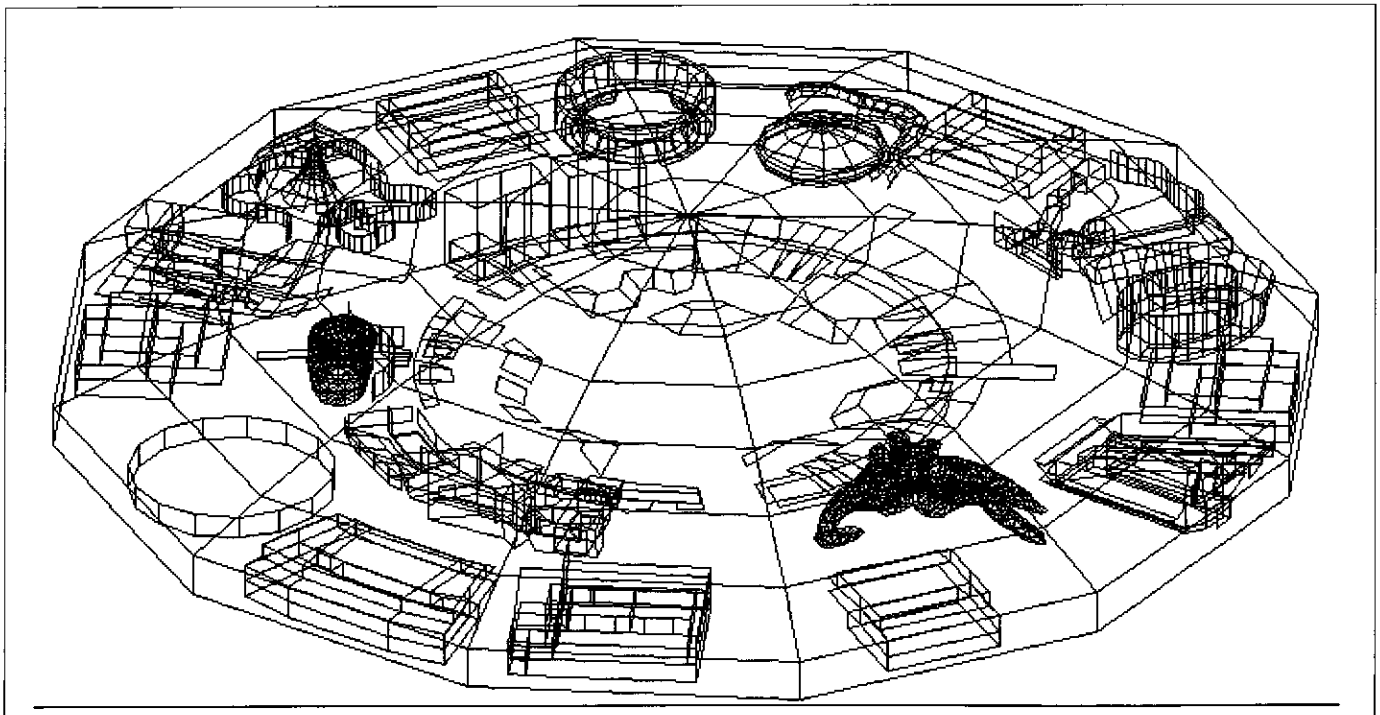

Fig. 2. Acoustic model of the Dome structure and exhibits

These were used to determine the architectural acoustic properties of the space, including octave band early decay and reverberation time. As is common with modern-day auditoria, the 'multi-purpose' venue is used for cinema, theatre and rock concerts alike. Each of these various types of performance require different reverberation times to support optimum sound reproduction. For cinema and theatre, the optimum range is between 0.8 to 1.1 seconds from 250 Hz to 8 kHz with a modest rise below 250 Hz. For rock concerts, an extended time of 2 seconds mid-band increasing to 2.5 seconds below 250 Hz is generally acceptable. The measurements made show that the acoustic properties of Skyscape provide a compromise between the requirements of a uniform reverberation time for cinema and theatre and an extended low frequency time for rock concert performances.

## Architectural Acoustics – Exhibits

In addition to the outer shells of the main structures, there were also issues associated with some of the internal structures within the Dome. These issues included the following aspects:

- The potential for exhibits to be affected by sound generated by neighbouring activities
- The possibility that noise generated within different areas of the same exhibit may be in conflict
- The acoustic quality within some areas, either in terms of the natural acoustics, or the effect of the proposed sound system
- The possibility of the larger structures causing acoustic defects within other areas, such as the central arena

From the outset of the project, it was recognised that given the proximity and number of differing activities taking place within the one general space, the solutions to the above problems were always going to be a compromise, in terms of activity interference. Our approach was to take each zone or activity as a separate project and consider the likely requirements for acoustic treatment, based upon the acoustic criteria described earlier in this article.

Much of the advice provided to the design teams was based upon acoustic modelling work carried out for each specific area. Examples of the wire-frames for some of these models are shown in Figure 3.

Typically, our advice included insulating measures to improve the sound reduction through some of the structures, or to provide more protection against some of the background noise sources where a low background level was highlighted as being desirable for that particular activity. For instance, two adjacent areas within the Local Zone, separated by a wall constructed essentially from cardboard, were likely to conflict, due to their differences in noise sensitivity. Symonds worked with the materials consultant, DCAB on this matter to try to improve the sound insulation of the intervening wall, which had the constraint that it should be made from recycled paper. Faith zone was also highlighted as a concern, given its desired low ambient noise characteristics within the central 'contemplation' space and the proposal to construct the internal structures from only two sheets of canvas. A solu-

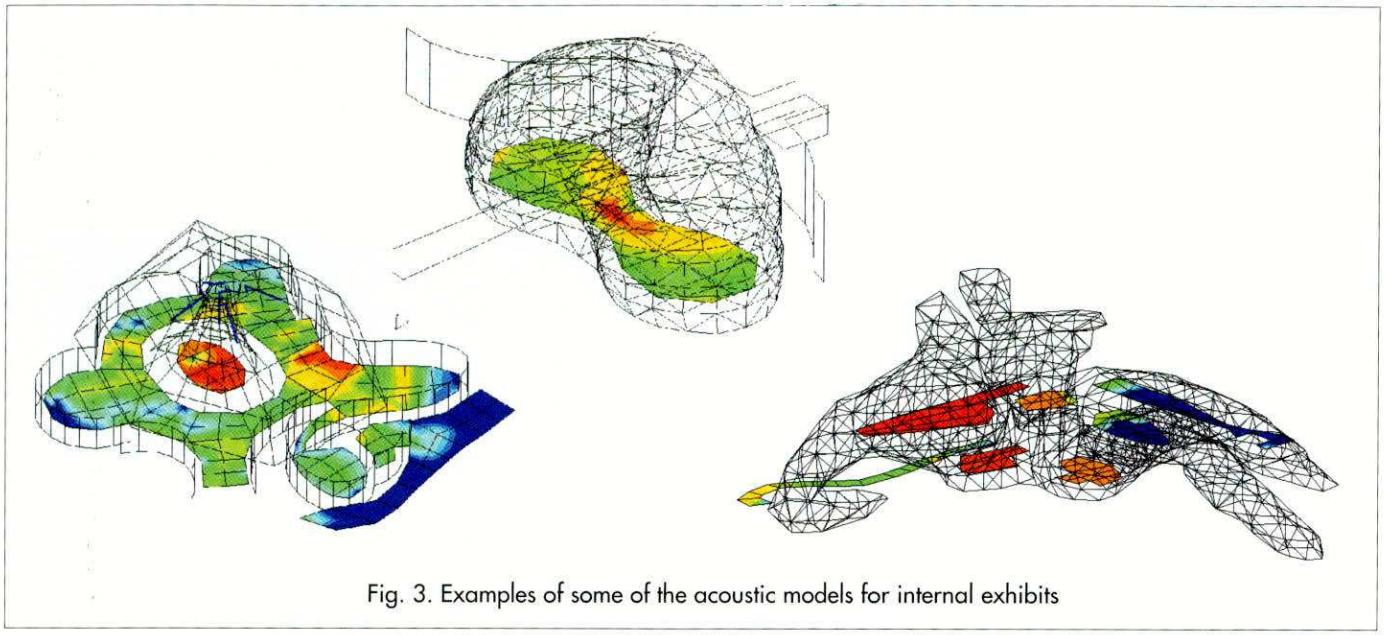

Fig. 3. Examples of some of the acoustic models for internal exhibits

tion to this problem was never really found, since the zone also had structural constraints, in terms of its weight loading upon that part of the site. In some areas, acoustic treatment was recommended where internal reverberation was likely to affect the visitor experience or the intelligibility of the proposed VA system, such as the heart room in Body, the main space in Rest and the acoustic dislocation space in Mind zone. Symonds also liaised with the sound designers for each zone to determine the nature of sound equipment being proposed and to provide some feedback to them on the likely acoustic properties of the space, based upon the findings of our modelling work.

In many cases, our advice on these issues had to be considered by the various members of the design team, ie architect, project manager, sound designer, structural engineers and ultimately our client, NMEC, in respect of all other constraints affecting any one zone. It was therefore inevitable that our advice was not always taken on board, due to these constraints.

## Environmental Noise

The MES is located at the Northern end of the Greenwich peninsula in the London Borough of Greenwich. Two other borough boundaries, Tower Hamlets and Newham are also close to the Dome, located on the northern bank of the River Thames. Some of the closest residential properties are located on the north side of the river in Tower Hamlets.

A series of baseline noise measurements were made in 1996 and are regularly being updated [4,5,6,7]. The results were typical of those expected for the London area, dominated by road traffic noise throughout the day and until the late evening. Other local noise sources included aircraft movements, pleasure boats and noise from activities associated with the various wharves situated along the river.

The acoustic model described for the architectural acoustics was also used to predict the noise propagation to areas external to the Dome. The predicted results are displayed graphically in Figure 4. These results were used, together with the baseline data and the environmental noise criteria [8], as the basis of our noise impact assessment. The study indicated that all properties met the criteria, apart from the nearest community sites located on the north bank of the river to the north and west of the Dome. These properties marginally exceeded the criteria for the late evening period only. Symonds therefore recommended a revised sound control level within the central arena for shows taking place during the evening period. This control level identified was 3 dBA lower than the value assumed for the predictions,

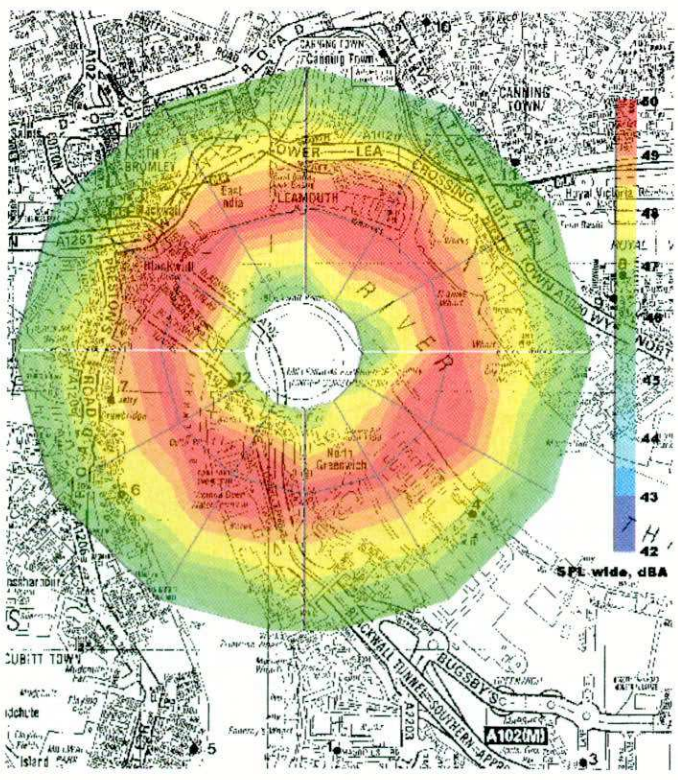


Fig. 4. Predicted environmental impact during Central Show

Fig. 5. Part of the sound system used for the October 1998 tests

and consequently the advice was given that careful monitoring and control of central show sound levels would need to be implemented in order to avoid environmental noise impact, also taking into account the likely variations due to meteorological effects.

In support of the predicted noise impact study, environmental noise tests were completed in conjunction with the Local Authorities. This exercise was undertaken in late 1998, when the exterior of the Dome was largely complete, and during the late evening, in order to assess as a worst case, the period close to the proposed closing time of the Dome when the background noise would be at its lowest. A high-powered sound system (see Figure 5) was hired, and both shaped pink noise and music used as the sources. The results from these tests generally correlated well with the predictions at the nearest sites where sound from the Dome could be measured. The sound at the other ten sites was either barely audible or inaudible and therefore a direct comparison between predictions and measurements could not be made.

A similar study was completed the following year for Skyscape, using the in-house sound system. As discussed earlier, this facility was constructed to meet an $R_w$ of 30 dB, since it was proposed to be used as a concert venue, implying internal sound levels in excess of 100 dBA. During the tests, internal levels reaching 102 dBA in the audience area, were observed to be inaudible at all environmental sites, with the exception of the nearest site in Greenwich. Levels in this location were audible and just met the criteria. A weak acoustic link was identified to be the single shutter door facing this particular site. A secondary internal door was therefore specified and installed.

Other tests have been carried out during the operational year for other temporary tented structures such as Starship, which is currently installed near Skyscape. Given the acoustically weaker construction of this structure compared to Skyscape, maximum internal noise limits were imposed for music events taking place within this structure during the night-time period [9].

NMEC has control over the sound levels generated by the Central Show, Skyscape and Starship. On the basis of the earlier tests and final commissioning of the actual performances taking place within these areas, maximum noise limits have been set by digital signal limiters, which are a feature within each sound system.

The environmental controls have been a great success in minimising the disturbance to the local community. As of October 2000, only around 10 noise complaints have been received during the construction and operational phases of the Dome. A number of complaints were initially received in the early hours of the morning when rehearsals and sound system tests for the central show were being carried out prior to opening. These tests had to be completed at night as there were internal construction activities during the day up to New Year's Eve. The level of complaints was minimised by controlling the internal levels to 80–85 dBA. The permitted levels varied as a function of the meteorological conditions, which affected sound propagation to external areas.

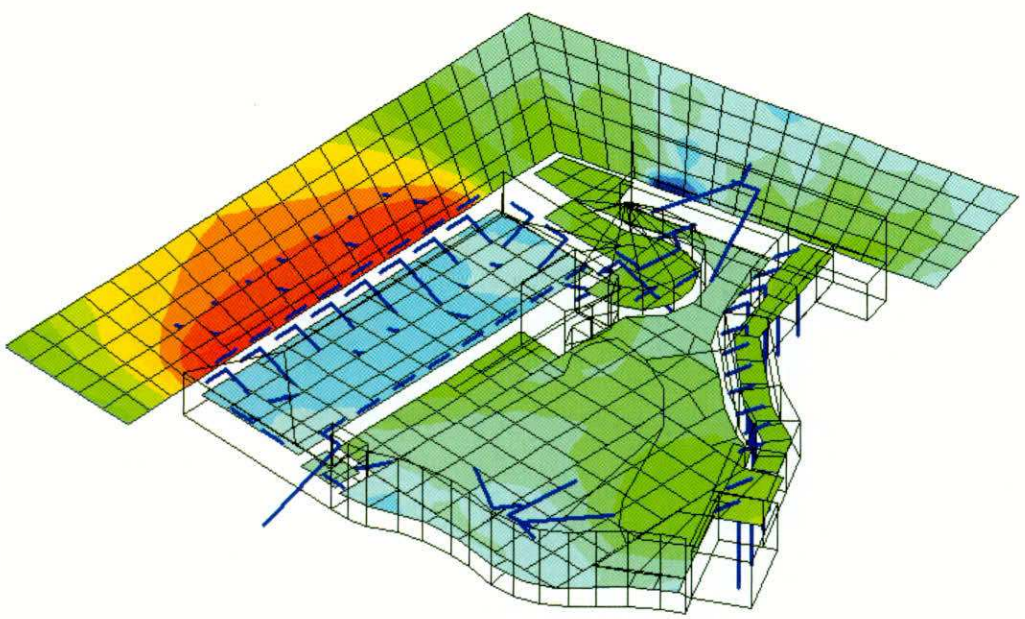

Fig. 6. Example of a speech intelligibility assessment

Two continuous noise monitoring stations, one internal and one external, have been operating at the Dome over a number of months. The external station was also operational throughout the main construction period. These systems are useful to assess the daily trends and in particular to monitor any high noise levels generated outside the operational period of the Dome which may lead to complaints eg testing of the sound system at night. The analysers are downloaded by remote outstations and routine reports are produced for NMEC and the Planning Authority.

## Voice Alarm Systems

Further to our initial contract, in February 1999, The Symonds Group's Scope of Works was expanded to include additional consultancy services and reporting regimes for the Millennium Dome's Voice Alarm systems. In particular, Symonds Group accepted design responsibility for the performance specifications and concept designs.

We were required to use computer-modelling techniques to assist in the verification of the predicted speech intelligibility of the Voice Alarm system on the whole of the site. The system design for the various different areas can be broken down into three main types:

- Building Systems
- Exhibit Systems (including the Central Arena)
- Circulatory Space Systems

The approach that was adopted was to (wherever possible) integrate Voice Alarm system specifications and design requirements with production sound systems and to model the predicted system intelligibility. The Exhibit Systems and Central Arena systems were widely integrated with the production audio requirements and dedicated system designs supplementing where there were no proposed production audio systems.

