Institute of Acoustics

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Volume 20 No 3
May - June 1995

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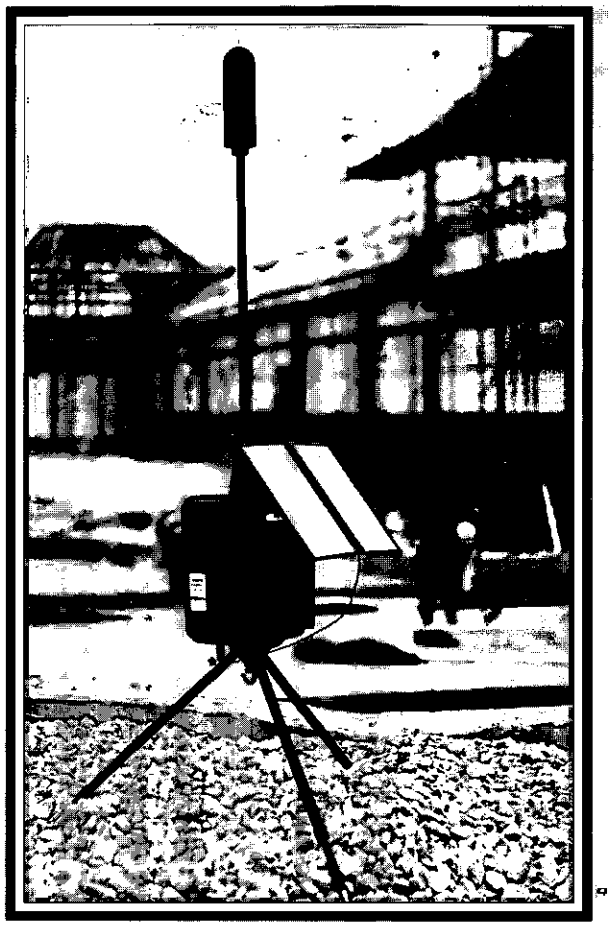

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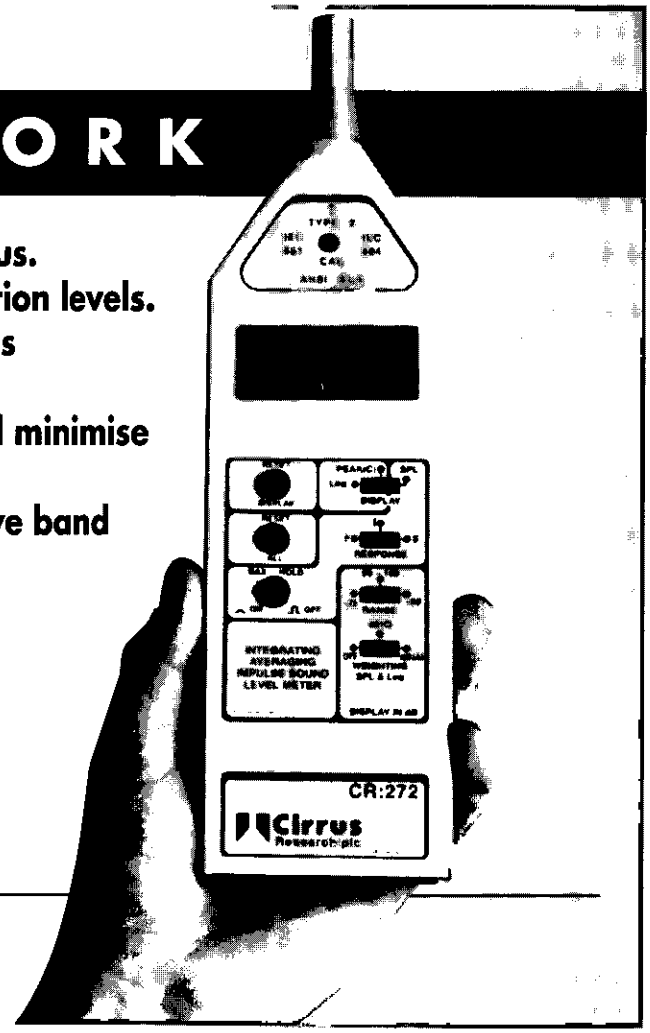

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contents

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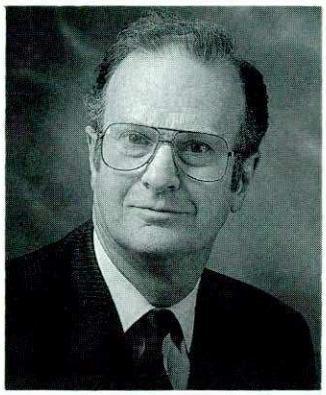

Dear Fellow Member

As a Liverpudlian born and bred, albeit one who migrated to the south forty years ago, it was with considerable interest that my wife and I set off for Acoustics '95 to stay in the Adelphi Hotel – that elite among Liverpool hotels which so few of us were privileged to visit in the pre-war and immediate post-war years. A fair number of you joined us. Attendance at this Spring Conference was up to previous years' standards and ensured a technically successful meeting. A feature of this conference, and a continuation of a development which has been well acccepted recently, was the programme of workshops; these encouraged discussion following one or more introductory papers. The technical report on the conference will appear in the next Bulletin.

At the 1995 AGM, which was held during the conference, Keith Broughton of HSE and Professor Marcel Tatham of the University of Essex were elected to Council and Dr Tony Jones of AIRO succeeded Dr David Hothersall as Hon Secretary.

Council. is currently investigating ways of determining what you, the members, want from the Institute in the way of conferences, meetings, educational initiatives etc. This is expected to culminate in a questionnaire which will probably be circulated with the subscription notices next year. In the meantime, any comments will be welcome.

This issue of the Bulletin sees the continuation of Steve Goswell's article on Planning and Noise. Perhaps members have been waiting for the completion of this contribution before writing with comments or dissenting views!

I was introduced to 'Jovian Acoustics' during Michael Collins' A B Wood Medal Lecture to the Underwater Acoustics Group in Weymouth last December. I am sure you will all enjoy reading about the fascinating effects following the impact of the Comet Shoemaker-Levy 9.

In my last letter I commented on the passing of set95*; you may be interested to read the letter to the Editor on this subject from Trevor Cox and Bridget Shield of South Bank University who were very active in* set95.

Sincerely yours

Alex Burd

Just When You Thought The Horse Had Bolted . . .

You may remember that I was rather concerned that some IOA members claimed they'd never heard of **LARSON • DAVIS** and our range of **SUPERIOR INSTRUMENTATION FOR ACOUSTICS AND VIBRATION**. You may also remember that in an attempt to rectify the matter I decided to display a rather nice picture of a horse. Well, since the appearance of the "horse", sales in the UK have increased dramatically. Remarkable you might say. We'd like to think that acousticians have come to realise that **Larson • Davis** instruments really are worth considering and sales across the range must surely be proof of that. However, I must confess to being a little superstitious, and perhaps the horse *has* had *something* to do with this rather pleasing increase. Funny though, we've sold Real Time Spectrum Analysers, Night • Nurse Neighbour Nuisance DAT systems, replacement Microphones, Microphone Power Supplies, Sound Level Meters, and Environmental Noise Analysers - but no Horses!

Anyway, just in case the horse *has* helped sales, here's another rather nice picture for *you* to complete. When you've finished, perhaps you'd like to pick up the phone and ask us about

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DEVELOPMENTS IN BUILDING ACOUSTIC STANDARDS IN EUROPE

Paul Royle MIOA & Les Fothergill FIOA

Introduction

The advent of the European single market has made it necessary for Member States to work to common technical standards as a step towards reducing barriers to trade. Building acoustics is no exception, and considerable activity has taken place throughout Europe over the last few years, mainly in the area of test methods, in order to obtain agreement amongst Member States. This work has been led by CEN – the European standards organisation – working with ISO, and where possible existing ISO standards have been used as the basis for CEN standards. BSI has been fully represented in the development of these standards.

Progress has been good, and as well as producing technical advances in the test methods the work has also covered rating methods and entered the new field of predicting sound insulation. In addition, survey test methods are being developed to provide a simpler, but less accurate, alternative to the engineering methods currently in use.

In the field of building acoustics the most widely used standards are the BS 2750 and BS 5821 series. This paper highlights the principal improvements to them, but also outlines several other new standards connected with building acoustics. The BS 2750 series will be known as the BS EN 20140 series, and the BS 5821 standards will be known as BS EN 20717–1 and 2. In each case the last three digits of the CEN number correspond to the familiar ISO numbers.

The standards go through many drafts and a lengthy consultation procedure among CEN and ISO members; prEN denotes an advanced but not final draft of the standard. Earlier stages are denoted here simply as drafts, and all are subject to change.