With many of the exhibit structures still being revised and content/fit-out in a constant state of flux almost until completion, our consultants worked in consultation with architects and designers in all areas to progress the integrated audio system designs. The speech intelligibility of each design proposal was modelled prior to installation. This approach enabled computer modelling to be used to confirm that the designs were likely to meet the required performance and enabled the condensed nature of the design stage of the project to meet construction deadlines.

An opportunity for a certain degree of validation of this process was provided with the relatively early completion of one of the exhibition spaces (National Identity, or 'Living Island'), shown below in Figure 6. Symonds commissioned AMS Acoustics to use their own RASTI prediction model to predict the intelligibility parameters within this space [12], as a means of validating our own predictions. The results indicated close agreement between the two prediction methods.

## Workplace Noise

It was part of Symonds' remit that we advise our client, NMEC, on any areas of risk associated with the operation of the Dome. One of the possible elements of risk

was identified to be the exposure of employees to high levels of noise during the operational year, given the large number of relatively high-powered systems used for production sound and effects within the Dome and Skyscape. A noise at work assessment was therefore undertaken in accordance with the Regulations [11] in order to identify any NMEC staff who might be exposed above the action levels. There was a particular concern regarding some of the performers in the Central Show, who spend a lot of time 'flying' in front of some of the more high-powered systems 50 m above the audience.

Other groups of people identified in the assessment were hosts (those who are employed to assist and supervise visitors), retail staff and technical staff operating sound and other equipment. The assessment was undertaken partly on an area basis, using measurement samples taken within general areas such as exhibits and walkways, and partly by use of dosemeters for those with more complex work patterns, such as performers and technical staff.

The exhibit areas were generally found to be below the action levels. However, the control pit area, below the stage and close to the main loudspeaker cluster, was above the second action level. The required duties under the Regulations, such as the provision and use of proper hearing protection and signage, were implemented.

Whilst at the time of the noise at work assessment the noise exposure of employees working within Skyscape was found to be below either of the action levels, it was recommended that during any proposed concert events, ear defenders should be provided and worn by NMEC employees.

## Summary

From the point of its conception through to its operational period during the year 2000, the Dome has unfortunately been the victim of bad press on both political and financial issues. So much so, that much of the innovative work and successes achieved in the design and engineering of this visitor attraction have often been forgotten.

Fig. 7. Performer being fitted with a Dosemeter.

The Symonds Group have had the pleasure of being involved in the project over the last few years on a remit which has 'mushroomed' to include all acoustic aspects of the Dome's operation, covering issues ranging from environmental impact, the potential conflicts between different areas/activities on the site, assessing employees' and performers' daily noise exposure, through to the specification, design, prediction and measurement of voice alarm sound systems for emergency use.

These tasks have involved liaising with a large number of different groups of people, such as Designers, Consultants, Architects, Producers, Artists, Structural Engineers, M & E Engineers, Contractors, Project Managers and ultimately our client, the New Millennium Experience Company.

Given that there was a different set of each of these parties working on each of the 14 internal exhibition spaces, this aspect of our work has been both a challenging and rewarding experience. Our innovative approach in recommending the integration of voice alarm and production sound systems for many areas was considered useful in keeping both architects and building control personnel happy at the same time!

Our work relied heavily upon the use of acoustic modelling for many parts of our remit, including the prediction of environmental impact, the potential for conflicts between internal and external spaces on the Dome site and the assessment of speech intelligibility of the many sound systems. On such a large project where all these effects were interrelated, this proved to be an invaluable approach.

The fact that all visitors were evacuated safely and quickly during a recent test of the voice alarm system, and the low level of complaints from visitors and nearby residents on issues related to noise, leads the authors to conclude that the Dome was indeed a 'Sound Investment'....at least with respect to sound, noise and acoustics.

## References

[1] NR/NC curves
[2] Noise Council Code of Practice on Environmental Noise Control at Concerts (1995)
[3] 'Noise Control at an All-Night Event at Turweston Aerodrome', Peirce & Garthwaite, IOA Bulletin, March/April 1998
[4] Sandy Brown Associates, Millennium Dome, draft preliminary report, July 1998
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**Jim Griffiths FIOA and Angela Thompson MIOA are with Symonds Group at Symonds House, Wood Street, East Grinstead, West Sussex RH19 1UU.** ❖

# HOW MANY PEOPLE SUFFER HEARING PROBLEMS FROM NOISE AT WORK?

Trevor Benn

## Introduction

How many people acquire hearing problems from noise at work? As with most examples of work-related health problems there are various sources of statistics that can be examined for an answer to this question. Some of the data are in the form of incidence figures, that is to say numbers of new cases that develop each year, and some are prevalence figures covering estimates of the number of existing cases, including those that are long standing as well as those that have developed recently. For a chronic problem like Noise Induced Hearing Loss (NIHL) it follows that the prevalence figure greatly exceeds the incidence figure.

This article comments on the statistics available from four sources. The explicit or implicit limits to which the data refer varies among the four approaches, a fact that makes direct comparison among the sources difficult.

## Sources of Statistics

Four sources of data will be considered here.

**DSS Occupational Disease Scheme**

Hearing loss has been a prescribed occupational disease compensatable by the goverment's Department of Social Security (DSS) since 1974. The requirements are a minimum of 50 dB of threshold shift, which is quite a severe loss, and a minimum of 10 years spent in one or more of a number of specified noisy jobs. It might be held that any noisy work environment should qualify, but the DSS requirements are quite specific and this produces some anomalies. For example, compensation can be available as a result of having been deafened by the noise in ships' engine rooms, but not by the identical kind of diesel engines if they were located on land. As well as the restrictions on eligibility, the DSS statistics may also be affected by factors which influence people's propensity to claim compensation. These include the awareness that compensation is available and the attitude of unions in promoting claims.

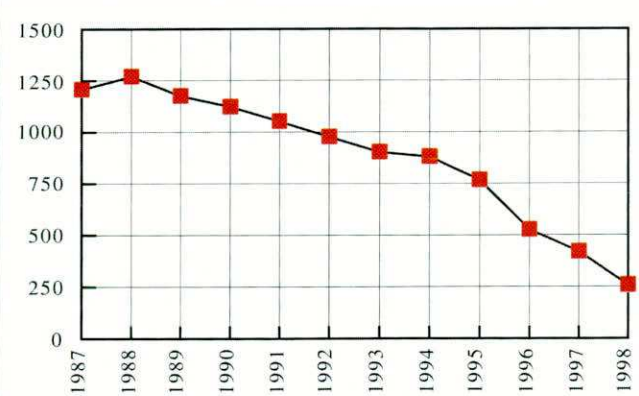


Fig. 1. Showing the trend in new cases (DSS data)

**University of Manchester Schemes**

Two voluntary medical surveillance schemes are operated by the University of Manchester Centre for Occupational and Environmental Health with funding from the Health and Safety Executive (HSE). These are:

**OPRA** This stands for the Occupational Physicians Reporting Arrangement, and the statistics are based on the number of people listed in occupational physicians' reports on work-related health matters, including hearing problems.

**OSSA** This is the Occupational Surveillance System for Audiology which has been set up to collect reports of hearing problems encountered by specialist audiological physicians.

Neither scheme can give complete information because many workers do not have access to an occupational physician at their place of work and the cases seen by audiological specialists will tend to be mostly the more severe cases that are referred to them, or the cases referred for medico-legal purposes.

**HSE's Self-Reported Work-Related Illness Scheme (SWI)**

In the HSE survey of self-reported work-related illness, the term *illness* is taken by the interviewers to cover 'illness, disability or other physical problem'. In fact deafness, tinnitus or other problems with the ears were among the most frequently reported categories of disability.

Obviously not every individual's attribution of their hearing problem to their work is reliable, but the two HSE surveys of self-reported problems attempted to examine the validity of responses both by internal and external means. It was concluded that work-related hearing problems are one of the more reliable self-reported categories of problem. One of the external validation tests that was applied was how the self-reported figures compared with the DSS figures, where the cases have all been validated by checking work history and examination by an ear specialist.

**Association of British Insurers (ABI)**

Finally there are the claims against Employer's Liability Insurance, compiled by the Association of British Insurers (ABI). Their statistical bulletins give annual numbers of claims settled but they exclude those settled at zero cost.

## Observations on the data

**DSS**

**Trends:** Figure 1 indicates that the numbers of new cases have been falling steadily for several years and the latest

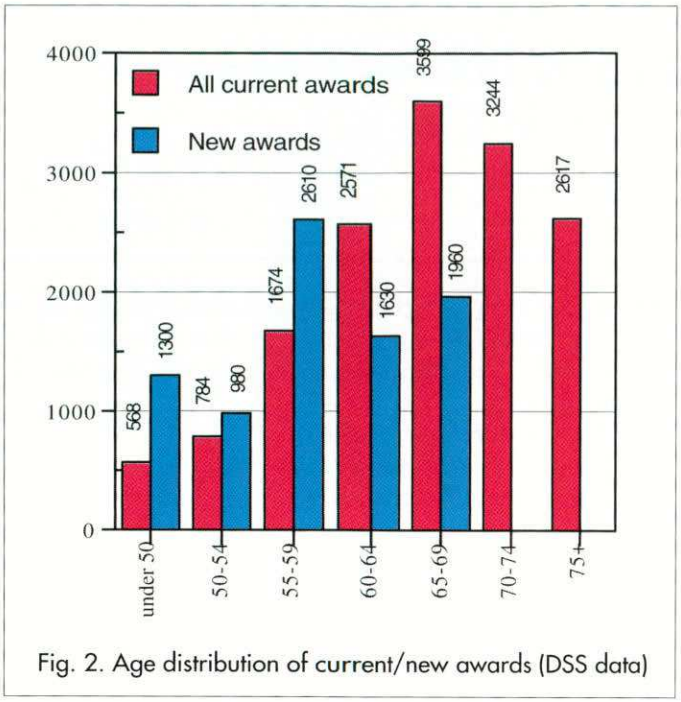


Fig. 2. Age distribution of current/new awards (DSS data)

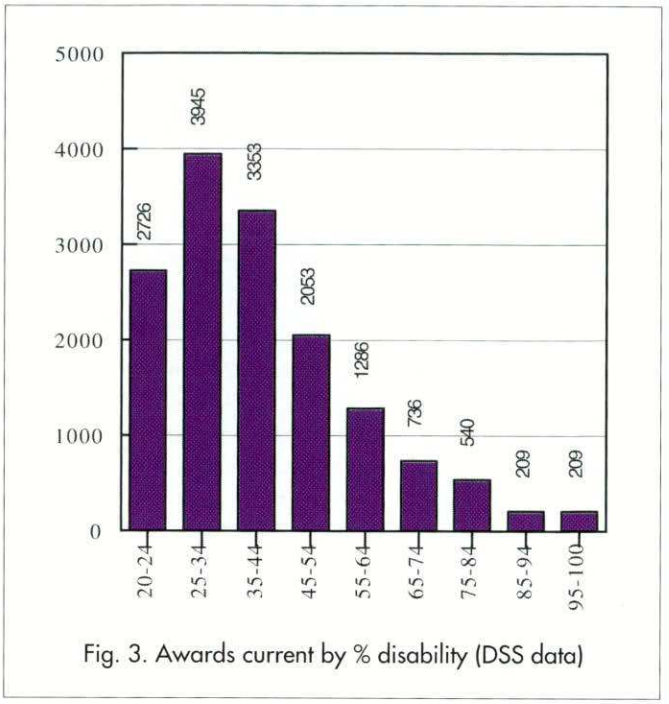


Fig. 3. Awards current by % disability (DSS data)

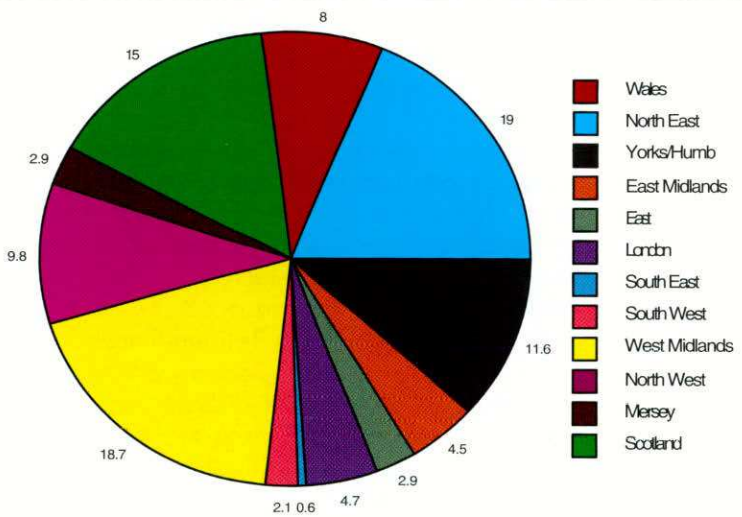


Fig. 4. Awards current at 5/4/97 by region (DSS data)

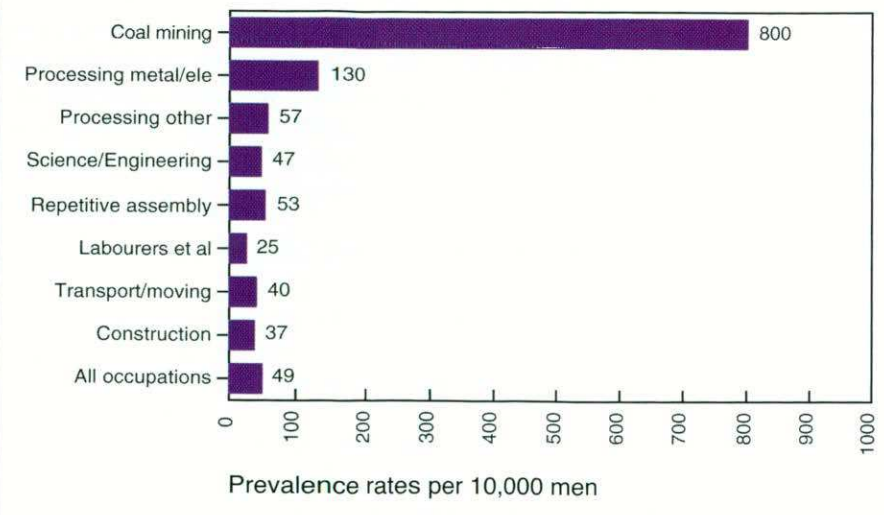


Fig. 5. Self-reported deafness cases caused by noise (SWI90 data)

figure is 258 new claims accepted in 1998. It should be recalled that this covers people with 50 dB or more hearing loss.

Figure 2 places the average age of new cases at 58 with just over a quarter below age 55; it is therefore not true to think of NIHL as limited to what may be termed 'old' people. These figures may have been influenced by the DSS 'five year rule' under which claims have to be submitted within five years of leaving a 'prescribed occupation'. If all the previous cases are included, the long-standing ones will move the distribution upwards.

**Percent Disability:** Figure 3 sets out the occurance of different degrees of disability. 50 dB is equal to 20% disability and 106 dB equates to 100%. The peak of distribution is seen to occur at about 30% disability which corresponds to 54–60 dB.

**Regional Distribution:** Figure 4 indicates a clear predominance in the Midlands, North, Scotland and Wales. This appears to reflect the geographical distribution of relevant industries.

**SWI**

**The SWI90 report:** Within this report for 1990 is presented the way in which NIHL is distributed among the employees of various industries. This is given in Figure 5.

**Employers Liability Claims**

Figures from the Statistical Bulletin of

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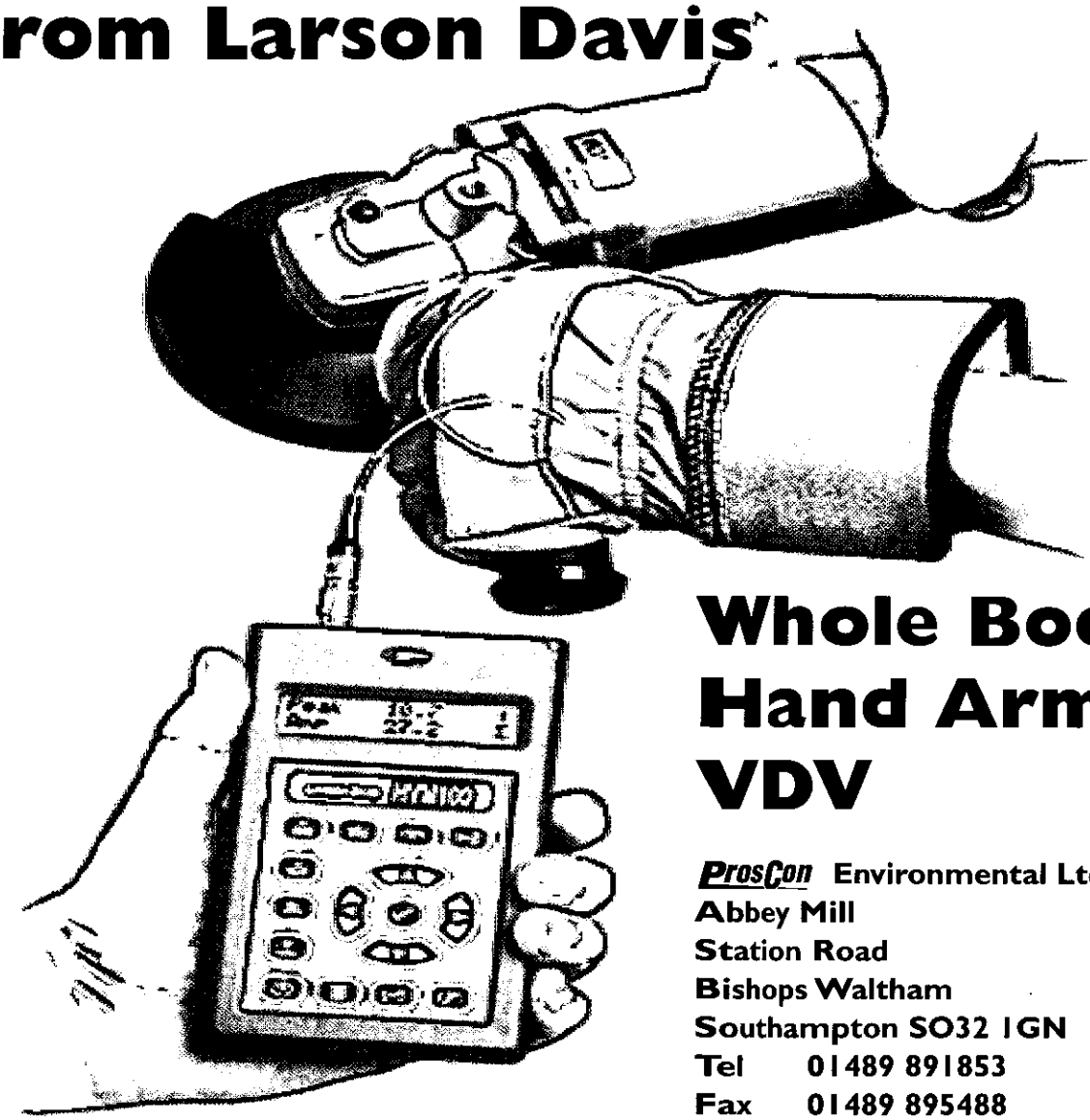

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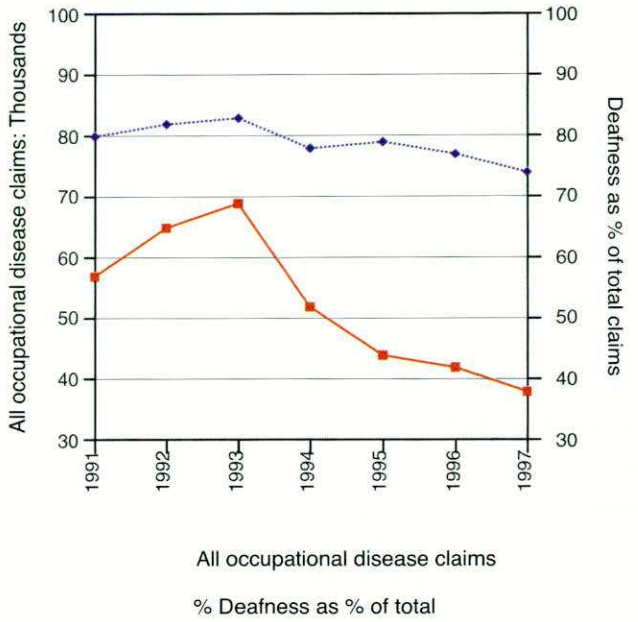


Fig. 6. Employers' liability insurance claims (ABI Statstical Bulletin)

the Association of British Insurers (ABI) are presented in Figure 6. It should be noted that these figures relate only to claims settled and exclude those settled at no cost.

The ABI Bulletin doesn't give actual numbers of claims for occupational deafness, instead it gives annual totals of claims for all occupational diseases combined, and they also express each disease as a percentage of the total.

In fact deafness makes up approx 80% of occupational disease claims; that percentage has stayed roughly constant over recent years up to 1997, so the trend in deafness claims mirrors the total for all diseases.

From 1993 to 1997 total disease claims were falling, also deafness as a percentage of the total of claims shows a definite falling trend.

## Commentary on the Estimates

The estimates from various sources are brought together in Table 1. Observations follow below.

**DSS**

Obviously the DSS incidence and prevalence figures would be considerably greater if the threshold were reduced to below 50 dB. It is possible to make an estimate of this increase based on the number of individuals whose claims were turned down because they had less than 50 dB of threshold shift, but more than 35 dB. It works out that there would be a probable incidence of at least 800 new assessed cases annually and a prevalence of at least 47,000 cases if the DSS payment threshold were lowered to 35 dB. These are almost certainly lower bounds because many may come forward who would not have done so previously due to a low expectation of success.

| | Incidence | Prevalence |
|---|---|---|
| DSS (1988) | 258* | 15,300** |
| OPRA (occ physns) | 350 | n/a |
| OSSA (audiologists) | 582 | n/a |
| SWI (1995) | 0 to 11,000 | 150,000 |
| Employers' insurance | 28,000? | n/a |

*estimated at 800 if threshold lowered to 35 dB
**estimated at 47,000 if threshold lowered to 35 dB

Table 1. Occupational hearing loss: Comparison of estimates

**OPRA**

There were an estimated 350 new cases of hearing loss seen by occupational physicians who participate in OPRA in 1998.

**OSSA**

The number of cases seen by specialist audiological physicians is slightly higher than the number seen by occupational physicians, with 582 cases reported in 1998.

**HSE SWI data**

The HSE's SWI prevalence estimate is for the number of people reporting deafness or tinnitus which they say was caused, not merely made worse, by work. The figure of 150,000 is quoted rather than 170,000 because this excludes ear infections etc.

The SWI survey was not primarily intended to give incidence estimates because the number of new cases of self-reported problems which appeared in the sample, those where the respondents said that they had had the problems for less than 12 months prior to the interview, was quite small. And because the number of new hearing problems in the sample was small it hasn't been shown as a single estimated incidence figure, but rather the 95% confidence interval for the estimate, namely from 0 to 11,000.

**The Association of British Insurers**

They reported in 1997 that there were 28,000 claims for deafness against employers' insurance and this is shown in Table 1. ABI acknowledge that there may be problems with their data. One is that the same case can be counted more than once if there is more than one insurance company involved – due perhaps to the involvement of more than one employer, or if their employer has insured with different companies in the course of the period of work.

A general difficulty with the ABI figures, especially some of the earlier ones, is that they seem too high to be credible in comparison with self-reported data.

## Conclusion

It is not possible to present a single figure that describes the incidence or prevalence of noise induced hearing loss since the observations drawn from the data described here depend on the level of hearing loss taken as the defining level.

**Trevor Benn is a Statician with the Health and Safety Executive, Magdalen House, Bootle, Merseyside L20 3QZ** ❖

# NEW SOUND DIFFUSERS IN PRACTICE

Raf Orlowski FIOA

We are well aware that the heavy ornamentation in nineteenth century concert halls gives rise to a high degree of sound diffusion and that this is evidently beneficial for providing good acoustic quality. The reduction of ornamentation in twentieth century architecture has led to other geometries and devices being used to provide diffusion. However, design of these various diffusing elements has had only tenuous connections with the theory of sound scattering. For example, Parkin advises in his book [1] that diffusing elements should protrude between 300 mm and 600 mm or alternatively they should be convexly curved in plan and section.

This rather general approach was dramatically changed when Schroeder proposed a method for providing sound diffusion using mathematical number theory sequences [2]. The idea was quickly taken up by Marshall who installed Schroeder-type diffusers, based on a quadratic residue sequence, in the new Michael Fowler Centre concert hall in Wellington, New Zealand.

The acoustic result appeared to be successful and Marshall's next concert hall design, the Segerstrom Hall in Orange County, California, also incorporated quadratic residue diffusers.

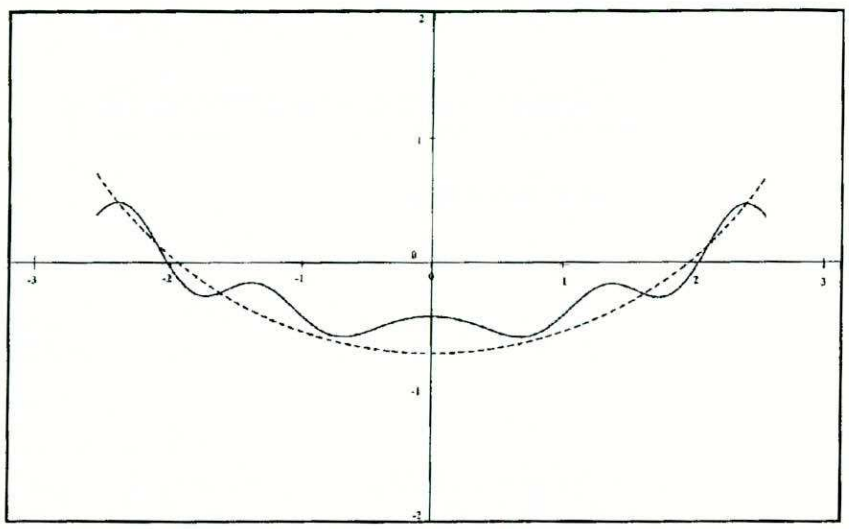

Fig. 1. Concave wall and optimised amplitude modulated diffuser

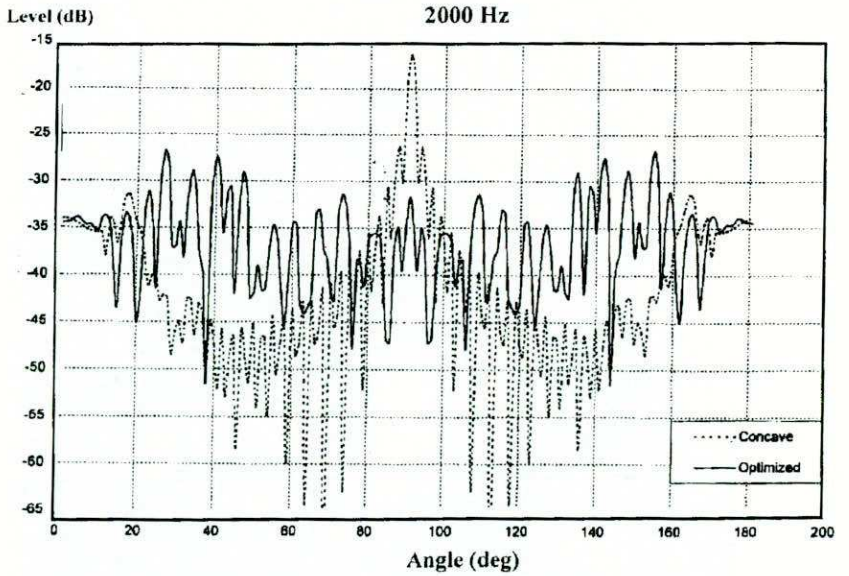


Fig. 2. Comparison of sound scattering at 2 kHz by optimised and concave surfaces with source on axis and receiver at focal point

However, Schroeder diffusers have not become universally popular because their aesthetic, which generally consists of a series of parallel slots of different depths, does not particularly appeal to architects and designers of auditoria.

Research by Cox, latterly in collaboration with D'Antonio [3], has resulted in accurate prediction methods for scattering from diffusers based on boundary element methods. This has enabled diffuser design to break out of the mould of Schroeder's number theoretic diffusers to provide a much greater range of stepped and curved diffusers.

Using numerical optimisation techniques and prediction methods, an architect or designer can select a desired shape or motif and this can be tailored to provide a diffuser with the required diffusion.

This technique has been applied by Arup Acoustics to the design of a new rehearsal hall, the Edwina Palmer Hall, for the Benslow Music Trust which provides residential music courses. For architectural reasons, a concave form was developed for the hall which obviously gave rise to concerns about focusing.

Curve-shape optimisation was used to minimise focusing by the concave wall using a geometrical motif based on an amplitude modulated wave; the concave wall and optimised curve are shown in Figure 1. A comparison of the sound scattering by the optimised and unoptimised surfaces is shown in Figure 2.

The optimised 'wiggly' wall satisfied the architect's design intentions as well as meeting the acoustician's requirement to neutralise focusing and provide diffusion. Figure 3 shows a plan of the rehearsal hall and Figure 4 shows a view of the diffusing wall in the completed hall.

The wall was formed from 25 mm thick medium density fibreboard (MDF) with a paint finish although glass reinforced gypsum (GRG) was considered as an alternative material.

It can be seen from Figure 4 that the wall steps back at high level. Also, thin vertical strips have been added to the curved surface. Both these changes to the optimised curve were implemented by the architect to enhance the visual aspects of the wall in the context of the overall space. Neither is considered to have a significant effect on the overall scattering performance of the wall.

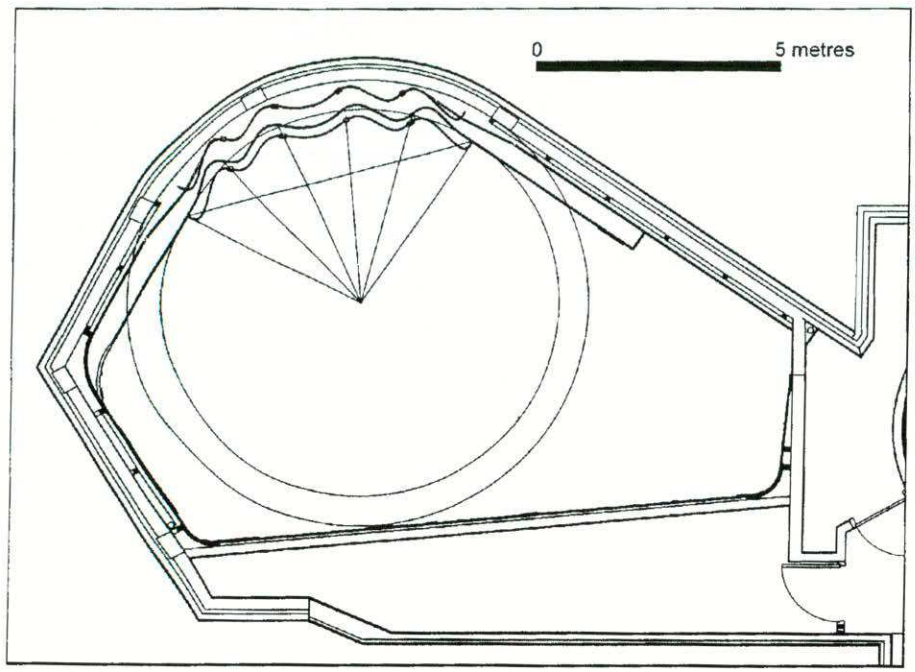


Fig. 3. Plan of Rehearsal Hall

Subjective listening tests to piano and clarinet music in the hall indicated a very uniform sound field with no evidence of focusing. Furthermore, both instruments produced an expansive sound with a very good balance between clarity and reverberance. Both musicians found the hall easy to play in. Objective measurements relating to diffusion have not yet been carried out.

The success of the Benslow project has led Arup Acoustics to consider the curve optimisation technique for providing diffusion for other projects. Currently, a design is being developed for a set of rehearsal halls where the modulations of the walls occur in both vertical and horizontal planes. It is hoped to report on the results in due course.

Fig. 4. View of diffusing wall in completed hall

## References

[1] P H Parkin, H R Humphreys and J R Cowell, 'Acoustics, Noise and Buildings', 4th Edition, Faber and Faber, (1979)

[2] M R Schroeder, 'Diffuse sound reflection by Maximum Length Sequences', JASA, 57, 149-150, (1975)

[3] P D'Antonio and T Cox, 'Two decades of sound diffuser design and development Part 1: Applications and Design', JAudioEngSoc, 46(11), 955-976, (1998)

**Dr R J Orlowski FIOA is at Arup Acoustics, St Giles Hall, Pound Hill, Cambridge CB3 OAE** ❖

# EPSRC AND THE INSTITUTE

A joint meeting was held between the representatives of the Institute of Acoustics and the Engineering and Physical Sciences Research Council (EPSRC Programme Managers for General Engineering and IT and Computing) on 20 September 2000. EPSRC funds research and postgraduate training in UK universities and other organisations.

The meeting was instigated by Professor Keith Attenborough FIOA of the University of Hull as the profile of acoustics appears to have recently declined within EPSRC. Overall, the Programme Managers were well disposed towards the Institute and interested in having further contact with it. A twelve point summary and action plan was drawn up including the following items.

EPSRC representatives reported that there was a relatively small volume of acoustics-related funding and no proposals related to fundamental acoustics, unlike subjects such as optics. EPSRC currently recognizes ISVR and Salford as main centres of excellence in acoustics research, but would welcome Institute advice on the extent and location of UK acoustics research.

Plans for Institute of Acoustics involvement with EPSRC programme planning were discussed, probably with a joint meeting in the spring.

Furthermore, EPSRC has indicated support for an acoustics-related Theme Day to enable discussions between EPSRC and acoustics researchers about funding, possibly attached to the Autumn Conference in 2001.

Other issues mainly centred on the funding calls within which acoustics research fell. Anyone wanting a copy of the twelve point list can email t.j.cox@salford.ac.uk.

Professor Attenborough is collating a list of grants concerned with fundamental aspects of acoustics for the information of EPSRC. If you are an investigator on such a grant, please email the title, grant number and abstract to K.Attenborough@eng.hull.ac.uk.