Development of Existing British Standards

BS 2750 : Part 1: Requirements for laboratory test facilities with suppressed flanking transmission
(status: prEN 20140–1)

The conditions of the test rooms have been more closely specified and for example, any dependence of the measured sound insulation values on the reverberation times should be examined if at low frequencies the reverberation times lie outside the range one to two seconds. There is detailed guidance on testing windows and glazing and the associated filler walls. Flanking transmission limits and the maximum measurable sound reduction indices must be stated in test reports. To help laboratories establish flanking limits for various types of construction, special high performance walls and floors are described.

BS 2750 : Part 2: Determination, verification and application of precision data
(status: this standard has been published as BS EN 20140–2 : 1993)

The ISO version of this standard has been adopted by CEN without change. It describes procedures for determining reproducibility and repeatability from inter-laboratory tests. It gives repeatability values for tests carried out to different BS EN 20140 parts but does not give guidance on how to measure repeatability within an individual laboratory.

The round-robin inter-laboratory comparison project described later in this paper will provide valuable data for the next revision of this standard.

BS 2750 : Part 3: Laboratory measurement of airborne sound insulation of building elements
(status: will be published as BS EN 20140–3)

This standard contains many technical advances. The reproducibility of measurements of sound reduction index between laboratories is notoriously poor, partly owing to their differing shapes and sizes but also because of inadequate attention to sound field generation.

Accordingly, in order to reduce this latter problem, the standard requires that at least two loudspeaker source positions must be used. These can be in the same source room or alternatively, one (or more) in each room so that the specimen can be tested in both directions. There is a very time-consuming procedure for determining the optimum loudspeaker positions – the objective being to find a small number of loudspeaker positions that lead to the same SRI as a large number of positions. Alternatively moving speakers may be used.

The position of a test specimen within the test aperture must be such that the niche depths are in the ratio 2:1, as this has been found to improve repeatability.

The flanking limit of the laboratory for the type of construction being tested must be stated in the report.

Other changes include: Guidance is given for low frequency measurements (50–80 Hz), although the mandatory minimum frequency remains at 100 Hz. The reverberation time must be measured over at least a 20 dB range. Measurements on glazing must be made after it has remained at 20°C for 24 hours.

Temperature and relative humidity during the test must be measured and reported.

A suggested layout (single side of A4) is given for a certificate which can be used for presentation of the results in a uniform way.

Graphs in the main report and optional certificate are to be drawn at a specified scale to facilitate comparison of results from different laboratories.

BS 2750 : Part 4: Field measurements of airborne sound insulation between rooms
(status: draft)
The main changes are as follows: Two loudspeaker positions are required (with the larger room being used as the source room). Care must be taken to avoid measuring in the near field of the loudspeaker. Reverberation time must be measured over at least a 20 dB range.

There is an option to use third or octave band measurements. Guidance is given for low frequency measurements (50–80 Hz), although the mandatory minimum frequency remains at 100 Hz.

The suggested layout (single side of A4) is given for a certificate which can be used for presentation of the results in a uniform way.

BS 2750 : Part 5: Field measurements of airborne sound insulation of façade elements and façades
(status: draft)
This standard gives alternative loudspeaker test methods and a road traffic noise method for use when the flow meets certain conditions. A normative (ie mandatory) annex gives test methods based on aircraft and rail noise.

An informative annex contains details of a sound intensity technique for measuring façade insulation.

Other changes include: Reverberation time must be measured over at least a 20 dB range. There is an option to use third or octave band measurements. A suggested layout (single side of A4) is given for a certificate which can be used for presentation of the results in a uniform way.

BS 2750 : Part 6: Laboratory measurements of impact sound insulation of floors
(status: draft)
The main changes are as follows: Reverberation time must be measured over at least a 20 dB range. The performance of the tapping machine must be checked fully.

Guidance is given for low frequency measurements (50–80 Hz), although the mandatory minimum frequency remains at 100 Hz. Temperature and relative humidity during the test should be recorded and reported. The suggested layout (single side of A4) is given for a certificate which can be used for presentation of the results in a uniform way.

BS 2750 : Part 7: Field measurements of impact sound insulation of floors
(status: draft)
The main changes are as follows: The reverberation time must be measured over at least a 20 dB range. The performance of the tapping machine must be checked fully.

Guidance is given for low frequency measurements (50–80 Hz), although the mandatory minimum frequency remains at 100 Hz. The suggested layout (single side of A4) is given for a certificate which can be used for presentation of the results in a uniform way.

BS 2750: Part 8: Laboratory measurement of the reduction of transmitted impact noise by floor coverings on a standard floor
(status: prEN 20140–8)
The main changes are as follows: Guidance is given for low frequency measurements (50–80 Hz), although the mandatory minimum frequency remains at 100 Hz. Reverberation time must be measured over at least a 20 dB range.

The performance of the tapping machine must be checked fully. Temperature and relative humidity must be recorded during the test and be reported. The suggested layout (single side of A4) is given for a certificate which can be used for presentation of the results in a uniform way.

BS 2750 : Part 9: Laboratory Measurement of room-to-room airborne sound insulation of a suspended ceiling with a plenum above it
(status: published as: BS EN 20140–9:1994)
BS EN 20140–9:1994 has been published with no changes from BS 2750: Part 9.

BS 3638 : Acoustics. Measurement of sound absorption in a reverberation room
(status: published as: BS EN 20354:1993)
Amendment 1: Annex D – Test specimen mounting for sound absorption tests. This has just completed the penultimate stage of voting. It deals with mounting a wide range of materials.

BS 5821 : Parts 1 & 3: Methods for rating the sound insulation in buildings and of building elements – Part 1: Airborne sound insulation
(status: prEN 20717–1)
This standard, which combines Part 1 (rating the sound insulation in buildings and of interior building elements) and Part 3 (rating the sound insulation of façades), has found a novel way of reconciling the rating requirements of various countries in the European Union. The main methods in use are either based on the curve shifting method used in the UK as BS 5821, or the dB(A) level difference method.

The starting point for the new method is calculation of the weighted sound reduction index R_w (or weighted standardized level difference $D_{nT,w}$) in the familiar way. Next, two adaptation terms (C and C_{tr})are calculated and appended such that the single number rating is written as: $R_w(C; C_{tr})$.

The adaptation term C is the difference between R_w and a rating calculated from the difference between the A-weighted source and receiving room levels – assuming a pink noise source. The second term C_{tr} is similar to C but a standard traffic noise spectrum is assumed for the source level.

The standard has been extended to allow measurements made in octave bands to be rated.

BS 5821 : Part 2 : Rating of sound insulation in buildings and of building elements – Part 2: Impact sound insulation
(status: prEN 20717–2)
This standard provides the single number ratings required from BS 2750 Parts 6, 7 and 8.

The reference curve method of BS 5821: Part 2 has been retained, and extended to allow measurements made in octave bands to be rated.

The spectrum adaptation rating terms (which are compulsory for airborne sound insulation) only appear in an

informative annex – and then only as the 'C' term (from the A-weighted calculation).

The adaptation term is an attempt to make the ratings correlate better with subjective judgements. It has not been made mandatory because there is insufficient experience of using the method, and it has been included in the standard to stimulate its use and to encourage users to provide feedback.

A method for rating the incremental improvement in impact sound insulation provided by floor coverings is also described.

BS 6864 : Laboratory tests on noise emission from appliances and equipment intended for use in water supply installations
(status: prEN 3822 Parts 1–4)
The UK rejected the original ISO versions of these standards because they did not reflect UK practice. The new European versions have been greatly amended and now meet the UK's needs.

ISO 3382 : Reverberation times in auditoria
(status: draft ISO/DIS 3382)
This is entitled 'Measurement of the reverberation time of rooms with reference to other acoustical parameters' and includes the integrated impulse method, together with an Informative Annex dealing with sound strength, early decay time, and the balance between early and late arriving energy.

New Standards for Test Methods

Survey test method standard
(status: draft)
This standard will describe simplified but less accurate test methods for measuring:

i) airborne and impact sound insulation
ii) façade sound insulation
iii) noise from equipment such as heating and ventilation systems, water services, lifts, rubbish chutes, boilers, and power operated doors.

It is currently at the drafting stage.

Laboratory measurement of airborne sound insulation of small building elements
BS EN 20140–10:1992
BS EN 20140–10 was published in 1992. This Part of BS EN 20140 gives a laboratory method for measuring the sound insulation of building elements having an area of less than $1m^2$ by building them into a filler wall. Examples include cable ducts and ventilators.

Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a standard timber floor
Draft ISO 140–11
This standard is needed because floor coverings perform differently on timber and concrete floors and currently only concrete floors are catered for (in Part 8).

Laboratory measurement between contiguous rooms of the flanking transmission of airborne and impact noise (by an access floor)
Draft EN 20140–12
This standard is needed for assessing the performance of access floors as used in computer installations.

Sound Absorbers for use in Buildings – Rating of Sound Absorption
Draft ISO 11654
This new standard tackles the problem of giving a single number rating to sound absorption measurements (to BS EN 20354, formerly BS 3638) obtained on general purpose absorbers (eg mineral wool). We have previously used the American noise reduction coefficient which is an average of the coefficients measured at three frequencies but which takes no other account of the frequency characteristics.