# EDITOR OF ACOUSTICS BULLETIN

The Institute is seeking applications from Institute Members for the post of part-time Editor of Acoustics Bulletin, with effect from January 2001. As all Members will know, the Bulletin is produced bimonthly and is the main means by which the Institute communicates with its members. It is a professional journal containing news for our members, technical articles designed to appeal to a wide readership, and advertising.

The role of the Editor will be to obtain suitable material for publication in the Bulletin and to work with the Editorial Board, the Advertising Manager and the Institute's appointed Publications Contractor to ensure that the high quality of the publication is maintained and it is published to an agreed schedule and cost plan.

Candidates should have a broad knowledge of acoustics and be ready to deal with people and subject matter covering the whole range of Institute activity. The post offers opportunities to attend Institute Meetings and Conferences, allowing the Editor to keep abreast of current developments and to maintain contact with those who work in the various subject areas.

Candidates need not have specialist publishing or reprographic skills, but must be willing to work with the Institute's appointed Publications Contractor, who will provide design, reprographic and printing services, and with the Advertising Manager, who will raise advertising copy.

The Editor of the Bulletin will be invited to attend meetings of the Publications Committee and meetings of the Bulletin and Register Board of Management and to contribute to the ongoing plans for the Bulletin.

Salary and terms: negotiable.

Applications for the post should be sent, together with a current CV, to:
*Roy Bratby, Chief Executive, Institute of Acoustics, 77A St Peter's Street, St Albans, Hertfordshire AL1 3BN*

# MEETING NOTICE

## One-Day Seminars

# THE ASSESSMENT OF WORKPLACE NOISE EXPOSURE

**Tuesday 21 November 2000**
**Commonwealth Conference Centre, London**

**Thursday 30 November 2000**
**Chamberlain Tower Hotel, Birmingham**

**Thursday 7 December 2000**
**Le Meridian Queens Hotel, Leeds**

These one-day seminars are designed as a refresher course for holders of the Certificate of Competence in Workplace Noise Assessment, but are also suitable for all persons involved with workplace noise. The programme includes information on the changes made to the HSE guidelines and will bring delegates up-to-date with the latest methods and techniques available to assist in carrying out a competent assessment.
Early booking is advised as each day will be limited to a maximum of 50 delegates to allow effective interactive sessions.

### Programme

| | |
|---|---|
| 10.00 | Registration |
| 10.30 | Introduction |
| 10.45 | Latest HSE Guidelines, Including Changes to Certificate Syllabus and Examples of New Calculation Methods |
| 11.45 | Review of Making Competent Assessments and Reports |
| 12.15 | Summary of Morning Session |
| *12.30* | *Lunch* |
| 13.30 | Case Studies and Structured Exercises. Delegates Split Into Groups and Prepare Responses to Questions Related to Case Studies of Workplace Noise Assessments |
| 15.00 | Discussion of Group Responses |
| *15.30* | *Tea* |
| 15.45 | Discussion, Including Specific Problems Raised by Delegates |
| 16.30 | Close of Meeting. |

---

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# CALL FOR PAPERS

## One-day Meeting

### Measurement and Instrumentation Group

# To Verify or Not to Verify That is the Question

### 14 February 2001: London Venue

As the concepts of legal metrology become more accepted by the acoustics community, the pattern evaluation of new designs of measuring instruments by their manufacturers along with the routine periodic verification of their performance by users are becoming routine. There is now considerable experience of the application of the British Standard BS 7580 with a number of calibration laboratories offering the tests it sets out; in addition there is the overlay of UKAS accreditation.

The objective of all of this is to raise the standard of professional practice in respect of the quantification of noise and to ensure equity for all those who will be affected by the resulting measurements. In the good old days however, we just believed the manufacturer's statement of compliance and went into the field with nothing more than our trusty old calibrator - a device for calibrating not to be calibrated!

So were things so bad that we need to add all this extra cost and administration just to prove we were doing it right all along? If you have any opinions or personal experiences you would like to add to the debate let us have a note of the contribution that you would like to make. This meeting will form part of the consultation exercise of the IOA designed to feed opinions to the UK members of the International Standards Committees who are working on the new sound level meter and calibrator standards that could well considerably strengthen the pattern evaluation and periodic verification requirements for sound level meters.

Please send your outline contributions to:

Ian Campbell MIOA
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# CALL FOR PAPERS

## Underwater Acoustics Group

## 2nd Symposium on

# Underwater Bio-Sonar Systems and Bioacoustics

## Loughborough University, UK

## 23/24 July 2001

It is now over 2 years since our last conference on this theme, and a review of new developments in the field is becoming overdue. The ever-increasing public interest in the interaction between human activity and the marine environment has led to enhanced priorities in all aspects of underwater bioacoustics. There is a need to consider the environmental impact of man made noise but also, in a less direct sense, acoustic techniques as a means of remotely studying the marine environment continue to develop. In addition, we can learn much from the many examples of sophisticated acoustic systems where evolution has shaped the biological sensory system to achieve performance in excess of that obtainable by conventional signal processing.

The purpose of this conference will be to review the present state of this continually evolving subject and to report on new developments and future trends. Particular themes of the conference will include, but are not restricted to

*Sound production and reception mechanisms in marine organisms.*
*Impacts of underwater sound - environmental assessment.*
*Data capture systems for the localisation and classification of natural underwater sound sources.*
*Performance evaluation of biological sonars.*
*Classification and analysis techniques for bioacoustic signals.*
*Problems and mitigation of shipstrike - collisions between marine mammals and ships and boats.*

The conference proceedings will published in Vol. 23 of the Proceedings of the Institute of Acoustics, and copies will be available at the start of the conference. This publication carries ISSN and ISBN numbers, and papers will be refereed.

Prospective authors are invited to submit an abstract of up to 300 words as soon as possible, but not later than 4th December 2000, indicating whether their proposed paper is better suited to oral or poster presentation. Successful authors will be notified by 8th January 2001. Complete manuscripts may be up to 10 pages long, including diagrams, and these must be submitted electronically using the IoA camera ready format (an MS Word-97 template file will be available via the web site).

Papers for refereeing must be submitted by 5th March 2001, and all final manuscripts must be in the hands of the conference organisers by 7th May 2001 (those arriving after this deadline will not be printed).

All enquiries relating to this conference should be addressed to the organisers:

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Tel: +44 (0) 1509 22-7076
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Abstracts should be sent to David Goodson at the above address, preferably by e-mail.

The latest information will found at the conference web site: http://sonar-fs.lboro.ac.uk/uag/ioa

# MEMBERSHIP

The following were elected to the grades shown at the Council meeting on 5 October 2000

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Goodson, A D

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Cox, B T
Dutton, A J
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**Associate Member**
Bignall, C G
Deacon, R J
Hayes, S
Johnston-Wood, C R
Kirby, L D
Oakton, C I
Parkin, L K
Raisborough, M J

**Associate**
Camp, R S

**Student**
Edwards, P J
Hales, C M
Hounslea, A S
Jack, S H
Pengelly, I J

# INSTITUTE DIARY 2000/1

## 2000

**2 NOV**
IOA CofC in W'place Noise Committee
*St Albans*

**7 NOV**
Draft Code on Noise from Pubs and Clubs Working Group
*St Albans*

**9 NOV**
Meetings Committee
*St Albans*

**10-11 NOV**
Autumn Conference Industrial Noise, Industrial Noise Group Conference
*Stratford upon Avon*

**15 NOV**
London Branch Annual Dinner
*London*

**17 NOV**
IOA Certificate of Hand Arm Vibration Exam
*Accredited Centres*

**17-19 NOV**
Reproduced Sound 16 Electroacoustics Group Conference
*Stratford upon Avon*

**20 NOV**
Engineering Division Committee
*St Albans*

**2 NOV**
IOA CofC in W'place Noise Committee
*St Albans*

**21 NOV**
Workplace Noise Assessment Seminar
*London*

**21 NOV**
North-West Branch Evening Meeting – Noise and Health – Too Many Eurodecibels??
*Manchester*

**28 NOV**
IOA CofC in Env Noise Measurement Committee
*St Albans*

**30 NOV**
Distance Learning Sub-Committee, Education Committee
*St Albans*

**30 NOV**
Workplace Noise Assessment Seminar
*Birmingham*

**5 DEC**
Executive Committee
*St Albans*

**7 DEC**
Workplace Noise Assessment Seminar
*Leeds*

**7 DEC**
Medals & Awards Committee, Council
*St Albans*

**12 DEC**
Hand Arm Vibration Committee
*St Albans*

**13 DEC**
London Branch Evening Meeting on Cinema Sound
*London*

## 2001

**17 JAN**
London Branch Evening Meeting on Rodents and Ultrasound
*London*

**14 FEB**
Measurement and Instrumentation Group One-Day Meeting – To Verify or Not to Verify - That is the Question
*London*

**9-11 APR**
Underwater Acoustics Group Conference – Acoustical Oceanography
*Southampton*

**23-24 JUL**
Underwater Acoustics Group Conference – Second Symposium on Underwater Bio-Sonar Systems and Bioacoustics
*Loughborough*

# A VISIT TO CASELLA CEL AT BEDFORD

John W Tyler FIOA

*This is the final article on the three Key Sponsors of the Institute of Acoustics. However it is hoped to continue the series of company profiles in a broad range of subject areas associated with the world of acoustics.*

## Introduction

Another 'strategic' alliance was formed when Casella took over CEL Instruments Ltd from Welch Allyn in 1998. On 15 August 2000 Bob Selwyn welcomed me to Kempston and told me in some detail the story of the events leading up to this landmark union. Later Paul Rubens filled me in with more details of the Casella side of the story during a very interesting visit to the impressive Casella CEL Headquarters in Regent House, Kempston, Bedford. Unfortunately, due to some senior staff being away on holiday or business, a group photograph at the time was not possible. Thus Bob Selwyn had the unique opportunity of visually representing the company, Paul Rubens having vanished before the camera was produced! (Figure 1). Bob then took me on a tour of the building that houses the product design, production, testing and calibration as well as the administrative side of the business (Figure 2).

## Company History – CEL Instruments Ltd

Bob Selwyn, Product Manager (Noise Products), was well qualified to tell me the origins and development of CEL Instruments Ltd as he has been with the company for 21 years.

Computer Engineering Ltd was started in the late 1960s by Reg Norgan, an engineer skilled in digital techniques, at a time when digital methods were fairly new. The original set-up was very much 'cottage industry' with a total of four people to handle design, production, sales and accounts. They produced components for the fledgling computer industry, for example modems, line isolators and memory cards in the days when a computer occupied a fair sized room with everything in racks. This small company designed and had made by subcontractors in the area surrounding Hitchin, components like printed circuit boards, which they then tested and sold to computer manufacturers.

In 1972, as a result of their growing reputation as innovators, they were given a contract from NPL to design and make a prototype direct reading noise average meter, effectively the first $L_{eq}$ meter, to help NPL with their surveys of noise in the workplace, work which eventually led to the Noise at Work Regulations. This was the first instrument of its kind to obviate the need to first record the sound and then analyse the recording back at the office, Figure 3.

Then a new sales director, Ian Campbell (yes, the present Institute Past President!), joined the company. Ian had previously worked for Acos and Amplivox and had a lot of experience in acoustic instrumentation including sound level meters. He thus steered the company towards the acoustic side of things and the business expanded steadily, largely as a result of the increased design and production of sound level meters.

**Product Development**

The designs followed the needs both for more compact instruments, for example personal noise dosimeters, and the demand from environmental noise practitioners, driven by the Control of Pollution Act, for analysers to measure the L percentiles.

The latter need was for robust instruments that would stand up to being placed in people's back gardens, on construction sites and by the side of roads. These needs were satisfied by a range of instruments with remote microphones and in which the calculations required were done inside the instrument box without the need for additional tape analysis with a level recorder. The microphones used at that time were either Brüel & Kjær or General Radio precision capsules.

The next development was of printer units with timers for connection to the $L_{eq}$ and $L_{n\%}$ meters so that the combination could be left on-site to print the results every pre-set time period as long as was necessary. A natural extension to this stage was to put the printer, $L_{eq}$ meter and $L_n$ meter into a single box to form an environmental noise analyser with a remote microphone. This development effectively launched Computer Engineering Ltd into the local authority and environmental health markets and brought about the change of name in 1978 to CEL Instruments Ltd to minimise the computer aspect of their products which was by now in decline.

Shortly after this, Lucas, who already owned Dawe Instruments, bought CEL from the original owner, Reg Norgan, and made the decision that CEL would concentrate on the higher, more sophisticated products while Dawe would continue with the production of the simpler, general purpose, instruments.

In 1978 CEL released their first hand-held sound level meter (the CEL-175) with built-in microphone as opposed to the environmental boxes with separate microphones; in other words the first CEL SLM to look like they all do today, Concorde like!

CEL claim to have been the first company to produce direct integrating battery operated hand-held meters that did not require a heavy external battery, due to the development of low current drain circuits. These designs involve circuits where sections not being used at a particular moment in time are powered down until needed again, the switching taking place at sub-millisecond intervals and resulting in a substantial reduction in over-

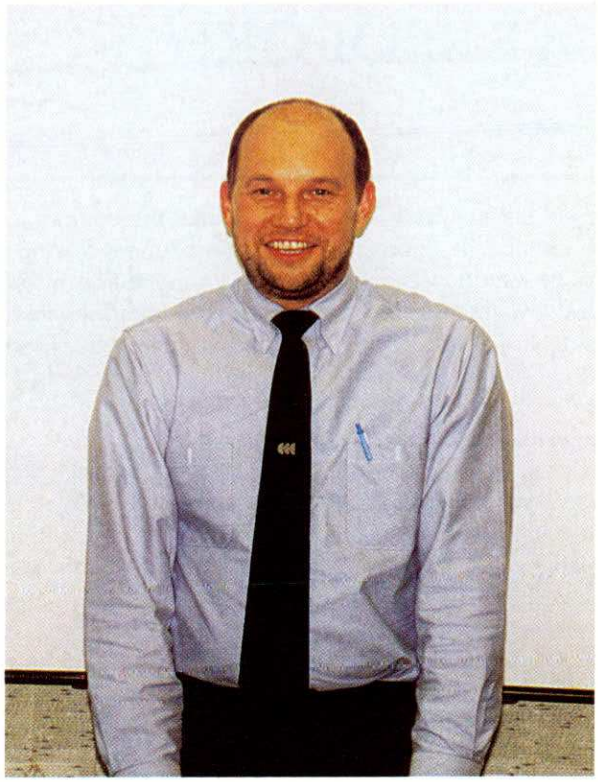
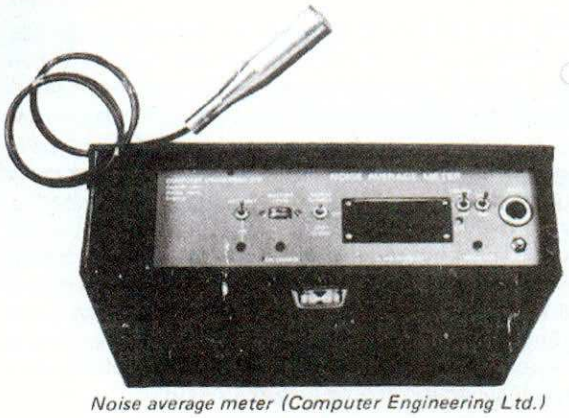


Fig. 1. Bob Selwyn, Product Manager, Noise and Vibration

all power consumption and hence increase in battery life.

Throughout the 1980s CEL produced a range of acoustics products in other areas such as signal conditioning and control amplifiers. These were required by local authorities, who were still using reel to reel tape recorders (Uher model 4000) to do complaint work, to enable the measuring microphones to be connected to the recorder. These took their power from the tape recorder and provided gain and frequency weighting to the microphone signal. They could also control the switching of the tape recorders to turn them on and off at certain times for unattended recordings.



Noise average meter (Computer Engineering Ltd.)

Fig. 3. Early CEL Noise Average Meter, circa 1972

Largely as the result of requests from the EHOs, and for a limited period of about six years, CEL entered the field of entertainment noise monitoring and control. However, this did not prove to be consistent with the direction in which the company was heading with the more mainstream meters. Also in this period, CEL produced equipment for airport noise monitoring and semi-permanent noise measurement systems for users such as the National Coal Board to measure noise levels from open cast mines. This was as a result of the reputation for robustness and reliability CEL equipment had achieved. By the end of the decade CEL had decided to concentrate on the hand-held range of products and so the airport monitoring system work was halted in favour of other technologies.

At this stage the Lucas group decided to rationalise the Dawe product range which was becoming dated, so they closed down the instrument manufacturing at Dawe and transferred the acoustic, vibration, stroboscope and ultrasonic leak detection business from west London to the main CEL factory at Hitchin. CEL then phased out the manufacture of what had been the earlier Dawe labelled range of sound level meters and introduced an updated range of CEL/Dawe low cost meters to go into other resellers' catalogues and to enable CEL to sell through distributors in other geographical regions. The manufacture of Dawe strobes, vibration meters and leak detectors continued only for a short while after the transfer as the company concentrated on the primary acoustic business.