This new standard introduces a reference curve which is shifted to fit the measured data and defines the weighted sound absorption coefficient, together with shape indicators for use when the spectrum shape deviates markedly from the reference curve.

Determination of sound absorption coefficient and impedance or admittance by the impedance tube method
Draft ISO 10 534
This new ISO standard describes the method of determining the sound absorption coefficient, reflection factor and the surface impedance or admittance of materials and objects.

As the standard requires a custom built apparatus to be used, UK practitioners may prefer to continue to use the B & K standing wave apparatus and test to the ASTM C 384 method which allows the same parameters to be measured.

Methods for the determination of dynamic stiffness
BS EN 29052–1:1992
This part deals with materials used under floating floors in dwellings, ie continuous layer materials such as mineral wool mats subject to a loading range of 0.4 kPa to 4 kPa.

Materials for acoustical applications – determination of airflow resistance
BS EN 29053:1993
This describes two methods of determining the airflow resistance of porous materials (such as mineral wool) which are used for acoustic applications. One method uses a steady airflow and the other method uses an oscillating airflow. When measuring the dynamic stiffness of some materials it is necessary to know the value of airflow resistance as measured according to this standard.

Prediction Standards

Estimation of acoustic performance of buildings from the performance of products
(Status: draft)
There will be a suite of standards covering the following topics (the first two are out for the first stage of consultation):

- Airborne sound insulation between rooms
- Impact sound insulation between rooms
- Airborne sound insulation for outdoor noise
- Reduction of transmission from indoor noise to the outside
- Sound levels in rooms due to technical equipment and installations
- Reverberation time in rooms and other enclosed spaces in buildings.

These standards are necessarily complex, and their value to the acoustics community will depend on their accuracy – which has yet to be fully evaluated. It may be argued that these methods have not yet been sufficiently validated to warrant standardisation.

European Round Robin

A round-robin comparison of sound insulation measurements in laboratories throughout Europe has been accepted for EU funding, under the control of Professor Pompoli of Ferrara University in Italy. There are 24 participants including BRE and the British laboratories that have NAMAS accreditation for BS 2750: Part 3 tests. Two Polish laboratories will also take part but at their own expense.

The aim is to measure, according to the new test standard, the laboratory airborne sound insulation of two specimens; a twin leaf wall and a single leaf wall. The results will be rated according to the new standard and will provide valuable information on the effectiveness of the improved standards. The test materials (plasterboard) will be sourced from one production run and an inspector will visit each laboratory to ensure full compliance with the new standards.

Summary

There has clearly been a tremendous amount of work by European acousticians to improve the accuracy of existing test standards and also to cover topics such as prediction of sound insulation. One criticism, however, might be that insufficient account has been taken of the cost to industry of these more labour intensive test methods – but this must be set against the benefit of achieving more consistent results from laboratories across Europe. This will ensure that manufacturers of acoustic products can compete on equal terms and results obtained from accredited laboratories should be accepted in other Member States. In situations where the rigour of the new engineering methods is not warranted the survey methods will enable results of reasonable reliability to be obtained at lower cost.

There have useful developments of the single number rating methods – especially for sound absorption – but perhaps the most far reaching advances are being made with the proposed prediction standards.

Note: The views expressed here are those of the authors and not necessarily those of BSI or the organisations they work for.

Paul Royle MIOA is Executive Manager of The Building Test Centre. He represents the Gypsum Products Development Association at the CEN TC/126 'Acoustic Properties of Building Products and of Buildings'. Dr Les Fothergill FIOA works in the Building Regulations Division of the Department of the Environment. He is Chairman of two BSI sub-committees on acoustics and heads the UK delegation to CEN TC/126. He has been active in several of the working groups responsible for drafting the new Standards. ❖

JOVIAN ACOUSTICS

Michael D Collins, W A Kuperman, B Edward McDonald & William L Siegmann

Introduction

Comet Shoemaker-Levy 9 was discovered in March 1993 [1]. Shortly thereafter [2], it was announced that this string of kilometer-sized fragments would collide with Jupiter in July 1994, and scientists throughout the world scurried to make predictions and to prepare for observing the impacts. Among the modelling problems that were of interest to planetary scientists are several types of wave propagation, including large-scale waves [3], seismic waves [4], and gravity waves [5]. We chose to investigate acoustic waves [6] because the largest fragments were expected to explode in the Jovian sound channel, a layer spanning the upper troposphere and lower stratosphere that is analogous to the sound channel in the Earth's oceans [7] and guides acoustic waves to great distances.

We were in an ideal position to model Jovian acoustics because our interests during the previous few years had been in global ocean acoustics [8]. We had recently developed a three-dimensional acoustic model [9] that is practical for solving global-scale problems [10]. We incorporated the effects of fluid flow into this model [11] to account for the Jovian zonal winds [12], which blow east or west depending on the latitude and correspond roughly to the familiar cloud belts. As Figure 1 indicates, the zonal winds reverse directions several times between the poles. This spatial variability of the wind velocity causes horizontal refraction because the effective sound speed is modified by the component of wind velocity in the direction of propagation.

The acoustic model predicts that wind-induced refraction leads to the formation of intense horizontal caustics about 10 hours after impact. The energy in the caustics is enhanced by an order of magnitude. Raw data from the Hubble Space Telescope contains evidence of both acoustic [11] and gravity waves [13] near the impacts sites (prior to the formation of the caustics). Our model indicates favorable locations and times to search for evidence of caustics in the data, which are presently being analyzed by several teams of scientists. Our results also apply to gravity waves, which exhibit similar horizontal caustics. If either type of wave is detected far from the impact sites, it should exhibit distortions due to wind-induced refraction. This information might reveal something about the depth dependence of the zonal winds, which are presently known only at the cloud tops.

Prediction

The adiabatic mode solution [14] is based on the normal modes of the depth separated wave equation. The assumption that energy does not couple between modes

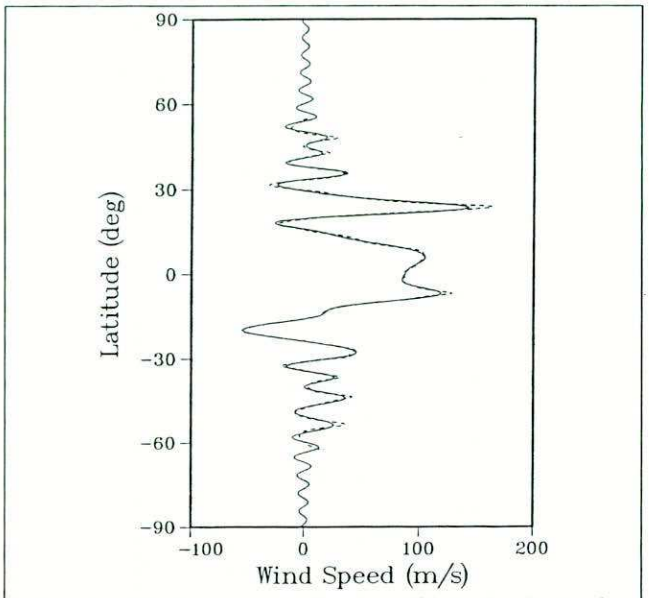

Fig. 1. Wind speed as a function of latitude obtained from Voyager data. The dashed curve corresponds to the data from [12]. The solid curve was obtained by extrapolating the data to the poles and smoothing the cusps introduced in the extrapolation process.

leads to a set of two-dimensional wave equations in the horizontal coordinates [15]. This assumption is valid when the acoustic properties of the medium vary gradually with the horizontal coordinates. With the reduction in dimension, it becomes practical to solve large-scale problems. We solve the horizontal wave equations with the parabolic equation method [16], which is efficient for handling horizontal variations in the acoustic parameters.

Since ocean currents are very slow relative to the speed of sound, the effect of fluid flow is neglected in the adiabatic mode parabolic equation solution that was developed for ocean acoustics. However, because the effect of fluid flow is important for Jovian acoustics, it was necessary to modify this technique. The horizontal group speed for energy trapped in the Jovian sound channel is approximately 900 m/s. The peak winds near the impact latitude of 44° S are approximately 40 m/s. Although the Mach number is small, it is well known that small amounts of refraction can have profound effects. For example, weak refraction in the ocean sound channel is sufficient to duct acoustic energy for thousands of kilometers [8]. The smallness of the Mach number is an advantage in that we were able to incorporate the effect of fluid flow into the horizontal wave equation as a perturbation correction [11].

We illustrate acoustic propagation in the Jovian sound channel at 0.02 Hz. Appearing in Figure 2 are the

first nine modes and the vertical dependence of the sound speed, which was obtained from Voyager data [17]. The modes are centered about the axis of the sound channel and occupy between 50 and 400 km in the vertical. Shown in Figure 3 is the adiabatic mode solution for the fifth mode, which has a phase speed of 1009 m/s and a group speed of 908.5 m/s. The cells between wind reversals act as horizontal waveguides. When acoustic energy passes through a wind cell in the upwind direction, it is refracted toward the center of the cell and gets pinched together to form a caustic as Figure 4 indicates. For a source near the equator, the wind cells can trap acoustic energy and duct it around the planet.

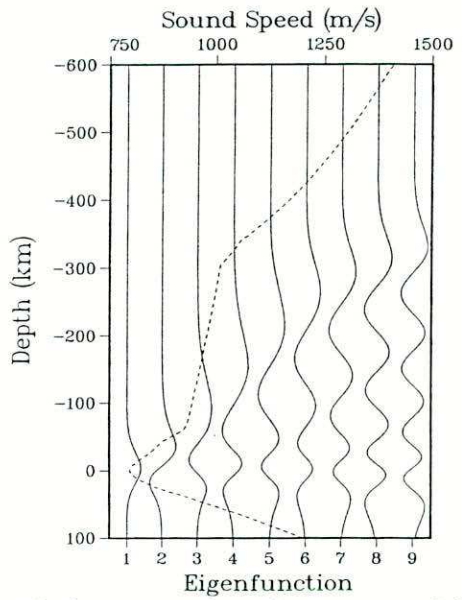

Fig. 2. The first nine modes in the Jovian sound channel at 0.02 Hz. The solid curves correspond to the mode functions. The dashed curve corresponds to a sound speed profile obtained from Voyager data [17].

The cells near the impact site do not trap energy because they deviate too far from the geodesics that the acoustic energy would follow in the absence of refraction. However, acoustic energy is pinched into strong caustics, which radiate toward the east and west from the impact site and remain well defined all the way around Jupiter. The energy in these caustics is enhanced by an order of magnitude. We have integrated travel times along horizontal ray paths to determine that the caustics are well formed about 10 hours after impact. Taking into account the locations of the impacts (just over the western limb of Jupiter) and the Jovian diurnal period (just under 10 hours), we would expect 13 hours to be a favorable time to look for evidence of the caustics.

Observation

Images from the Hubble Space Telescope show evidence of waves propagating from the impact sites of several of the fragments [13]. The images in Figure 5 show evidence of acoustic and gravity wave fronts propagating away from the impact site of fragment G. The gravity wave front is prominent in both the green and near infrared images. Identifying acoustic waves is com-

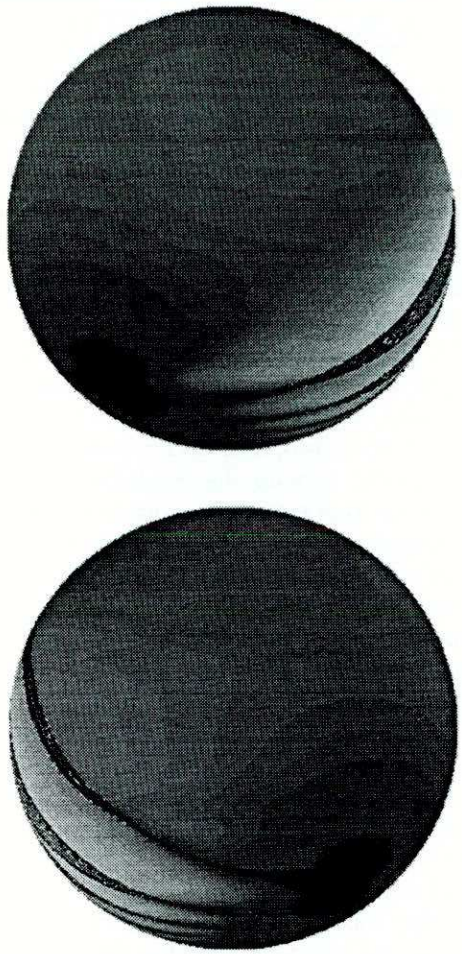

Fig. 3. Transmission loss at 0.02 Hz for a source that excites the fifth mode and is located at 44° S. This view is as Jupiter would appear through a telescope that could see acoustic energy: (top) the caustics that form toward the east; (bottom) the caustics that form toward the west. The dynamic range is 20 dB, with black corresponding to the highest intensities and white corresponding to the lowest intensities.

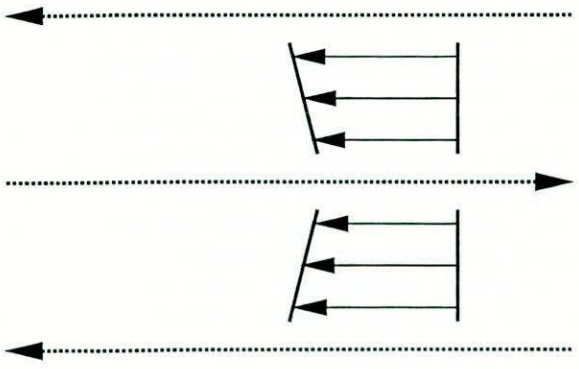

Fig. 4. Explanation of wind-induced refraction. The dashed lines correspond to the zonal winds, with the arrow heads indicating the wind direction. The plane wave fronts that are initially oriented vertically are bent toward the upstream region by refraction. The cells between wind reversals therefore act as horizontal acoustic waveguides.

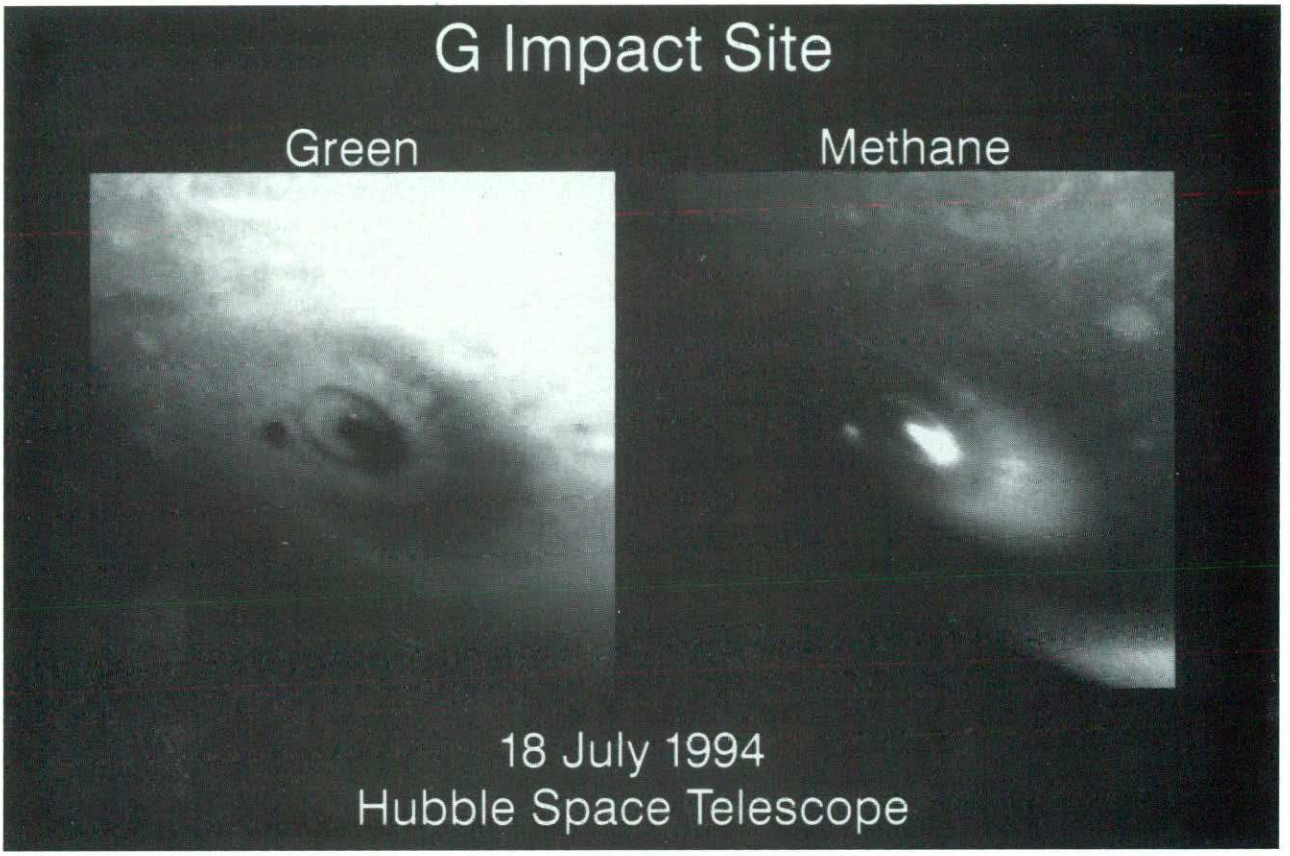

Fig. 5. Hubble Space Telescope images that were taken 1 hour and 45 minutes after the impact of fragment G of Comet Shoemaker-Levy 9, which occurred on 18 July 1994 at 3:28 am EDT. The image to the left was taken in green light. The image to the right was taken in the near infrared. The spot in the center of the images is the impact site. The large oblong feature to the lower right of the impact site is the debris of the collapsed fireball. The small circular feature (which looks like an ellipse due to the viewing geometry) that appears in both images is approximately 7500 km in diameter. The large circular feature that appears amidst the fireball debris in the infrared image is approximately 12000 km in diameter. The small spot to the left of the small circular feature was created by the impact of fragment D on 17 July 1994 at 7:45 am EDT. *[Courtesy of the Hubble Space Telescope Comet Team and NASA]*

plicated by the fact that their horizontal group speed places them amidst the debris of the collapsed fireball at the time the images were obtained. This coincidence of features can be resolved by taking into account the asymmetry of the fireball debris.