Fig. 2. Casella CEL Headquarters in Bedford

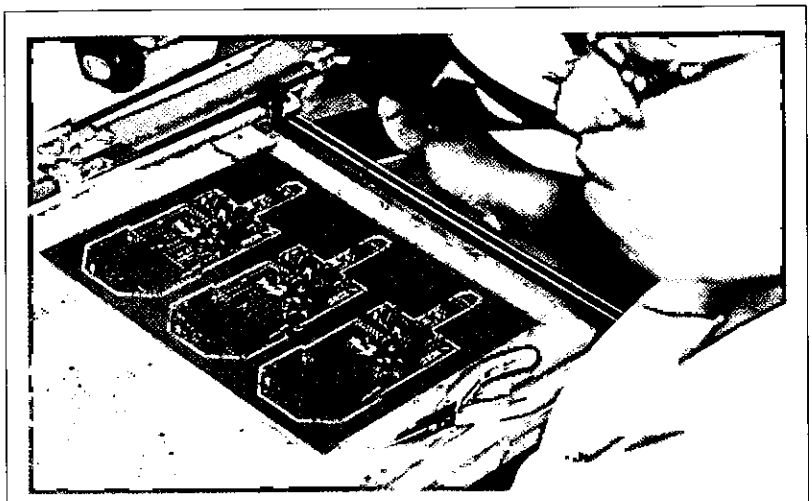


Fig. 4. Manufacturing the printed circuit boards in a CEL- 200 series meter.

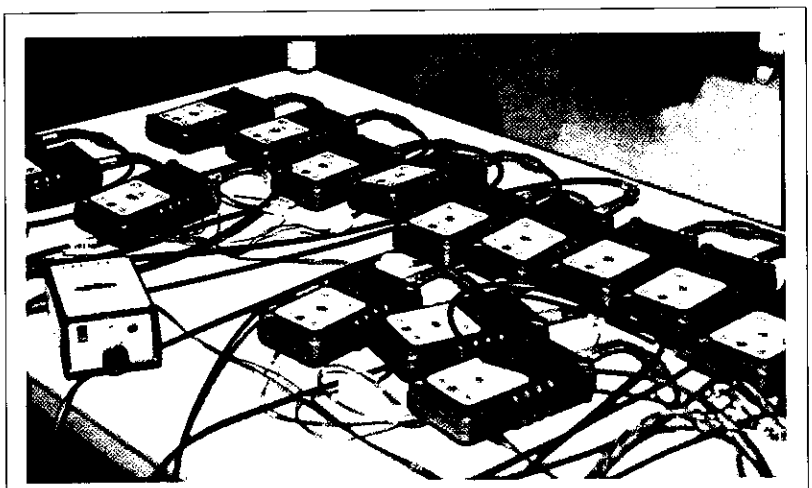


Fig. 5. CEL-460 noise dosimeters undergoing soak testing

**International Activities**

By the mid-1980s CEL had established a sales office in the USA, a small office in a Lucas building in the area around Detroit, and sales continued to grow in the American market. One of the first big contracts was to supply the USA OSHA (Occupational Safety and Hygiene Association) with simple meters for their inspectors to use in visits to factories. This was in the face of stiff local competition with General Radio, Quest and others. As the business expanded, the CEL office was relocated to the Washington area, to reduce problems arising from different time zones. CEL continued to increase sales in the American market throughout the 1990s, not only sound level meters but also personal noise dosimeters, a big market in the USA. Primary customer groups are the health and safety markets and noise nuisance measurements.

Whereas in the 1980s nearly 80% of the business was in the UK, by the end of the 1990s a third of the business was in the UK, one third in the USA and a third in the rest of the world. With built-in firmware most modern microprocessor-based CEL instruments can be localised by agents or customers in other countries so that the display is in the correct language; literature is produced in the 5 major languages.

**Current Products**

CEL have concentrated on producing families of instruments which have a certain similarity both in the high end of the market and at the lower end too. For example, simple sound level meters meeting type 2 general purpose accuracy are available as the CEL-200 series (Figure 4) and a family of dosimeters for the workplace noise market, the CEL-420/460 series (Figures 5 & 6). In the middle range of octave- and third-octave band sound level meters, the CEL 440/480 series offer a wide range of useful features.

Finally, the CEL-500 series of real time analysers offer many sophisticated measurement modes for specialised measurement systems for building acoustics and long term environmental noise logging. Figure 7 shows part of the service department; a personal noise dosimeter is being serviced.

As with other manufacturers' products, those of CEL Instruments Ltd have been described in the New Products section of *Acoustics Bulletin* over the last two or three decades.

**Ono Sokki**

Since 1983 CEL have been agents for the Japanese company, Ono Sokki, who make high quality single and multi-channel spectrum analysers and more recently, acoustic and vibration products which complemented the CEL range of hand-held instruments. This arrangement, in use for the past 16–17 years, has worked very well. Ono Sokki is well known in the automotive industry both with manufacturers and

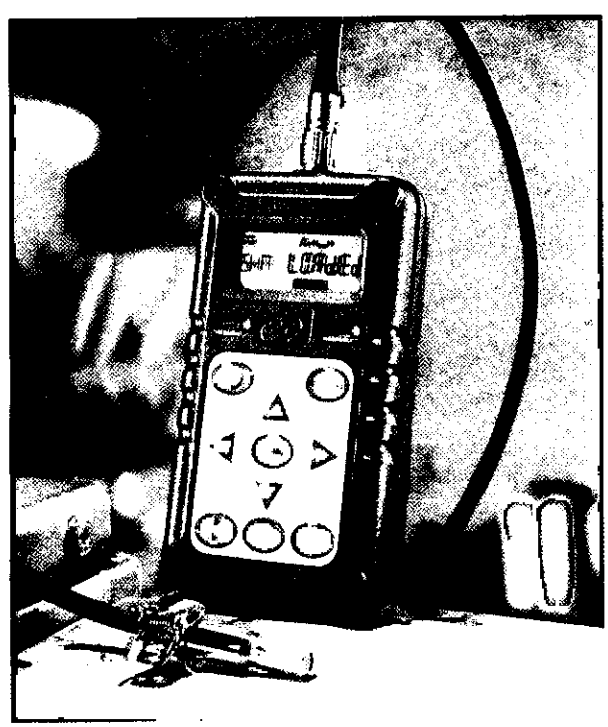


Fig. 6. CEL460 Logging Noise Dosimeter

component suppliers. The fit with CEL was very good because at that time CEL were still part of the Lucas organisation and that group was mainly involved in the automotive and aerospace industries.

**Other Developments**

In the early 1990s CEL bought a UK company called Datalab which made high speed transient waveform recorders used, for example, in the nuclear industry or for multi-channel crash testing of vehicles. The integration of Datalab into the company proved to be difficult at a time of the rapid development of PCs and software-based systems and the recession in general engineering in many European countries.

By this time CEL and Datalab had moved to larger premises in Hitchin and the decision to discontinue the Datalab products was taken to allow the company to concentrate on the core business of acoustics products. This released extra accommodation that was used to increase the effort put into instrument development and customer training.

The increased demand for training was driven by the advent of new noise legislation and the consequent need to train customers to use CEL instruments. By the time the numbers attending courses grew to 100–150 the existing accommodation on site became inadequate and so courses were held in other, specialist conference buildings including a large old country house on the outskirts of Hitchin.

By the mid 1990s, Lucas, who had been going through a recession, were looking to consolidate their business into their traditional areas of automotive and aerospace and thus wanted to dispose of non-core businesses. Earlier in the USA, Lucas had bought GSI, a large audiology company and had combined this with CEL to form Lucas Acoustic Technology based on the East coast.

**Welch Allyn**

In 1993 Lucas sold CEL and GSI to Welch Allyn, an American medical company, who wanted to expand into medical audiology and noise measurement. During this period Bob Selwyn ran the American CEL office for two years. In 1998 Welch Allyn decided that sound level meters and audiometers did not, after all, fit into their range of medical products and sold CEL to the Casella Group who were wanting to expand into the area of noise monitoring equipment. For 200 years Casella been a British environmental company and their long and distinguished history is outlined below. The transfer took place in October 1998 with the whole of the operation of CEL at Hitchin being transferred to the current Casella site at Bedford in April 1999.

**NAMAS**

CEL have maintained a NAMAS accredited acoustic calibration lab for over 12 years, the longest independent acoustic calibration laboratory outside the Ministry of Defence (MOD). Even longer than another major acoustics supplier – as Bob was proud to point out! MOD, CEL, B&K, Acquila and NPL are currently the only NAMAS accredited acoustic calibration laboratories.

CEL has also gained accreditation for many of their products from PTB, the independent German testing laboratory, which gives instrument manufacturers a third party accreditation for their products in Europe.

## Company History – Casella

Paul Rubens, Sales and Marketing Director, spoke to me about the background to Casella. This element of the Casella Group manufactures a wide range of environmental monitoring equipment and services covering the areas of environmental quality and climate assessment, occupational health and safety and meteorology.

The company was established in Holborn, London, in 1799 during the reign of George III, by Cesare Tagliabue, an Italian immigrant who was an instrument manufacturer/engineer. Louis Pascal Casella joined him in 1812 and they worked together until about 1830 when Tagliabue was bought out by Casella. The business continued as a Casella family concern through three generations until the early 1900s when a partner, Abrahams, took over and the last of the Casellas dropped out. Casella the business then went on through three generations of Abrahams until the last, Tony, sold the business in 1993 in a management buy out.

In the early years the product ranges being exported around the world included exploration, navigation, photographic, meteorological and medical research instruments. During the two World Wars the company expertise in optics, compasses and photogrammetry equipment was put to good use while in more recent years Casella has designed and built dust monitoring equipment for the deep mining industry and developed solutions to environmental health issues in the coal and extractive industries, petrochemical, electronic and nuclear industries.

During this long period the company has contributed to several historical events. For example Casella supplied Charles Darwin with meteorological and navigational equipment for his voyages on the Bounty. They provided Dr Livingston's expeditions with equipment to measure atmospheric pressure, humidity and temperature.

The company invented the first clinical mercury-in-glass thermometer in the mid-nineteenth century and designed and made a special watch for the Scott expedition to the South Pole in 1900. This watch provided the means to obtain the directional information that was not available from the magnetic compasses of the day that did not work near the poles. The design was patented (long since expired) and CEL has a copy of the Patent. The watch supplied to Scott was lost with the party but two more were made, one owned by a descendant of one of the victims and the other by the Science Museum. Over 200 items of Casella equipment that have been manufactured over the years are now held by the Science Museum.

During the 19th century the product range continued to grow and Casella exhibited instruments, including theodolites and other surveying equipment at the first Great Exhibition held in the Crystal Palace, Hyde Park, London in 1851.

## The Association of Noise Consultants

The Association of Noise Consultants (ANC) is a non-profit organisation formed to promote the reputation of professionals in the field of noise control engineering.

The primary purposes of the Association are to:

- *promote engineering solutions to noise problems*
- *improve and control the quality of service offered*
- *advance the reputation of the profession*

The ANC publishes guidance documents to ensure uniform technical competence is achieved. Membership is open to practices able to demonstrate to the satisfaction of the Association that:

- *the necessary professional and technical competence is available*
- *a satisfactory standard of continuity of service and staff is maintained*
- *there is no significant financial interest in acoustical products.*

In addition, members are required to carry a minimum level of professional indemnity insurance.

There are currently more than 50 member companies and practices, mainly in the UK, with 2 in Europe.

Any company interested in becoming a member of the ANC should contact Gwen Rhein at the address below to receive a membership pack.

6 Trap Road
Guilden Morden
Nr. Royston
Herts.
SG8 0JE
Tel: 01763 852958
Fax: 01763 853252
Email: anc@ukgateway.net

Fig. 7. Servicing a personal noise dosimeter

**Company Expansion**

Six years ago turnover was £2.5m; with the subsequent expansion and the acquisition of CEL in 1998, the current year's turnover is expected to be in the order of £25m. As the Casella Group is actively pursuing the acquisition of additional companies this turnover is set to increase further in the years to come.

**Other Elements of the Casella Group**

- Casella Science & Environment is the company consultancy and they are in the process of integrating with Stanger Science & Environment which they bought a few months ago.
- Greater Manchester Scientific Services is Casella's analytical side. This is a Public Analyst's Laboratory based in Manchester with 30 staff. The laboratory is UKAS accredited for a number of disciplines including asbestos, air, water, soil, food and radioactivity. Their performance is continuously monitored through participation in external analytical proficiency schemes.
- Overseas activities – currently Casella has 15 offices throughout the UK, a wholly-owned subsidiary company in the USA in Amherst, New Hampshire and one in Madrid, Spain, Casella Espana SA which sells all the Casella and CEL instrumentation products.

Another company in Nigeria employs three British nationals and a number of local Nigerians to service a particularly large contract with an oil refinery. There are staff continuously stationed in Bahrain providing a local service to the oil industry. Several other international consulting jobs are in progress. Casella has 97 international distributors on the instrumentation side.

**Senior management staff**
At the present time the senior members of staff are as follows:

William Pope: Group Managing Director
Ian Simpson: Group non-Executive Chairman
Paul Robson: Group Finance Director
Paul Rubens: Sales and Marketing Director
Mike Whelan: Production Director
Steve Tearle: Applications Engineering Manager
John Killen: UK Sales Manager
Alan Townsend: Quality Manager
Bob Selwyn: Product Manager (Noise Products)

## Conclusion

Thus ended an interesting and informative visit to another manufacturer of acoustic instrumentation who has demonstrated their support of the Institute of Acoustics by being a Key Sponsor. As with the other two Key Sponsors, CEL, now Casella CEL, has been through a tortuous period of development and has survived with greater strength and the resources to succeed in the future.
The IOA is grateful for the continued support of Brüel & Kjær, Casella CEL, and Cirrus, and indeed all the Sponsoring Organisations and wish the companies well in the future.

**John W Tyler FIOA was formerly at the Transport Research Laboratory and is an Associate Editor of Acoustics Bulletin. He also took the photographs for this article except Fig. 6.** ❖

# NOISE ON THE NET NO 5

Matthew Ling MIOA

This is the fifth of a series of articles written with the aim of introducing you to some of the sources of information on noise and acoustics that can be found on the internet. The previous articles can be found in web format at the IOA's website http://www.ioa.org.uk/ or in MS Word form at http://www.bre.co.uk/acoustics/

## Associations and Organisations

Institute of Acoustics (IOA)
http://www.ioa.org.uk/
Association of Noise Consultants (ANC)
Contains a list of contact details for members, with email and website addresses.
http://www.association-of-noise-consultants.co.uk/

## General Sources of Noise News and Information

I/INCE now have their list of internet resources on their website.
http://users.aol.com/iince1/noiseart.html
Information for Industry publishes Noise Management, with back issues available on its site.
http://www.ifi.co.uk/
Noise Pollution Clearing House (NPC) is a US based pressure group with comprehensive online noise resources.
http://www.nonoise.org/
Noisenet contains a very useful search facility for acoustic consultants in the UK, along with some helpful descriptions of legislation.
http://www.noisenet.org/
NoiseWatch (formerly Citizens' Coalition Against Noise) is a non-profit volunteer organization based in Canada dedicated to raising public awareness of the negative effects of noise. The site contains a useful document submitted to Toronto's Board of Health on links between noise and health.
http://www3.sympatico.ca/noise/
The UK Quiet Pages provides a summary of noise in the news in the UK, with relevant links to information sources. The site also has a comprehensive listing of noise and acoustics books via Amazon.
http://www.quiet.org.uk/
The Virtual Times audio and acoustic links is one of the most comprehensive listings of useful sites. An excellent starting place if searching for information or contacts.
http://hsv.com/scitech/audio/

## Academic

**Brazil**
Federal University of Santa Catarina, Florianopolis – Laboratorio do Conforto Ambiental, (Note that this site is all in Spanish).
http://www.arq.ufsc.br/~labcon/

**UK**
Cambridge University – Auditory Perception Group
http://hearing.psychol.cam.ac.uk/

## Transportation

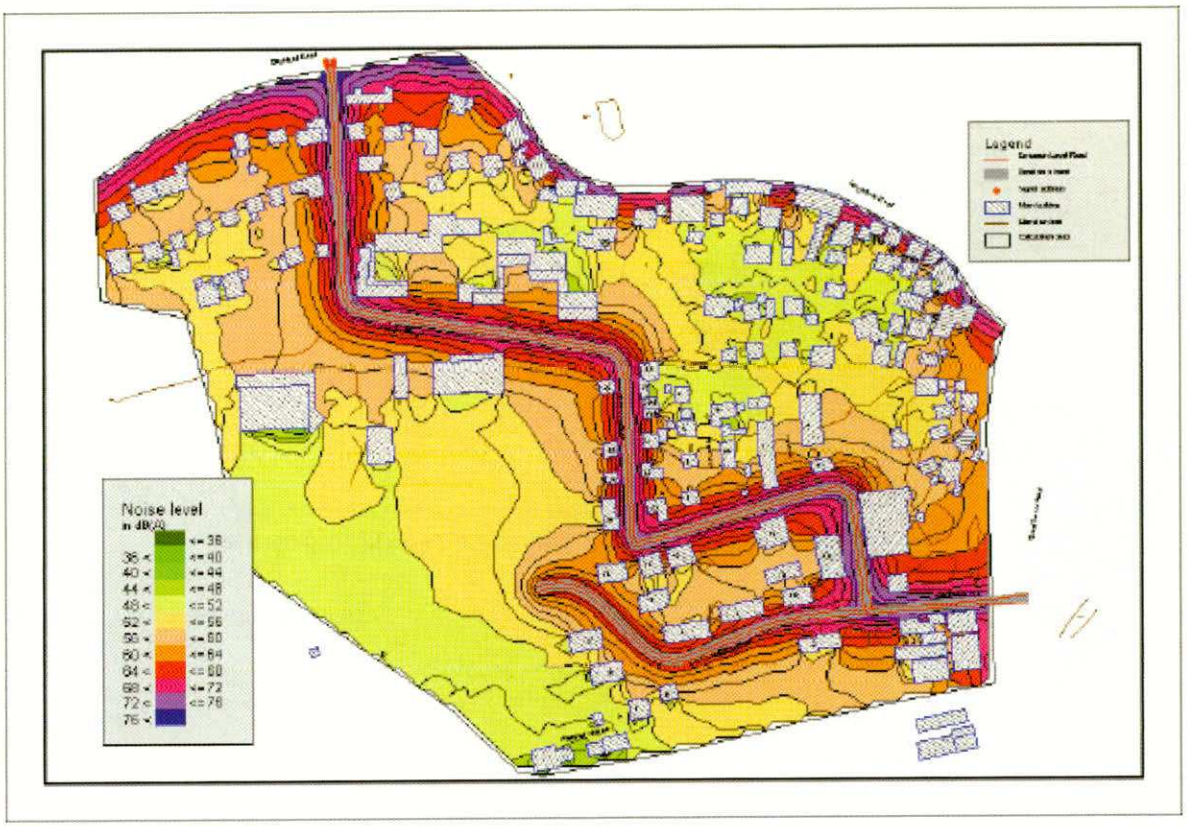
RAF Halton
http://www.health.demon.co.uk/NVD.htm
Ricardo are a world authority on powertrain, testing and technology, dedicated to refining (reducing/tuning noise and vibration) of powertrains and vehicles, with one of the largest national vehicle noise and vibration facilities.
http://www.ricardo.com/
The Wall Journal contains the International Journal of Transport Related Environmental Issues which has a link to a discussion forum on noise barriers.
http://www.thewalljournal.com/

## Government

EU DG Environment noise section has a list of current and proposed noise directives.
EU draft directive on relating to the Assessment and Management of Environmental Noise COM (2000)468
http://europa.eu.int/comm/environment/noise/
http://europa.eu.int/comm/environment/docum/00468_en.htm/
DETR consultation on control of noise from civil aircraft
http://www.aviation.detr.gov.uk/consult/conofnoise/index.htm/
As ever, if you know of sites that have passed me by, then contact me at mailto:lingm@bre.co.uk and I'll feature them at a later date.