The comet fragments entered the atmosphere at approximately a 45° angle. After a fragment explodes, the fireball rises back through the path of entry [18]. As a result, a debris field is formed off to the side of the impact site after the fireball collapses. The debris of the collapsed fireball appears to the lower right of the impact site in the images appearing in Figure 5. The infrared image contains a large circular feature amidst the fireball debris. It is unlikely that this symmetric feature is part of the asymmetric debris field [19]. This feature also appears to move outward in images that were obtained at later times [20]. The fact that this feature is prominent in the infrared image and absent in the green image also suggests that it is not part of the fireball debris.

The radius of the large circular feature is 6000 km, which coincides with the propagation distance of the simulated wavefronts appearing in Figure 6. These wavefronts were obtained by integrating travel time along ray paths for a source located just above the ammonium hydrosulfide clouds, where the largest fragments are believed to have exploded. Since the wavefronts are strongly refracted into the sound channel from below, it is not surprising that no evidence of seismic waves (which penetrate thousands of kilometers below the sound channel) has been reported. The large circular feature appears to span only part of a circle. This could be due to either a limb effect in the imaging or the directionality of the source, which was an obliquely oriented flattened disk rather than a point source. The small circular feature also appears to be directional.

Conclusion

The acoustic model predicts that horizontal refraction associated with wind shear leads to the formation of caustics to the east and west of the impact sites. The energy in the caustics is enhanced by an order of magnitude. The caustics are well formed about 10 hours after the impacts. Images from the Hubble Space Telescope contain evidence of both acoustic and gravity waves near the impact sites. If waves are observed far from the impact sites, they might provide information regarding the depth dependence of the zonal winds and other acoustic properties. Our predictions, which apply to both

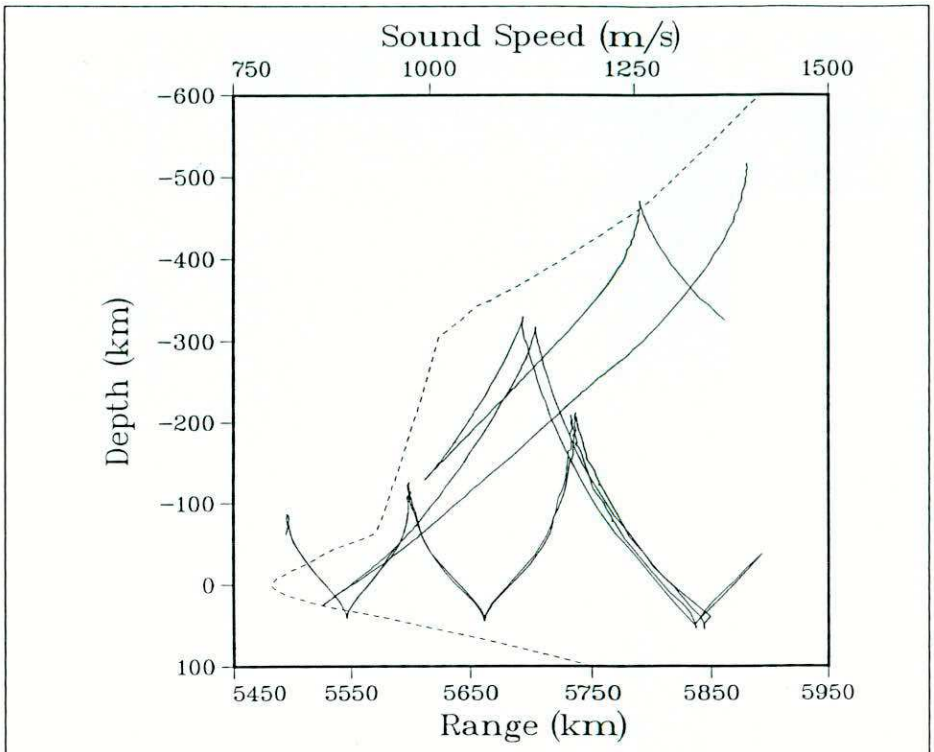

Fig. 6. Simulated wave fronts (solid curve) that were obtained using a sound speed profile obtained from Voyager data, which appears as a dashed curve. These wave fronts correspond to 1 hour and 45 minutes after the explosion of a comet fragment at a depth of 40 km below the tropopause (the location of the minimum speed of sound). The horizontal propagation distance (range) agrees with the radius of the large circular feature appearing in the infrared image in Figure 5.

types of waves, indicate the favorable locations and times to look for these waves.

Acknowledgments

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PLANNING AND NOISE: NOISE FROM INDUSTRIAL AND COMMERCIAL DEVELOPMENT

Steve Goswell MIOA

Introduction

The impact of noise from industrial and commercial development is an important consideration in determining planning applications. At the planning stage there is a unique opportunity to control noise by the design, layout and construction of new buildings and by proper acoustic treatment of machinery.

Failure to control noise at this stage can lead to expensive alterations at a later date and long term friction between the occupiers of industrial and commercial sites and local residents.

The fact that premises have been granted planning consent and are complying with any conditions attached does not prevent subsequent legal action for nuisance by either the local authority or local residents.

Noise control must be considered both for new industrial and commercial development, and for new residential development proposed near to existing industrial and commercial sites.

An article in the previous issue of Acoustics Bulletin [1] reviewed the Government's policy advice document on planning and noise 'Planning Policy Guidance 24'. However, this gives surprisingly little advice on dealing with noise from industrial or commercial developments even though it is probably the most complicated and contentious area dealt with by the local planning authorities and their EHO advisers. The earlier article promised that further consideration would be given to this topic and this now follows.

Planning Controls

Earlier advice on this subject (DOE circular 10/73 now replaced by PPG 24) warned local authorities against increasing ambient noise levels and advised that for new industrial and commercial development near to existing sensitive development the applicant should be required to provide details of predicted noise levels from the new development.

These requirements are missing from PPG 24 which merely refers to the guidance in British Standard 4142, namely, *'a difference of 5 dB or higher indicates that complaints are likely. A difference of 5 dB is of marginal significance.'*

The difference stated is between background noise levels, normally measured as $L_{A90,T}$ and noise from the industrial source measured as $L_{Aeq,T}$ corrected by adding a rating of 5 dB if the noise source has clearly distinguishable tonal or impulsive characteristics.

The foreword to British Standard 4142 warns that *'Although, in general, there will be a relationship between the incidence of complaints and the level of general community annoyance, quantative assessment of the latter is beyond the scope of this standard as is the assessment of nuisance.'*

The local Planning Authority has an opportunity at the time of granting any planning consent to control noise by including appropriate planning conditions in the consent, or by requiring that the developer enters into a Planning Obligation made under Section 106 of the Town and Country Planning Act 1990. The obligation may be administrative or it may involve the funding of works outside the application site, eg the provision of acoustic treatment to nearby buildings.

The enforcement of planning conditions involves slow and cumbersome procedures. Penalties for failing to comply with 'Planning Obligations' can be rapid and punitive.

PPG 24 gives examples of planning conditions which are similar to those contained in the earlier DOE advice circulars 10/73 and 1/85. These include conditions to minimize the effect of noise on new sensitive development eg by barriers or sound insulation to the new buildings. For new industrial and commercial sites example conditions include administrative controls, restrictions on operating hours, the provision of sound insulation to the new buildings or specified plant and the control of noise emitted from the site by noise limiting conditions.

Noise Limiting Conditions

These are often called boundary noise level conditions. However, because the boundary may often be an unsuitable measuring point, the term Noise Limiting Condition (NLC) is more appropriate.

Basically, the setting of noise limits by planning conditions involves setting a level not to be exceeded by noise generated by activities on the specific premises involved. The measuring point must be accessible to all parties concerned.

It is fair to say that problems arose in the early days after Circular 10/73 when Local Authorities were inclined to set maximum permitted levels too low. PPG 24 urges caution in the use of noise limiting conditions. Annex 5 of PPG 24 goes into some detail on the specifying of noise limits and suggests that limits should be either:

(a) an absolute limit based on the average level of noise that should not be exceeded in a specified time period; or

(b) a relative limit based on the permitted increase in noise level with respect of background.'

In practice most Local Authorities favour option (a).

The guidance states that it may be appropriate to set different levels for day, evening and night periods. It

goes on to advise that: *'A noise limit which is too close to background may be difficult to monitor...This may be particularly important at quiet sites where the L_{Aeq} may be 10 dB or more above the L_{A90} – even when the noise source is not operating.'*

Alternatives to conditions controlling noise limits include conditions specifying the activity that may take place, any restrictions necessary on the hours of operation, and details of the construction, acoustic treatment and layout of the development.

The strong argument in favour of using noise limiting conditions is to be found in the notes to Annex 4 of PPG 24 which state: *'But control of activity, construction and layout may prove less effective than noise limits in controlling noise resulting from future changes within the development. In practice, therefore, a combination of both types of condition may be advantageous.'*

This is a key point. NLCs will apply to control future activities and changes on the site.

There is little doubt that, used intelligently, noise limiting conditions represent powerful long term controls to prevent noise problems from new industrial and commercial development. In effect, by applying a condition of this sort the Local Authority will have created a mini Noise Abatement Zone (NAZ) without all the complex administrative and resource intensive problems associated with NAZs [2].

From the Local Authority's point of view it is important that where a NLC is likely to be applied to a planning consent there is early consultation with the developer. The implications of the noise levels proposed should be explained to the developer together with, either guidance from EHO staff as to what will be necessary in order to meet the required levels, or a recommendation that the developer himself obtains independent acoustic advice to satisfy himself that the proposed levels can be achieved. It is important that both the local Planning Authority and the developer are satisfied that the proposed levels are both achievable and reasonable before NLCs are included in any planning consent.

The main concerns voiced by developers when faced with NLC conditions are that: (a) they will be in default whenever there is a transient noise event from the site: and (b) the premises will be subject to long term noise monitoring from the Local Authority.

PPG 24 touches on these two points with the comments: *'There may also be the administrative difficulty of dealing with the occasional transient high noise levels from the site'* and, in respect of monitoring states, *'A disadvantage of this type of condition is that to ensure compliance, noise emissions must be monitored.'*

In practice Local Authorities are unlikely to be concerned about occasional transient noise events and there is no legal obligation for a local Planning Authority to monitor noise levels once consent is granted.

An attempt to cover these two specific points was included in South Cambridgeshire District Council's Local Plan (approved by the Department of the Environment in 1990) which states: *'Where the levels set in a noise limiting condition in any planning consent are exceeded enforcement action will not normally be taken by the Council unless complaints arise from local residents. Furthermore, the levels will not normally, unless specifically stated in the condition, apply to vehicle movements or to transient or occasional events lasting for less than thirty minutes in any day. For example, from noise arising from material handling or deliveries during normal daytime working hours. The levels are intended to apply to plant or activities, including impact noise activities, forming an inherent part of the business or recreational activities.'*

In practice many Local Authorities only monitor NLCs when development first commences and are unlikely to check noise levels again unless complaints arise. However, it is important that local authority environmental health departments keep a detailed record of all premises on which NLCs have been applied so these can be referred to if complaints are received.

Noise Indices for Noise Limits

The example NLC given in PPG 24 is given as a one hour L_{Aeq}. The guidance has a section on specifying noise limits which comments that *'$L_{Aeq,T}$ has emerged as the best general purpose index for environmental noise'* and that *'to describe background noise $L_{A90,T}$ is appropriate.'* It also recognises that *'at quiet sites the $L_{Aeq,T}$ may be 10 dB or more above the $L_{A90,T}$ – even when the noise source is not operating.'*

It is the author's experience that there are practical difficulties in using L_{Aeq} in quiet areas and that these difficulties become greater the longer the time period T used. In such areas L_{Aeq} tends to be dominated by transport noise (road, rail and air) and it is difficult to separate these elements when measuring multiple noise sources using L_{Aeq}. Shorter time period L_{Aeq} levels are easier to measure in quieter periods of background noise.

When a shorter time period L_{Aeq} is used this will obviously have the effect of being a more severe control of the noise source, ie a one minute L_{Aeq} will effectively restrict the use of any machinery that exceeds the dB level specified, whereas a one hour L_{Aeq} may allow the same machinery to be used for limited periods.

Indices used in NLCs may need to vary depending on the individual noise source concerned. However, it is the author's view that a short time period L_{Aeq} (eg either one minute or a few minutes) may prove best for general use. Where predominantly tonal characteristics are unavoidable levels lower than the existing L_{A90} may need to be set. Similarly where impulsive characteristics are anticipated a maximum noise level may also need to be specified.

Some local authorities set NLC levels as 'corrected' noise levels referring to British Standard 4142. This provides for an automatic adjustment of minus 5 dB(A) if the noise source contains clear tonal or impulsive characteristics.

Setting Noise Limiting Levels

When planning consent is sought for new industrial or commercial development it is frequently subject to objections from local residents. One of the grounds of objec-

tions will normally be noise.

If the proposed development will generate noise levels which are clearly audible to local residents in their gardens, or inside their bedrooms at night then they are justified in using noise as grounds for objection. If, however, noise from the proposed development is barely audible in nearby gardens or in bedrooms at night with windows open and is free from any predominantly tonal or impulsive characteristics, then objections on the grounds of noise may be discounted by the local Planning authority.

The term *'barely audible'* is subjective. However, it is the author's experience that in a quiet rural area where new noise sources are introduced with a short time period L_{Aeq} (measured 3.5 metres from façades of dwellings) equal to only 2 or 3 dB(A) above the existing background L_{A90} and the new noise is free from any predominantly tonal or impulsive characteristics, then it is likely to be perceived as *'barely audible'* by local residents and not likely to generate complaints.

Daytime L_{A90} readings should be representative of a typical quiet period of the day.

Where background L_{A90} values are 47 dB(A) or higher then a local authority may be justified in arguing that the new noise source, measured near to existing dwellings as a short time period L_{Aeq} should be kept below existing L_{A90} levels in order to minimize any further increase in ambient noise levels.

The above levels relate to a point 3.5 metres from nearest dwellings, 1.2 metres above ground level. However, the measuring points for NLCs should be accessible to all parties (or at least to the developer concerned and to the local authority) and so would not normally be located in the gardens of dwellings.

Where the new noise source is likely to affect upper floor living rooms, or bedrooms at night, and noise at these levels is expected to be significantly higher than at the 1.2 metre level, an alternative measuring point may be more appropriate.

Where night-time activities are permitted it will be necessary to set lower noise levels than those set during the day because background L_{A90} levels may fall below 30 dB(A).

WHO guidelines [3] state that *'based on the limited data available, a level of less than 35 dB(A) is recommended to preserve the restorative process of sleep'.*

The insulation provided by a partially open window will be 10–15 dB(A). Accordingly it is the author's view that NLCs permitting external levels of up to 40 dB(A) as a short time period L_{Aeq} (free from any distinctive tonal or impulsive characteristics) are unlikely to result in complaints even when background levels are very low.

Increasing Ambient Noise Levels

Circular 10/73 advised local planning authorities to use their powers to avoid increases in ambient noise levels near to residential development. This was an idealistic approach but not a very practicable one. To prevent any increase in ambient noise levels would mean that any new noise source should be 10 dB(A) lower than existing L_{A90} levels. In quiet areas this would involve setting NLCs as low as 20 dB(A) at night and in the low thirties during the day.

The advice to avoid increasing ambient noise levels is now absent from PPG 24 (which replaces circular 10/73). The author's views on setting NLCs detailed in this paper do involve an increase in ambient noise levels. However, the suggested basis for setting daytime noise levels is based on L_{A90} readings taken during the quieter parts of the day. For noisier daytime periods the suggested NLC noise levels may be equal to or lower than

the background L_{A90} levels.

In addition, particularly where the new noise source is intermittent in operation, there may be no significant increase in hourly L_{Aeq} levels in quiet locations when existing L_{Aeq} levels are often substantially higher than the L_{A90}.

Where two or more new activities are proposed care does need to be taken to ensure that the combination of noise sources does not result in increases to the existing L_{A90} of more than 3 dB(A) and in these circumstances the local authority may be justified in setting lower noise limits.

In practice the measuring point may be set at an agreed point between the boundary of the industrial or commercial premises concerned and the nearest dwellings, and will be higher than the levels to be achieved 3.5 metres from the dwellings concerned calculated to allow for attenuation for distance. The point of measurement of the NLC should be shown on a plan and the height of the measurement point specified. Noise levels specified in the NLC should be in suitable weather conditions (wind less than 5 m/s average, temperatures above 3°C in dry conditions).

New Residential Developments Near to Existing Industrial and Commercial Sites

The fact that a noise source was present before new residential development does not prevent individuals or local authorities from taking action for noise nuisance.