**Matthew Ling MIOA is Senior Researcher with the Acoustics Centre, BRE, Watford**
 ❖

# NOISE MAPPING

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**Notts**
**DN22 6AJ**

**Telephone: 01777 707072**
**Fax: 01777 707991**
**e-mail:kcaacoustics@cs.com**

**Tony Holdich**
**Applied Acoustic Design**
**The Green Business Centre**
**The Causeway**
**Staines**
**Middlesex**
**TW18 3AL**
**01784 464404**
**01784 465447**
**mail@aad.co.uk**

# NPL'S NEW UNDERWATER ACOUSTICS PRESSURE VESSEL FACILITY

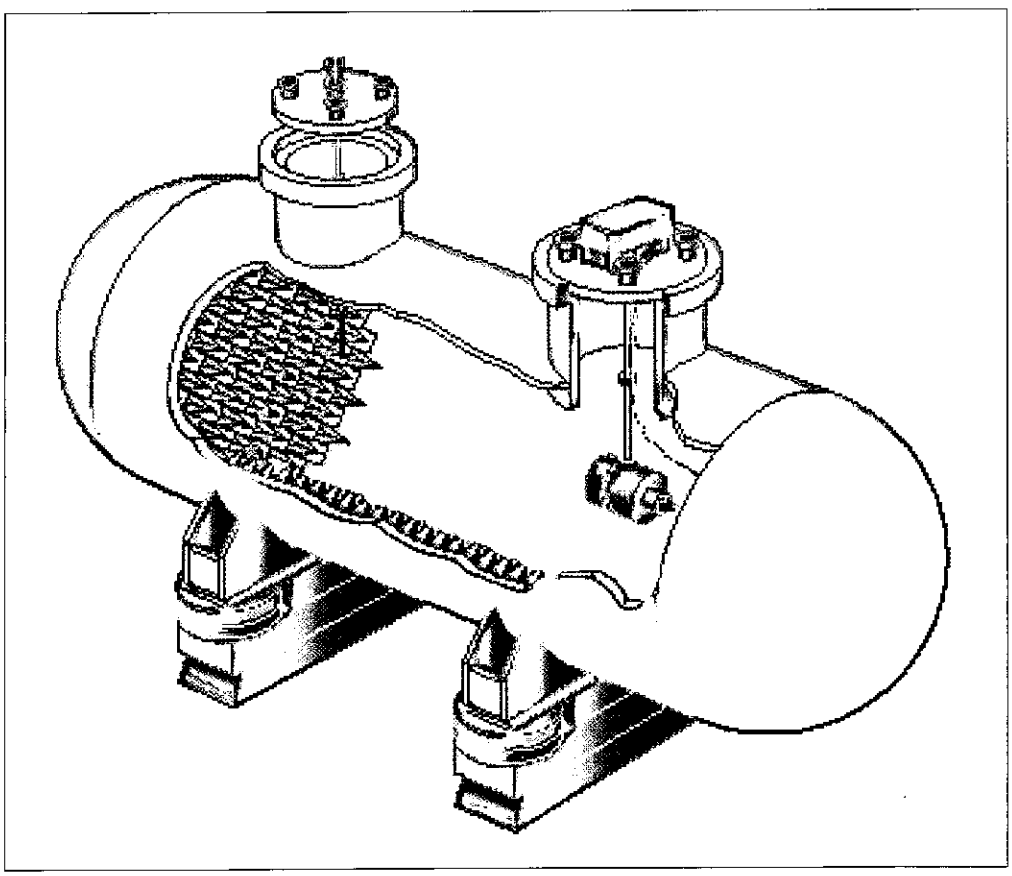
Brian R Chapman

Europe's largest commercially available underwater acoustics pressure vessel facility is now open for business at the National Physical Laboratory. Based in Teddington, SW London, NPL is the UK's national standards laboratory and has an internationally renowned reputation for undertaking independent calibration, test and verification of acoustical devices. This new purpose-built acoustic pressure vessel facility will provide for the first time vital measurements needed by manufacturers of sonar equipment used in the oil and gas, oceanographic and defence industries.

The facility features a 7.5 long 100 tonne steel pressure vessel that is acoustically lined with access ports capable of accepting devices up to 0.84 metre diameter. NPL's facility is designed for acoustic testing of underwater acoustical devices over the frequency range 1 kHz to 2 MHz, and under simulated ocean conditions to a depth of 700 m with a temperature range of 2°C to 35°C. The pressure vessel is owned by the UK's Defence Evaluation and Research Agency (DERA) and is provided on permanent loan to the UK Department of Trade and Industry (DTI) and operated at NPL. It was acquired from the Underwater Sound Reference Division in Orlando, Florida, USA, and will now form an essential part of the UK National Measurement System for underwater acoustics.

Manufacturers and defence contractors face increasing demands from customers and quality assurance regimes to establish the acoustical performance of complex state-of-the-art devices used for deepwater operations at temperatures well away from ambient conditions. Recognising these commercial and quality assurance trends, NPL's experienced acousticians are developing a facility with a test capability that will contribute significantly to reducing the risk of acoustical failure in new devices and the costs associated with vessel hire and sea trials.

Applications would be at design, development and proof-of-principle stage, as well as production type testing and sampling. Future testing undertaken over a range of hydrostatic pressures and temperatures would include absolute acoustic measurements of transducers, projectors and receivers, the determination of material properties, beam forming characteristics, array performance, model simulations and pressure integrity testing. Measurement standards will be developed to provide industry with traceable calibrations.



NPL undertakes research primarily on behalf of government aimed at developing and maintaining measurement standards for the most important physical quantities. It regularly undertakes collaborative research projects with others making use of its facilities and measurement techniques to solve industrial problems and enhance the quality and competitiveness of manufactured products. NPL has a unique range of facilities and expertise in the field of underwater acoustics measurement in the UK. The pressure vessel builds on established facilities at NPL that include a large, 5.5 m diameter and 5 m deep, open test tank with a high-precision positioning system for the characterisation of acoustics fields generated by high frequency sonar systems. ❖

# SHAKING ALL OVER

## 27 June 2000

This one-day meeting, held at the Royal Society and run by the Measurement & Instrumentation Group, comprised not only an update of the *Getting a grip on hand-arm vibration* one-day meeting held almost exactly a year previously, but also some additional presentations on whole-body vibration. Forty-four delegates (including presenters) registered to catch up on the latest developments in the world of hand-arm vibration and receive an introduction to the issues of 'shaking all over'.

The morning session opened with a presentation from Chris Nelson (Health & Safety Executive) on the various national and international standards that relate to both vibration exposure and emission. As well as the proposed EN ISO 5349-1 that will draw on the better elements of existing BS and ISO standards, Chris looked ahead to consider future developments expected from ISO. Paul Pitts (Health & Safety Laboratory) continued with the topic of standards by describing the latest draft of EN ISO 5349-2, which will contain practical advice on measurements in the workplace and guidance for new practitioners. He outlined the contents of the standard and demonstrated the importance of considering all sources of uncertainty when making measurements.

The next few presentations described some practical experiences with various aspects of measuring hand-arm vibration. Richard Stayner (RMS Vibration Test Laboratory) gave a description of vibration problems found in agriculture and forestry. He presented vibration levels, references to relevant standards, and discussed measurement practicalities such as the effects of accelerometer mountings and the use of various measurement instruments. The development of a strategy for management of exposure was described by Kenneth Hill (Glasgow City Council). Kenneth also described field assessments of machines, considered the accuracy of the measurements performed, and discussed exposure guidelines based on dose values for individual machines. Paul Pitts also presented a paper by Liz Brueck (Health & Safety Laboratory) on experiences of assessing measuring instruments against ISO 8041. Assessments of four instruments have been made, and problems with the existing specifications and methods have been identified, and these areas will be under consideration in a full revision of this standard which is underway.

The afternoon session commenced with a presentation by Tim South (Leeds Metropolitan University) on the merits of frequency analysis of vibration over HA-weighted results. Tim had developed his experimental findings presented previously to include investigations of sources of measurement error and showed a number of examples of the potential of frequency analysis in investigating vibration problems. The session continued with a new area: medical exploration of hand-arm vibration effects. Dr Ian Lawson (Rolls Royce plc) gave a comprehensive account of the history and state of the art of assessment of vibration white-finger and other vibration-related disorders, including the vascular and neurological objective tests that are used in screening patients. Richard Stayner returned to present an introduction to whole-body vibration, describing the lack of suitable measurement standards and the prime importance for whole-body vibration exposure of the object the sufferer is sitting on. Richard showed data to suggest that lift-truck and farm equipment drivers are most at risk.

The final formal presentation came from Ian Critchley (Peninsular Acoustics) and covered a hand-arm vibration risk assessment undertaken for a public utility. This work involved recreating realistic measurement conditions to determine levels, risk evaluation in terms of a daily vibration dose, and implementing a management system and training programme to ensure that real benefits were reaped in the workplace. To conclude the day's events, meeting organiser Richard Tyler chaired a question and answer session with the assembled presenters which discussed topics including the new IOA course in hand-arm vibration and details of transducer mounting arrangements. The greater part of the discussion covered the various criteria for expected suffering from daily and weekly exposure to various levels of hand-arm vibration. The assembled experts were able to build on their excellent presentations, and the day as a whole showed that there is much progress being made in understanding the measurement of vibration from all sources.

*Peter Hanes MIOA*

# Eastern Branch Meeting

## 8 June 2000

On 8 June 2000 the Eastern Branch held what is turning out to be their annual half-day meeting in Bury St. Edmunds. It was decided that this year's topic would be instrumentation and four guest speakers were invited to attend to discuss and demonstrate their products, both hardware and software.

First to talk was Ian Campbell (Campbell Associates), not because he is Immediate Past President but because his surname was first alphabetically. Ian demonstrated the Cadna A noise prediction and noise mapping software. Using a few simple models, he showed the detail that could be incorporated into the prediction and the results that could be achieved. It would have needed a whole afternoon to go through it in any real detail.

Second up was Bob Selwyn from Casella CEL. Bob chose to talk about and demonstrate the EPM hand-arm vibration meter and to talk through some of the more important points about carrying out HAV measurements correctly. He also reiterated some of the details about the causes and symptoms of HAV and the very unpleasant effects it can have. As most people now realise, it is taking over from noise induced hearing loss as the major health risk in industry.

The next presentation was given by John Shelton of AcSoft Ltd. John ran through the 01dB dBfa32 software package, or 'virtual instrumentation'. This has many features including narrow and broad band and real time analysis and others too numerous to mention here but it can be very easily customised to provide the user with what they want instead of providing a tool of which possibly only 10% would ever be used seriously. Because it uses a Microsoft Windows environment it is compatible with office based systems and therefore will allow reports to be generated with all the analysed data as needed.

Last but not least was Peter Wilson from INVC Ltd. Peter discussed the user interface and some of the problems encountered by people who have tried to make measurements with overly complicated instrumentation. Using the eNVi noise and vibration hardware and software, he demonstrated the requirements for making good measurements especially in terms of frequency content, which is very important when trying to identify noise sources. He also discussed why he thought it was important to use DAT recorders in the field when obtaining noise data.

Finally, after the meeting the Eastern Branch Chairman, the Branch Secretary, the Institute's Immediate Past President and the Acsoft delegation consisting of two, went to the Nutshell pub for refreshments. Being the smallest pub in Britain meant that the five IOA members filled it to capacity – but what a good way to relax after a meeting.

*John Hustwick MIOA* ❖

# BSI News

## BS EN Publications

**BS EN ISO 4869**: Acoustics – Hearing protectors.
**BS EN ISO 4869-4:**2000 Measurement of effective sound pressure levels for level-dependent sound-restoration ear muffs. No current standard is superseded.
**BS EN ISO 7029:**2000 Acoustics – Statistical distribution of hearing thresholds as a function of age. Supersedes BS 6951:1988.
**BS EN 12354:** Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements.
**BS EN 12354-1:**2000 Airborne sound insulation between rooms. No current standard is superseded.
**BS EN 12354-2:**2000 Impact sound insulation between rooms. No current standard is superseded.
**BS EN 12354-3:**2000 Airborne sound insulation against outdoor noise. No current standard is superseded.
**BS EN 12545:**2000 Footwear, leather and imitation leather goods manufacturing machines – Noise test code – Common requirements. No current standard is superseded.
**BS EN 12668:** Non-destructive testing – Characterization and verification of ultrasonic examination equipment.
**BS EN ISO 15667:**2000 Acoustics – Guidelines for noise control by enclosures and cabins. No current standard is superseded.

## Special Announcements

**BS 3889:** Non-destructive testing of pipes and tubes.
**BS 3889-1:**1983 Methods of automatic ultrasonic testing for the detection of imperfections in wrought steel tubes. This part of BS 3889 has been replaced by part of BS EN 10246. The national foreword of this implementation of the European standard stated that when all relevant parts of BS EN 10246 were published, this part of BS 3889 would be withdrawn. This time has now come and therefore the above part is now withdrawn.

## New Work Started

**BS ISO 15186-3** Acoustics – Measurement of sound insulation in buildings and of building elements using sound intensity – Part 3: Special low frequency applications under laboratory conditions.
**IEC 60862-2** Surface acoustic wave (SAW) Part 2: Guide to the use of surface acoustic wave filters.

## Drafts for Public Comment

**00/203032 DC IEC 62092** Ultrasonics – Hydrophones – Characteristics and calibration in the frequency range from 15 MHz to 40 MHz (IEC Document 87/176/CDV) (Possible new British standard).
**00/562493 DC** Draft BS EN ISO 9614-3 Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 3: Precision method for measurement by scanning.
**00/562811 DC** Draft BS ISO 11205 Acoustics – Determination of emission sound pressure levels in situ at the work station and at other specified positions using sound intensity.
**00/562933 DC** Draft BS EN 352-6 Hearing protectors – Safety requirements and testing – Part 6: Ear-muffs with audio communications.
**00/562934 DC** Draft BS EN 352-7 Hearing protectors – Safety requirements and testing – Part 7: Level-dependent ear-plugs.
**00/709273 DC** ISO/DIS 5982 Mechanical vibration and shock – Range of idealized values to characterize seated-body biodynamic response under vertical vibration (Revision of ISO 5982:1981 and ISO 7962:1987).
**00/710065 DC** ISO/DIS 15086-1 Hydraulic fluid power – Determination of the fluid-borne noise characteristics of components and systems – Part 1: Introduction.
**00/710581 DC** ISO/DIS 14839-1 Mechanical vibration – Vibration of rotating machinery equipped with active magnetic bearings – Part 1: Vocabulary.

## CEN European Standards

**EN12354:** Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements.
**BS EN 12354-1:**2000 Airborne sound insulation between rooms. Note: Implemented as BS EN 12354-1:2000.
**EN 12668:** Non-destructive testing – Characterization and verification of ultrasonic examination equipment.
**EN 12268-1:**2000 Instruments. Note: Implemented as BS EN 12268-1:2000.

## CENELEC Publications

**EN 60068:** Environmental testing
**EN 60068-2-47:** Test methods – Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests. Corrigendum: June 2000 to EN 60068-2-47:1999.

## IEC Publications

**IEC 60704:** Household and similar electrical appliances – Test code for the determination of airborne acoustical noise.
**IEC 60704-2-13:**May 2000 Particular requirements for range hoods.

## ISO Publications

**ISO 5577:**2000 Non-destructive testing – Ultrasonic inspection – Vocabulary (Bilingual edition). No intention to implement (BS EN 1330-4 is equivalent standard).
**ISO 7029:**2000 (Edition 2) Acoustics – Statistical distribution of hearing thresholds as a function of age. To be implemented as BS EN ISO 7029.
**ISO/TS 10811:** Mechanical vibration and shock in buildings with sensitive equipment.
**ISO/TS 10811-1:**2000 Measurement and evaluation.
**ISO/TS 10811-2:**2000 Classification.

**ISO 11342:** Mechanical vibration – Methods and criteria for the mechanical balancing of flexible rotors. Technical corrigendum 1:2000 to ISO 11342:1998.
**ISO 15667:**2000 Acoustics – Guidelines for noise control by enclosures and cabins. To be implemented as BS EN ISO 15667.

**This information was announced in the July and August 2000 issues of BSI Update, copies of which are kept in the Institute library.**

# Book Review

**Sound Reinforcement Engineering**
**Ahnert & Steffen**
**Spon 1999**
**ISBN 0419218106**
**Price: £85**

The publication covers all the aspects of sound reinforcement in quite some depth. It addresses a very wide range of issues and is very comprehensive in its field of coverage. This includes sections on functions, components, calculations, system design, calibration and testing of sound reinforcement systems. It also contains interesting forays on 'room acoustics' and 'auditory psychophysiology'.

The book aims to reflect modern trends in what is one of the most changeable facets of the noise and building acoustic world. It has been expertly translated from German to cover the Anglo/American English speaking world.

The stated aim of the book is that a very wide range of professions from architects, sound engineers and customers can use its contents immediately. The contents are certainly almost all encompassing and very detailed in many respects. However, it is difficult to fathom what academic level it is pitched at. There is a significant amount of detailed information and theory but it does not always include the basics. In some respects it assumes the reader has a grasp of the fundamentals of what is a very wide field. The book is most useful for acousticians and engineers who have some knowledge and who specialise in sound reinforcement systems. Such persons are likely to use it as their main reference book and find it good value for money.

The book is a hard-back publication and appears to be well constructed for frequent, long-lasting use.

*S R Peliza MIOA* ❖

# New Products

## SOUND REDUCTION SYSTEMS LTD

**A High Performance Acoustic Barrier**

A new acoustic barrier has been launched which is described as combining the highest levels of room to room sound insulation with easy installation. Called Soundbar 53, the high performance flexible barrier introduced by Sound Reduction Systems is designed to reduce sound transmission through suspended ceiling voids.

Installed from the soffit to the partition head, it is claimed to be ideal where partitions or walls are installed to the underside of a ceiling, and can be fitted from one side by one person, thereby causing minimum disruption and cutting installation costs.

SoundBar 53 is reported as being so acoustically efficient that it can actually reduce room to room noise by up to 53 dB, providing maximum speech privacy and protection against unwanted noise.

Formed with a dense core bonded between two fibrous layers, with an outer reinforced aluminium facing, it is supplied as a system with all accessories to make a properly scaled acoustic curtain within the ceiling void.

It is fixed to the soffit and walls by means of a steel angle which has a foam sealing gasket forming a compression seal against the soffit or wall.

SoundBar 53 is designed to deform and easily seal around any services that pass through the barrier.

Full details of the new SoundBar 53 system, accessories and acoustic performance are given in a comprehensive new brochure available now from Sound Reduction Systems.

**Four Soundblocker Options**

Four different options in Sound Reduction Systems' SoundBlocker range provide users with the opportunity to select exactly the right one to suit their individual requirements. Formed from a rigid attenuating layer bonded to an acoustic foam which absorbs reverberant sound within the ceiling void, the four standard types of SoundBlocker can satisfy varying demands from the normal office environment to locations where higher levels of sound need to be reduced in musical or industrial applications.

SoundBlocker 16 is ideal for stopping or reducing cross talk through the ceiling in a standard office, while SoundBlocker 19 is advertised as being suitable for areas where slightly higher room to room sound insulation is required or for reducing noise from services within the ceiling void.

SoundBlocker 25 is for use where higher levels of sound insulation are required and particularly where music or high levels of sound need to be reduced in clubs or the industrial environment. SoundBlocker Plus provides the highest level of sound insulation, reducing high noise levels through floors and the break out of environmental noise through roofs.

Easily installed with new or existing ceilings and simple to cut and clean, SoundBlockers are stated to be ideal for installation in both lay-in-grid and metal tray ceiling systems.

Details of the full product range are provided, in a brochure which has a handy reference guide as to which SoundBlocker to use in different situations, it also includes the extensive range of SoundBlocker accessories and comprehensive graphs showing acoustic performances.

Sound Reduction Systems, Adam Street, off Lever Street, Bolton BL3 2AP Tel: 01204 380074 Fax: 01204 380957

Website:www.soundreduction.co.uk

e-mail: info@ soundreduction.co.uk.

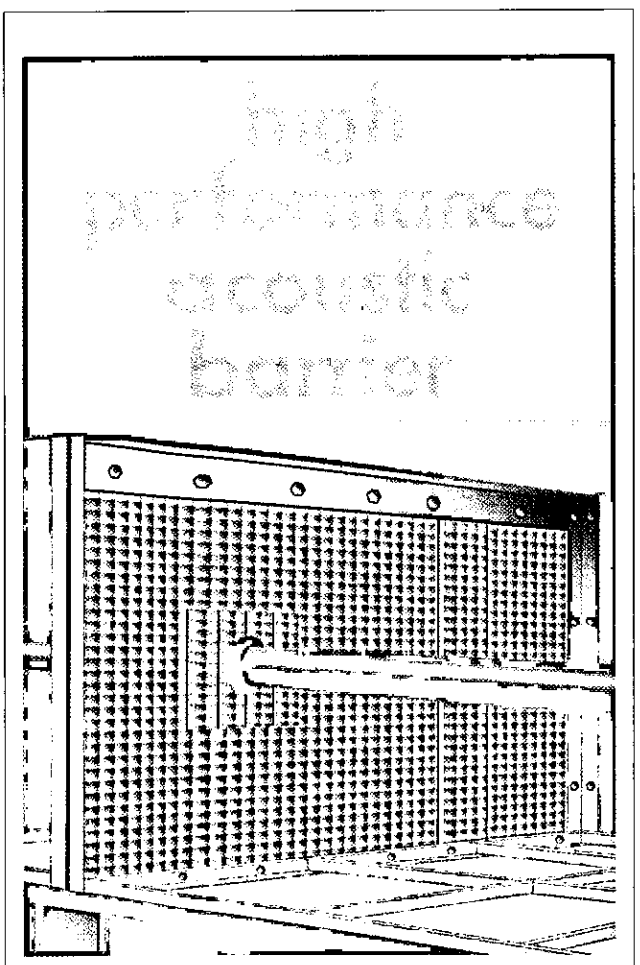
## BRÜEL & KJÆR

**New Subminiature High Performance Position Transducers**

Brüel & Kjær has announced the availability of new subminiature high performance position transducers from SpaceAge Controls, Inc.

Offering extended life, high reliability position measurement in a compact size, the 170 and 176 series position transducers are said to be ideal for a wide range of applications including vehicle testing, industrial control feedback, aircraft flight control, monitoring and medical equipment measurement.

Developed as a space-saving alternative to rod-and-cylinder products such as LVDTs and linear potentiometers, these products comprise a stainless steel cable wound




High performance acoustic barrier

round a bearing-mounted spring-powered drum. The bearing-mounted drum is mated to a precision potentiometric element that translates the linear position information into an electrical signal. The transducers may be quickly mounted using either the screws provided, an optional rotatable mounting base or custom-made installation plates.

Series 170 position transducers measure up to 51 mm of travel with external dimensions of only 24.4 mm diameter by 11.4 mm wide. The 176 series devices measure up to 165 mm of travel with dimensions of only 63.3 mm diameter by 13.2 mm wide. The transducers weigh less than 113 grams and are available with right- or left-hand cable pull. Custom configurations and signal conditioning are available for customers requiring special characteristics.

Specifications of the potentiometer include 5k3, co-moulded, conductive plastic potentiometer elements, −65 to +125°C operating temperature range, ±0.5% linearity, 0.75 W power rating and 50 million cycle operational life. Cable tension is user specified and factory set.

**Versatile Non-Contact Laser Doppler Vibrometer**

Brüel & Kjær has introduced a new non-contact vibration transducer for use in applications where it is impossible or undesirable to mount a conventional vibration transducer onto a vibrating object.

The introduction of this new product follows the recent signing of an exclusive sales distribution agreement between Brüel & Kjær and UK-based company Ometron. Under this agreement, all Ometron products will be sold via the world-wide Brüel & Kjær sales distribution network.

Based on a Michelson interferometer, the new Brüel & Kjær Laser Doppler Vibrometer, Type 8329, offers an alternative to microphones or accelerometers in applications where, for example, extreme temperatures may preclude the use of conventional sensors. Other applications include the measurement of vibration on lightweight, small, delicate and soft objects where an accelerometer would cause mass loading effects. Impact measurements, relative vibration measurements (eg on board ships, aircraft and cars), railtrack and track bed vibration monitoring are further suitable applications.

Capable of measuring vibration in any direction, the Type 8329 features a velocity range up to 425 mm/s, frequency range from < 0.1 Hz to 25 kHz and dynamic range of 73.5 dB over full bandwidth. Measurements are possible from as close as 0.4 m and up to 25 m away usually without the need for any surface treatment or retro-reflective tape. For measurements at distances greater than 25 m, retro-reflective tape can be used.

The Type 8329 is stated to be extremely quick and simple to set up. A built-in LED bar-graph confirms that the laser is adequately focussed. A second LED bar-graph indicates the approximate measured velocity level.

The Type 8329 connects via a simple BNC cable with any Brüel & Kjær sound and vibration analysis system such as PULSE™ or Portable PULSE. Battery or mains-operated, the portable compact Type 8329 offers integrated optics and electronics and features a Class II laser for safe operation. Despite the precision nature of the optical and electronic components, the unit is reckoned adequately robust for normal laboratory and field use.

**Software to Measure and Analyse Non-stationary Sound Fields**

The new Non-stationary STSF (Spatial Transformation of Sound Fields) package Type 7712, version 2.0, is intended to assist designers and manufacturers to comply with increasingly stringent noise standards and to better understand the noise radiation mechanisms of their products. Effective measurements can also reduce design time by pinpointing engineering changes and save measurement time to free test facilities for other purposes.

From one simple measurement, Non-stationary STSF can calculate any sound field descriptor such as sound pressure, sound intensity or particle velocity allowing users an unprecedented degree of optimisation of the sound-related features of their products. Results are typically displayed as animated maps to illustrate how a specific property changes as a function of time.

By displaying the radiated sound as a contour plot or an animation directly on top of a picture of the object under test, Type 7712 provides an intuitive map of noise problems that, it is suggested, can be understood even by non-acoustic engineers.

Non-stationary STSF Type 7712 includes special averaging and filtering functions to support detailed analysis of sound from engines. For example, it is possible to average over shaft angle in order to relate the specific sound sources to the operating cycle of the engine. Results can also be filtered to either fixed frequency bands, order bands or fractional octave bands.

With Non-stationary STSF it is possible to assess and locate noise sources accurately during a true run-up instead of approximating using successive stationary conditions. This typically gives misleading results for noise radiation due to varying load conditions on many engine components. Type 7712 can also analyse highly transient and non-repetitive noises such as those generated by office machinery and car brakes.

A single event can be recorded and analysed later with a time resolution down to one sample of the recording.

New features in Non-stationary STSF version 2.0 include: built-in time/frequency analysis to identify critical frequencies, orders or events prior to holography; order filtering to support analysis of run-up or coast-down conditions; an instantaneous active intensity function to accurately track moving sources and sources that come and go; separate licences for measurement, analysis and viewing to better support specialised working functions and data storage functions to make back-up and use of historic data even easier.

Further information on these products is available from Brüel & Kjær, Bedford House, Rutherford Close, Stevenage, Hertfordshire, SG1 2ND Tel: 01438 739000 Fax: 01438 739099 e-mail: info@bkgb.co.uk Web site: http://www.bk.dk.
**Brüel & Kjær is a Key Sponsor of the Institute.**

## ENDEVCO

**A Miniature Triaxial Piezoelectric Accelerometer**

Endevco has introduced a new miniature triaxial piezoelectric (PE) accelerometer that is designed specifically for vibration measurement in three orthogonal axes on small structures and objects.

Weighing just 17 grams, the model 2230D effectively minimises mass loading effects and, as a self-generating PE device, requires no external power supply for operation. The transducer features three 6-40 receptacles for output connection and is designed for adhesive mounting.

The model 2230D features Endevco's PIEZITE® type P-8 crystal elements which operate in annular shear mode and are stated to exhibit excellent output sensitivity stability over time. Signal ground is connected to the case and mounting surface of the unit while low-noise, flexible coaxial cables are supplied for error-free operation.

Specifications include a typical sensitivity of 3 pC/g (2 pC/g minimum), amplitude response from 1 to 5000 Hz (± 5%) and operating temperature range from −55 to +260°C. Package dimensions are 15.2 x 11.7 x 17.2 mm.

Recommended signal conditioners for use with the high impedance model 2230D include the Endevco models 133 or 2275A or the OASIS 2000 computer-controlled system.

**New Accelerometer for Top Performance in Crash Tests**

Endevco has also introduced a new piezoresistive accelerometer that meets the latest SAE J211 requirements for automotive crash testing. The new model 7264C-2000 is based on an advanced micro-machined sensor with integral mechanical stops that allow the accelerometer to withstand shocks up to 10,000 g.

The monolithic sensor offers improved ruggedness, linearity, frequency response and stability. The location of the centre of the seismic mass is near the tip of the accelerometer, making it a direct replacement for the Endevco model 7264-2000.

The 7264C is a full bridge design with fixed resistors for shunt calibration. At a full-scale acceleration of 2000 g the output is 400 mV with 10 V DC excitation. It has linearity better than 1% of reading, 2% amplitude deviation from DC to 2000 Hz, transverse sensitivity better than 1% and a zero acceleration output less than 25 mV. The accelerometer weighs only 1 g. The undamped design results in no phase shift over the useful frequency range.

**Portable Accelerometer Calibrator that Now Tests Piezoresistive and Variable Capacitance Devices**

Endevco has announced a new version of its portable accelerometer calibrator that features an option enabling testing of piezoresistive (PR) and variable capacitance (VC) type devices.

Model 28959E is designed to provide precision calibration of various accelerometer types in the field and it is reported as ideal for test engineers and technicians needing on-site end-to-end calibration of their complete measurement chain.

With a built-in charge converter and constant current source, the calibrator is designed to accept charge and voltage mode (ISOTRON®) piezoelectric (PE) accelerometers directly with an optional external signal conditioner available to enable calibration of PR and VC devices.

The model 28959E is a self-contained system that includes built-in vibration exciter, signal generator, computer-controlled amplifier/servo mechanism, reference accelerometer, thermal printer, RS232 serial interface, LCD screen and all necessary connectors and mounting accessories. The unit can be powered by AC mains voltage or internal rechargeable batteries (supplied).

Special features include automatic calculation of sensitivity, verification of accelerometer polarity, help screens to assist operators, hard copy output from built-in printer and storage and display of serial number, type, test parameters, date/time and test results.

Test amplitude is adjustable up to 10 g over the frequency range 3 Hz to 10 kHz. An internal reference accelerometer traceable to NIST serves as the comparison standard. Internal memory stores over 1600 test results and sensitivity can be displayed in either Imperial or metric engineering units. An automatic self-test and self-calibration function ensures measurement integrity every time the unit is switched on.

**Piezoelectric Pressure Transducers for Very High Temperature Applications**

Two new piezoelectric (PE) pressure transducers for use in very high temperature applications are available from Endevco. Both models 522M17 and 522M19 are designed to withstand extreme temperatures up to 538°C continuous and 649°C intermittent. Being based on a self-generating PE design, these pressure transducers do not require external power.

Manufactured from Inconel, the 522M17 and M19 sensors feature an integral, metal-sheathed triaxial cable. The standard length supplied is 3 m. Custom lengths are also available to special order. Model 522M17 terminates with a 10-32 connector that will mate with Endevco 3090C-XXX softline cable while model 522M19 terminates with a 5-44 connector designed to mate with Endevco 3007-XXX softline cable.