It is more difficult to control the impact of noise from existing activities on new residential development than it is in the reverse condition.

Planning conditions may be used to require barriers or the spatial separation of dwellings from the noise source. They may also be used to control the layout, design and construction of the residential site so that as far as possible living rooms, bedrooms, gardens and balconies are shielded from the noise source. The construction of dwellings, particularly windows and ventilation systems, may also be controlled by planning conditions.

An important option for reducing noise at its source is the use of the 'Planning Obligation' system. This has been used successfully to require the developer of residential sites to fund acoustic works at the noise source.

Naturally this has to be done with the complete agreement of the owner of the industrial or commercial operation. However, if it involves carrying out works designed to minimize noise problems in the future, without cost to the owner of the noise source, there are obvious benefits.

As far as the developer is concerned the costs involved may be minor in comparison to other site development costs, and the resulting reduction in noise levels may enhance the value of his development.

As a last resort the local authority may consider or threaten declaring a NAZ on the existing industrial site although the popularity of this method of control is now in decline.

Vehicle Noise

For certain types of development, vehicles both on site and on approach roads, may be an important noise source. Supermarkets, motorway service stations, freight and container depots, transport yards and certain public entertainment venues may all present vehicle noise problems. These may relate to increased traffic on access roads and/or on site vehicle problems. Individual sites may present special problems, eg the early morning warm up noise problems associated with heavy diesel vehicles, fork-lift truck movements, reversing alarm systems, vehicle refrigeration equipment etc.

For certain commercial developments such as fast food outlets, discos and public houses, noise may pose particular difficulties. Activities on these sites may peak in the evening and late at night and noise problems may arise from customers leaving these premises.

Control of vehicle noise often presents difficult problems which may be reduced by appropriate conditions or by planning obligations, eg by restricting areas where certain activities may take place, by screens or barriers or by restricting hours of operation and access roads to the site. However, for certain developments it may be very difficult indeed to effectively control vehicle noise which may present an ongoing source of noise if planning consent is granted.

Conclusion

Where noise is recognised as an important factor at the planning stage the developer is invariably eager to meet all reasonable requirements in order to get planning consent.

Technical or administrative solutions to reduce noise levels will be available in nearly every case. It is essential that these are identified and controlled at the planning stage.

The local planning authority and their advisors will be seeking not only to prevent noise nuisance from the development but, ideally, to achieve a situation where complaints are unlikely to arise relating to noise from (or to) the proposed development.

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Corrections

In the March/April 1995 issue of the Bulletin the photographs of Abigail Stinson and Bernadette McKell on page 57 were unintentionally interchanged.

The name of Cirrus Research plc was accidentally omitted from the list of Key Sponsors in the same issue.

Apologies to all concerned.

CALL FOR PAPERS

1995 Autumn Conference

Institute 21st Anniversary Event

STANDARDS, CRITERIA, MEASUREMENTS, DESIGN IN ACOUSTICS

Windermere Hydro Hotel
26 – 29 October 1995

The 1995 Autumn Conference offers an opportunity for IOA members to present and hear general presentations from across the wide interest range of the Institute. The conference seeks the involvement of all members and specialist groups to this 21st year celebration of the Institute.

Offers of contributed papers are welcome on any topic as a means of encouraging interaction between our specialist groups. Reviews of progress over the last 21 years and papers which present the latest findings are particularly welcome. Also, to establish a conference theme, papers dealing with standards, criteria and measurement techniques used in the general and specialist areas of acoustics are sought.
Suggestions of conference topic areas made to date include:

- Measurement of noise impact on persons/amenities/animals
- Hearing conservation and noise control in industry
- Measurement of impact and airborne sound insulation
- Use of intensity techniques to measure absorption
- Measurement of flanking sound transmission in buildings
- Design of buildings to meet Building Regulations.
- Design of barriers and measurement of insertion loss
- New criteria, PPG24, the new BS4142 , the revised BS8233
- Noise and sleep disturbance
- Measurement uncertainties and their relevance to practical situations
- Measurement and assessment of vibration effects on humans
- Accuracy of measurements/calibrations/verifications, standards

Workshops will be aranged to allow much debate on critical aspects in response to delegates' requests and demonstrations of measuring techniques are also planned.

Offers of contributions should be sent in the form of a short abstract by 20 July to allow the final programme for your 21st celebration conference to be finalised. Accepted papers will be published in Volume 17 of the Proceedings of the Institute of Acoustics (1995) for which purpose camera-ready paper will be provided. Arrangements will be made for papers to be refereed at the author's request; such papers must be available before 10 August. The final date for receipt of manuscripts of non-refereed papers is 1 October.

The conference will offer the usual social and accompanying persons programmes.There will be a technical exhibition and the inaugral meeting of the Measurement and Instrumentation Group, the latest IOA specialist group, will take place there.

All communications concerned with the technical programme, including queries over the suitability of an intended contribution, should be sent to the Chairman of the Programme Committee:

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CALL FOR PAPERS

11th Residential Week-end Conference

REPRODUCED SOUND 11

Hydro Hotel, Windermere

16 – 19 November 1995

Sessions are planned on the following topics: others will be arranged to match contributed papers.

- Aural Enhancement of Performace Spaces
- Audio Synthesis
- In-Car Acoustics and Entertainment Systems
- Loudspeaker Development
- Standards and Codes of Practice
- Speech Intelligibility
- Open Session

Additional evening workshop discussion sessions are planned for these topics

Offers of contributions should be sent in the form of a short abstract to the Institute office before 4 September. Accepted papers will be published in Volume 17 of the Proceedings of the Institute of Acoustics (1995) for which purpose camera-ready paper will be provided. Arrangements will be made for papers to be refereed at the author's request; such papers must be available before 24 August. The final date for receipt of manuscripts of non-refereed papers is 15 October.

A chamber music recital will be presented by
LARES Aural Enhancement System, sponsored by Harman UK

The training course on 'Acoustics for Sound System Engineers' will be run again

There will be the usual social and accompanying persons' programmes

A technical exhibition is being arranged

This conference is organised in collaboration with ABTT, AES, APRS, ISCE and PLASA.

Technical Programme Committee Chairman: Ken Dibble FIOA

INSTITUTE DIARY 1995

30 JUN
IOA CofC in Env Noise Mm'nt Advisory Committee
St Albans

12 JUL
Midlands Branch mtg
PPG24, Neighbour Noise Working Party
Birmingham

13 JUL
CEng interviews
St Albans

15 SEP
Engineering Division Committee
St Albans

20 SEP
Yorks/Humberside Branch mtg:
Legislation/Steel Indy
Rotherham

20 SEP
London Branch mtg:
London Heliport Working Party Report
London

21 SEP
IOA Publications, Meetings Committee
St Albans

27 SEP
Midlands Branch mtg
Clay Target Shooting Workshop
Birmingham

27 SEP
Eastern Branch mtg
Train Noise and Vibration
Chelmsford

28 SEP
IOA Membership, Education Committee
St Albans

- SEP
Southern Branch mtg
Lesser Known Techniques in instrumentation/measurement
ISVR Southampton

– SEP
Environmental Noise Assessment Workshop
Belfast

5 OCT
IOA Medals & Awards, Council
St Albans

13 OCT
IOA CofC in Workplace Noise Assessment exam
Accredited Centres

18 OCT
London Branch mtg:
Cross-Rail Project
London

25 OCT
Eastern Branch mtg
Sound Reproduction
Ipswich

26–29 OCT
21st Anniversary Event
Autumn Conference
Standards, Criteria, Measurements, Design in Acoustics
Windermere

– OCT
South-west Branch mtg:
Active Noise Control
Caerphilly

3 NOV
IOA CofC in Env Noise M'ment exam
Accredited Centres

10 NOV
IOA CofC in W'place Noise Ass't Advisory Committee
St Albans

16–19 NOV
Reproduced Sound 11
Windermere

20 NOV
IOA Publications, Meetings Committee
St Albans

21 NOV
Yorks/Humberside Branch mtg:
Instrumentation/Rev Chambers
York

22 NOV
Eastern Branch mtg
Medical Acoustics and Audiology
Cambridge

22 NOV
London Branch mtg:
Annual Dinner
London

23 NOV
IOA Membership, Education Committee
St Albans

29 NOV
Midlands Branch mtg

- NOV
Southern Branch mtg
Environmental Noise Barriers
Winchester

- NOV
Sout-west Branch mtg
Underwater Acoustics
Filton

1 DEC
IOA CofC in Environmental Noise Mm'nt Advisory Committee
St Albans

7 DEC
IOA Medals & Awards, Council
St Albans

13 DEC
London Branch mtg:
Use of PCs in Noise and Vibration Measurement
Epsom

18-20 DEC
Underwater Group Conference - Sonar Signal Processing
Loughborough

MEMBERSHIP

The following were elected at the Council meeting held on 25 May 1995

Fellow
Dobbins, P F
Thompson, D J

Member
Averchenko, B
Clingan, O R
Clinton, F J
French, S A
Gray, A J
Greatrex, A S
Harris, B G
Harrison, M F
Jarng, S S
Jay, L
Lear, J
Leversedge, D C
Long, C
McLaughlin, R B
Murkett, S E W
Pipe, A J
Senior, P L
Sotiropoulou, A G
South, T M
Thomas, D R
Wilkins, B A