These special design characteristics are claimed to deliver the optimum solutions for very demanding applications. These include laboratory, R&D or field test applications such as dynamic pressure measurements on gas turbine combustors and high temperature (538°C) steam lines in nuclear facilities. They are used for sensing or lis-

tening for irregularities in the fuel-oxygen burn cycles of gas turbines and detecting high frequency pulses in high temperature steam lines.
More information from: Sharon Stewart, Endevco/Brüel & Kjær, Bedford House, Rutherford Close, Stevenage, Herts, Tel: 01438 739000 Fax: 01438 739099 e-mail: info@bkgb.co.uk Web site: http://www.bk.dk
**Brüel & Kjær is a Key Sponsor of the Institute.**

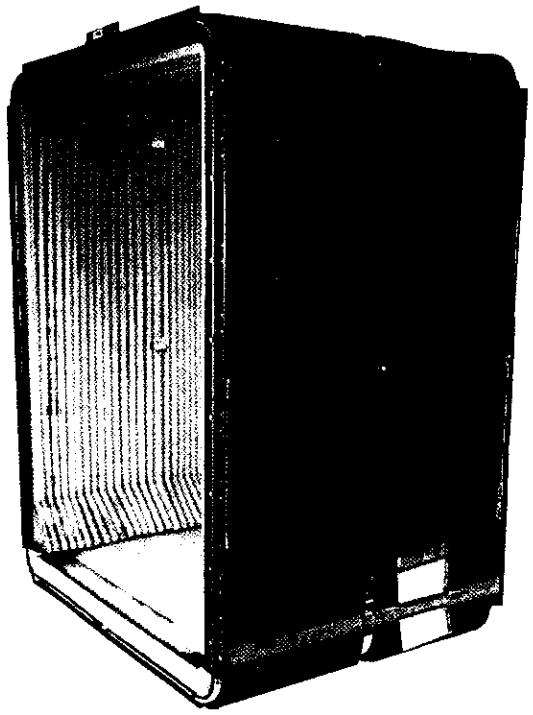
## WOODVILLE POLYMER ENGINEERING LTD

### CD ROM on Woodville Rail Technology

Available from Woodville Polymer Engineering, part of TI Group Specialty Polymer Products, is a new interactive CD ROM detailing the company's capability in inter-vehicle gangways, diaphragms and other rail and industrial products.

The CD ROM is compatible with any modern PC operating in a Windows-based environment and is designed to allow the user to navigate rapidly over topics ranging from the corporate background, quality accreditation and philosophy, to design and engineering, sales contacts and details of the different Woodville product groups. Finally, there is a multi-language questionnaire in which a potential specifier can enter details relevant to a specific project, such as dimensions, vehicle geometry, track curve data and the operating environment, in order to permit a speedy first assessment of requirements.

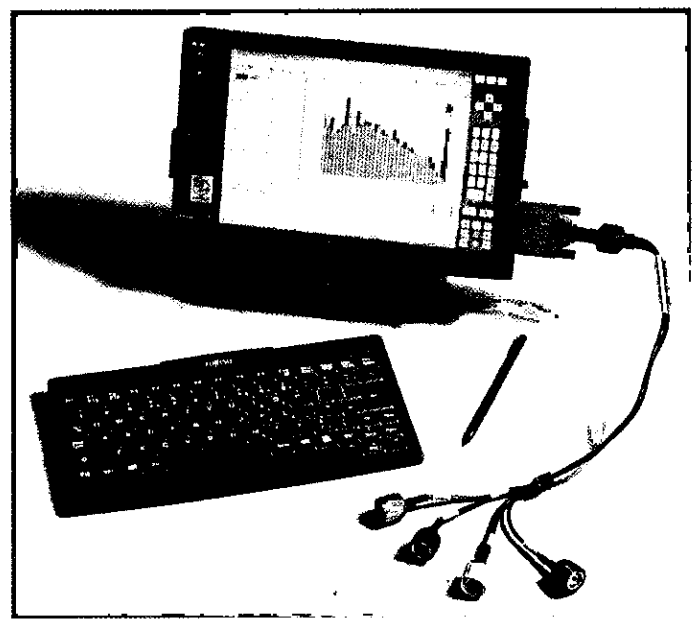
For the technical user, there is a full list of applications with still photos and video clips, as well as a comprehensive section on engineering and design, which incorporates manufacturing and materials information as well as test data on fire-resistance, low-temperature and acoustic performance. Design facilities include 'Track', an in-house computer programme which allows Woodville engineers



Woodville gangway for the SkyTrain

# Dynamic analysis in the palm of your hand

## ACE LT two channel dynamic signal analyser from less than £6000



### Features

**Less than 1 kg**
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**Long life rechargeable battery**
**Standard Windows 98 O/S**
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### Analysis options

**Full and third octave analysis**
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The ACE LT introduces a new level in portable analysis. Building on the success of the ACE analyser the ACE LT is a complete field instrument capable of a full range of analysis modes. Its features include; full colour graphics, a 4.3Gb hard drive, 64Mb RAM, 233 Pentium II processor and all the benefits of a Windows 98 O/S.

In the field, a battery life of approximately 3 hours with a range of charging options, offers complete flexibility. The analyser's size and weight provide a tool that is unrivalled in its overall performance. When you are back in the office, downloading of test data is easy with the office mini dock.

With integrated network adaptor and ports for external monitor, keyboard and printer, it's as good as having a desktop PC in your pocket. As with all Data Physics products this complete solution is backed by an unrivalled level of technical and customer support.

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to predict the relative movement of vehicles on the track and so the forces exerted on the train's gangways.

Gangway units designed and manufactured by Woodville Polymer Engineering are fitted in prestigious trains such as the Heathrow Express, Vancouver Skytrain and the new Norwegian Express. They are modular units with an integral floor surface forming an environmentally scaled passageway with outstanding thermal and acoustic isolation properties. Their robust, double-skinned construction meets the highest European standards of fire-resistance.

Other rail and industrial products from Woodville include 'Gummifronts' (fitted to the front of rail vehicles), large mouldings, diaphragms, flat forms, tube sleeves and inflatable parts.

Tests conducted on the elastomeric gangway units designed and manufactured by Woodville Polymer Engineering for the Vancouver SkyTrain, have shown that they help to make the train quieter, claiming to have achieved noise levels inside the gangway that are up to 48 dBA lower than outside.

The study was undertaken in order to demonstrate that the Woodville units were capable of meeting the noise reduction criterion of 39 dBA specified by Bombardier Transportation for its Mark II vehicles. The test programme, simulating typical open track conditions, was conducted by independent acoustic consultants at the Woodville factory and the values obtained under three different configurations ranged from 44 dBA to 48 dBA, all well within the specified limits.

The results confirm the evidence of earlier research conducted on Woodville gangway units in the Heathrow Express, which indicated that the gangway was quieter than the neighbouring carriages. This acoustic performance results from the flexible construction of the Woodville gangway with its double skin of fabric-reinforced rubber which absorbs noise and pressure differentials, attenuating their effects significantly better than a rigid structure such as a conventional railway carriage.

Woodville gangways are fabricated from advanced polymer/fabric composites, which meet the highest standards of fire-resistance. Each gangway is a single, modular unit with an integral floor surface and forms an environmentally sealed passageway between the carriages of the train. The floor consists of a stainless steel fixed plate, attached to the vehicle end and a flexible plate, sliding on top of it made from a series of smaller metal plates, encapsulated within an elastomeric envelope.

This structure accommodates the movement of the train when in service, while creating a safe, level surface for passengers to walk on. The Woodville gangways are easy to install or remove and require minimal maintenance. The use of active mechanical parts has been kept to a minimum to ensure high reliability.

For CD ROM or further information contact Woodville Polymer Engineering Ltd, Hearthcote Road, Swadlincote, Derbyshire DE11 9DX Tel: 01283 221122 Fax: 01283 222911.

## SCENSYS

### DIAdem Data Acquisition Software

DIAdem®'s easy-to-use, icon-based data acquisition and program operation are said to enable large amounts of data to be managed in a short amount of time.

A limitless array of parameters can be set for the program's new data overview, and, with DIAdem®'s new calculator, it is claimed that data, variables and functions can be linked with ease.

Efficient measurement and automation solutions require the use of a wide range of hardware drivers. New DIAdem® drivers in Version 7 support IOtech data acquisition products, the new Microstar DAP boards, National Instruments E series, HBM MGCplus, Vector CANcardX/CANdB and more. With DIAdem®, users have the freedom to choose the most cost-effective measurement hardware for their application.

With DIAdem®, raw and processed data and evaluations can be depicted easily in Internet browsers on any networked PC. Data can be accessed in a company's internal Intranet, in an enterprise-wide extranet, or even in the Internet. The Internet browser as a user interface, the DIAdem® OPC-Client in accordance with the current 2.0 standard, as well as the program's improved OLE functions, reputedly greatly simplify communication between various levels within an organization.

ASAM/ODS interfaces in DIAdem® encourage new perspectives and the comparison of results by simplifying data exchange. The new ASAM Data Navigator in Version 7 fulfills the vision of a company-wide data backbone by providing the link between various data models and formats. Users can browse through ASAM data, work interactively or automate read- and write-access to data using DIAdem® customizing features.

DIAdem®'s sophisticated customization functions, called Autosequences, allow the complete automation of data acquisition, analysis and report generation. The graphical dialog editor in Version 7 quickly creates input forms, while the new GPI Wizard reduces the efforts to create additional hardware drivers, functions or file import and export functions.

A new driver interface for devices using the GPIB, serial or parallel ports is said to considerably reduces the effort required to communicate with such devices. DIAdem® now also supports NI-VISA and ActiveX components that can be integrated into Visual Basic scripts.

Among the new features in DIAdem® Version 7 is a new FFT function: power spectral density.

For further details contact Scensys Scientific & Engineering Systems Ltd, Edison Business Centre, 52 Edison Road, Aylesbury, Bucks HP19 3TE Tel: 012961 397676 Fax: 01296 397878 e-mail: scensys@btinternet.com Website: www.scensys.co.uk

## CIRRUS RESEARCH plc

**CR:800A Sound Level Meter Launched**

The CR:800A is the first in a new generation of instruments from Cirrus, and is described as providing all the functions and features demanded from a modern sound level meter.

The menu operation and keypad provide a simple user interface, making the instrument easy to use, an essential requirement for today's busy safety professional as well as those involved in environmental noise monitoring and control.

A wide range of options and accessories are available for the new instrument, which allow the range of measurements to be enhanced. These include $^1/_1$ & $^1/_3$ octave band filters, a Type 1 option, as well as complete measurement kits.

All versions of the CR:800A are supplied with the Deaf Defier for Windows software which allows measurements to be downloaded to a PC. This program also includes a facility to calculate the effective protection provided by a range of hearing defenders and protectors.

Cirrus Research plc are now able to offer a UKAS (NAMAS) accredited calibration for the Class+ range of $^1/_2$" Microphone capsules as well as the CR:510 Series of Acoustic Calibrators including the new PTB Type Approved CR:511F unit.

For further information contact James Tingay, Sales & Marketing Manager at Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire YO14 0PH Tel: 01723 891655 Fax: 01723 891742 e-mail: sales @cirrusresearch.co.uk

Website: www.cirrusresearch.co.uk.

**Cirrus Research plc is a Key Sponsor of the Institute.**

# NEWS ITEMS

## ISOLATED SYSTEMS LTD

**Major Partnership Agreement Announced**

Derbyshire-based noise and vibration control specialists, Isolated Systems Ltd, have signed a major partnership agreement under which ISL have licenced noise control technology developed by Vibro-Acoustics of Ontario. Vibro-Acoustics have developed aerodynamic acoustic splitters which allow the airflow through the ductwork in air conditioning systems to run more smoothly and efficiently. The technology is said to bring with it a whole series of major advantages for the customer, saving space, construction time, energy and cost. ISL now have access to this innovative technology and also to Vibro-Acoustics' test facility which is one of the largest in the world.

For further information contact Brian Hobby Tel: 01773 761226 Fax: 01773 760408 or e-mail sales@isolatedsystems.com

## UNIVERSITY OF SALFORD

**New Masters Course in Audio Acoustics**

The School of Acoustics and Electronic Engineering launched a new Masters course in Audio Acoustics this autumn. The Masters course aims to train graduates in the acoustic aspects of audio such as digital signal processing, transducer design, room acoustics and sound reproduction. It is primarily designed as a conversion course for technically skilled graduates whose first degree was not in reproduced sound but another engineering or science discipline.

The course is designed for those currently working in the industry who wish to expand their expertise, and those wishing to train to begin an acoustics career. The majority of students on the course are studying part-time by distance learning.

Further information from Dr Trevor Cox, Senior Lecturer, Acoustics and Electronic Engineering, University of Salford, Salford M5 4WT EFax (UK): 0870 137 1611 Tel: 0161 295 5474

## CASTLE GROUP LTD

**New Directors Join the Board**

Simon Bull has been appointed Director – Sales and Marketing and Lee Trowsdale has been made Director – Manufacturing and Development.

Further information from Castle Group Ltd, Salter Road, Scarborough, North Yorkshire YO11 3UZ Tel: 01723 584250 Fax: 01723 583728 e-mail: sales @castlegroup.co.uk Web: http:// www.castlegroup.co.uk.

**Castle Group is a Sponsoring Organisation of the Institute.**

## SOCIETY OF ENVIRONMENTAL ENGINEERS

**Directory Now On-line**

The society's Test house Directory is now available on-line at www. environmental. org.uk.

## NOISE CONTROL SERVICES LTD

**Take over of N+H Acoustics Ltd**

Noise Control Services Ltd who market PAR Products have taken over N+H Acoustics Ltd.

Further information from Alan Nethersole MIOA, Noise Control Services Ltd, Oaklands, Old Ticknield Way, Benson, Wallingford, Oxon OX10 8PW Tel: 01491 833121 Fax: 01491 833100 e-mail: parncs@aol. com.

## ARUP ACOUSTICS

**New Appointment**

Colin Waters CEng FIOA has joined the company as head of Environmental Acoustics, based at the Cambridge office and can be reached on 01223 355033 or by e-mail at colin.waters@arup.com.

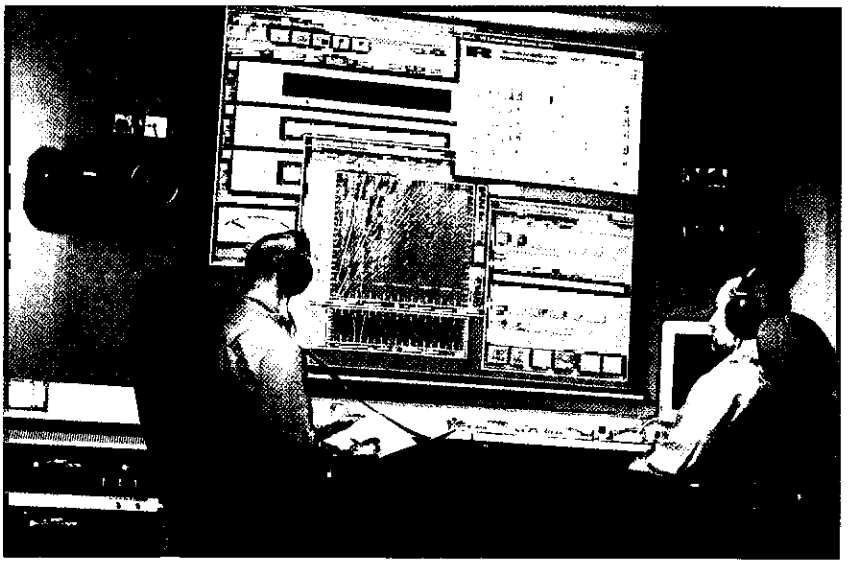
## RICARDO

**Centre of Excellence Open**

A new NVH (noise, vibration and harshness) test centre for more than 70 engineers has been opened at Ricardo's Shoreham site. This marks the latest phase of investment following five years of continuous capital expenditure.

Facilities available to customers include a multi-media room for the subjective assessment of improvements in vehicle noise characteristics and a data processing area with engineering workstations running state-of-the-art Ricardo and proprietary software for noise and vibration data analysis and simulation.

Ricardo's investment programme at the Shoreham site has included a new vehicle test facility, a mobile noise and vibration test laboratory equipped for noise and vibration to provide clients throughout Europe with direct on-site support, ISO 362-certified pass-by noise track and the refurbishment of three powertrain acoustic test facilities.



Ricardo's new multi-media room for sound quality engineering

Further information from Anthony Smith on 01273 794460 or e-mail AVSmith@rce.ricardo.com.

**Items for the New Products section should be sent to John Sargent MIOA, Oak Tree House, 26 Stratford Way, Watford WD1 3DJ e-mail j_w_sargent@hotmail.com.❖**

# Hire News

## Hand-Arm Vibration

Whole Body and Hand-Arm vibration measurements are very popular at the moment.

To deal with the increased demand we have added several more B&K 2537 Hand-Arm Vibration meters to our stock. They are ideal for this purpose.

For Whole Body Networks as well as the Hand-Arm Filters, the Norsonic 110 analyser is recommended. Select a suitable accelerometer and if you are doing Hand-Arm work add a mounting bracket.

The Nor-110 is a type 0 analyser and has the added advantage that you can make real-time 1/3 octave vibration level measurements down to 1Hz.

To see our full range - visit our web site.

# Instrument Hire

A wide range of calibrated sound & vibration equipment from the leading manufacturers.

From simple meters right through to real-time sound intensity and building acoustics kits.

A large quantity of weatherproof noise monitoring systems.

Engineers to discuss your applications.

Next day deliveries by overnight carrier.

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Gracey & Associates are audited by British Standards for the Hire and Calibration of Sound & Vibration Instrumentation.

Norsonic

**Sales, Support and Calibration**

*Precision Instrumentation and software from Norway:*

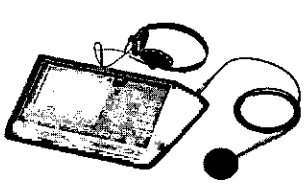
- *Environmental monitoring*
- *Industrial applications*
- *Building acoustics*
- *Vibration measurement*

Cadna A
*Computer Aided Noise Abatement*

**State of the art noise mapping software**

*Powerful and easy to use windows based programme*

- *Developed for small projects through to the mapping of complete cities.*
- *Free tutorial CD available on request.*



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*Precision microphones, preamplifiers and signal conditioning systems.*

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