Associate Member
Bailey, M S
Bradley, A M
Brown, G
Emms, J
Hart, C B
Ho, W L
Newton, A J
Nourse, V J
Robinson, B J
Whitfield, A

Associate
Asbury, A J
Boughton, P W
Kayes, M P

Student
Greaves, M J
Sabberton, J R
Sethi. R P S

NON-INSTITUTE MEETINGS

2–6 July 95
International Symposium on Musical Acoustics, ISMA 95
Dourdan, France
4–6 July 95
Undersea Defence Technology Conference & Exhibition
France
5–7 July 95
Ultrasonics International 95
Edinburgh
6–8 July 95
ACTIVE 95
Newport Beach, California, USA
10–12 July 95
InterNoise 95
Newport Beach, California, USA
21–25 August 95
2nd International Conference on Theoretical and Computational Acoustics
Hawaii, USA
30 Aug–2 Sep 95
Utilization of Ultrasonic Methods in Condensed Matter
Zilnia, Slovak Republic
28 Aug–8 Sep 95
Speechreading by Man & Machine: Models, Systems & Applications
France
3–7 Sep 95
1995 World Congress on Ultrasonics
Berlin, Germany
10–13 Sep 95
PLASA show
Earls Court, London
11–14 Sep 95
Chartered Institute of Environmental Health Annual Congress and Exhibition
Bournemouth
11–13 Sep 95
National Forum on Hearing Aid Research and Development
Bethesda, USA
14–16 Sep 95
Gear Noise
Ohio, USA
17–21 Sep 95
15th ASME Bienniel Conference on Mechanical Vibration and Noise
Boston, USA
21–24 Sep 95
17th Nordic Sound Symposium
Norway
23–26 Sep 95
Speech-Music-Hearing
Prague
25–29 Sep 95
Fourth International Course on Noise & Vibration from Rail Transport Systems
Germany
6–9 Oct 95
99th AES Convention
New York, USA
20–22 Oct 95
2nd International Acoustics Meeting in Chile
Valdivia, Chile
15–17 Nov 95
Acoustics Applied
W Australia
27 Nov–1 Dec 95
130th Meeting of the Acoustical Society of America
St Louis, USA
5–7 Dec 95
International Conference on Structural Dynamics, Vibration and Noise Control
Hong Kong
10–11 Jan 96
Second Annual Meeting
Singapore Society of Acoustics
Singapore
22–24 Feb 96
National Hearing Conservation Asso.
San Fransisco, USA
1–4 April 96
1st Convention of the EAA
Belgium
11–14 May 96
100th AES Convention
Copenhagen, Denmark
13–17 May 96
131st Meeting of the Acoustical Society of America
Indianapolis, USA
24–28 Jun 96
3rd European Conference on Underwater Acoustics
Greece
29 Sep–2 Oct 96
Noise-Con 96
Washington, USA

Institute email:
Acoustics@clus1.ulcc.ac.uk

CODE OF PRACTICE ON ENVIRONMENTAL NOISE CONTROL AT CONCERTS

Stephen Turner FIOA

Introduction

For about a quarter of a century, the phenomenon of the open air pop concert has been a feature of our summers. Large crowds gather at venues ranging from football stadia, the grounds of country houses or simply open fields to hear the rock musicians of the day perform. An intrinsic part of this type of event is the need for the sound of the music to be loud enough to satisfy the demands of the audience – a promoter can be severely criticised if it is felt to be too quiet. But with such audience satisfaction comes the consequential risk of severely disturbing those who live or work nearby and who do not have the desire to hear the latest pop songs in their homes.

In the mid-seventies, the Greater London Council tried to address this issue by publishing a Code of Practice setting noise limits on such events as well as controlling other very important health and safety issues. There were three versions of this Code issued before the abolition of the GLC in 1986, but even then it was recognised that, with respect to the noise element, there was scope for improvement.

The Noise Council, which is the body set up following the demise of the Noise Advisory Council by the four main professional institutions associated with noise (the IOA, the Chartered Institute of Environmental Health, the Royal Environmental Health Institute of Scotland, and the Institute of Occupational Safety and Health) set up a working party to examine the issues and produce a revised Code of Practice.

The development of the code took seven years during which time there had to be close liaison with the Health and Safety Executive during the production of their revised guidance [1]. Also, in order for the final code to be considered for promulgation by the Department of the Environment under Section 71 of the Control of Pollution Act, it was essential that a widespread consultation exercise was undertaken. Adoption of a Code of Practice under Section 71 means that it can formally be used as a test of Best Practicable Means as described in the Act. The consultation was carried out during summer 1993.

A full description of the development of the code up until the consultation process is given in [2]. This article, therefore, describes the outcome of the consultation procedure, identifies the issues that were raised by those who responded and highlights the major differences between the draft and final code.

The Draft Code

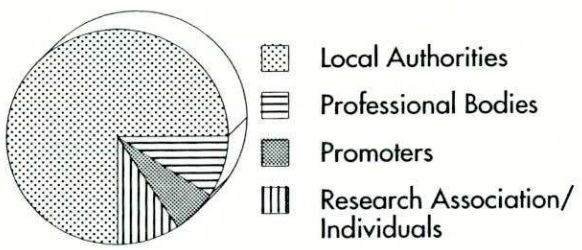
The draft code comprised four main elements: Definitions; Guidelines; Supplementary Guidance; and Noise Control Procedures.

The definitions covered basic acoustical parameters, but also other terms associated with concerts. The guidelines were set out in a Table, with a combination of absolute values and permitted increases in level over the background, depending on the location and the frequency of the events. These were followed by supplementary guidance covering a range of other matters, and the draft concluded with recommendations on procedures to adopt to run a successful event.

Consultation

A copy of the draft code went to every local authority, concert promoters, other organisations such as the NSCA and the Association of Noise Consultants. The aim was to achieve as wide a consultation as possible and try to avoid the accusation of inadequate consultation once the Code was published.

We received 44 responses distributed as shown:



Distribution of Responses

Some authorities had organised themselves into consortia and produced a combined response. For the following statistics each member of a consortium was treated separately.

In trying to focus on the issues, the responses were categorised according to which part of the code they referred. On this basis, the working party had 252 different comments to assimilate, with seven respondents offering ten or more comments as shown in Table 1:

Avon	15
Suffolk Coastal	14
Warren Residents Association (Reading Festival)	14
Wealden DC	13
Mendip DC	12
Glasgow DC	10
NSCA & EP Noise Committee	10

TABLE 1: Number of Comments from Respondents.

Table 1	65 dB(A) Limit	26
Para 3.5	Low Frequency Noise	26
Table 1	75dB(A) Limit	21
Para 3.4	Dealing with one-off events	15
Para 3.2	Night Events Limit	14
+ Note	Definition of Background Level	13
Para 4.1.2	Checking the viability of concerts – Typical Values	13
Table 1	Limit for 4–12 events per year	11
Miscellaneous Other Points		*19*

TABLE 2: Issues which attracted most comment.

The issues raised in respect of Table 2 were:

65 dB(A) Limit: The main observation about this came from rural authorities who felt the level was too high and that the limit should be set in terms of an increase over background. Others were unsure of the venue definition and some pointed out the potential inconsistency in the limits to be set when moving from 3 to 4 concerts per year with a background level of 55 dB(A).

Low Frequency Noise: Virtually all those who commented acknowledged the capacity for low frequency noise to be a problem, and as a result wanted more guidance to be included.

75 dB(A) Limit: There was general agreement with this limit, but some responses were concerned about the definition of events in relation to a festival. Could a four-day festival be regarded as a single event?

For one-off events, generally, those who commented thought it unreasonable to burden residents with the expectation of keeping windows shut even for one day. The night limits tended either to bring agreement or raise the usual issues regarding the use of inaudibility as a criterion.

The definition of background level caused comments broadly concerning the problem of the varying background level during an event, whereas checking the viability of the concerts raised some questions over the values quoted but also drew the comment from one set of responses that audience satisfaction was not an issue. Finally the limit from 4 to 12 events raised the valid issue of the scheduling of the various events.

Other points raised included:

- the use of dB(C) as a means of tackling the low frequency noise problem;
- the existence of other noise sources at events which could be significant;
- the desire to impose all noise control costs on the promoter;
- a rather interesting thought that if a one-off event effectively attracts no limit, why not amend the Environmental Protection Act to take away any illusion of control that the public still feel does exist in that situation.

Revision to the Code

Following the consultation process, the following changes were made:

Firstly the introduction was expanded and in 1.4 an attempt has been made to define the scope better.

1.4 This Code is not designed to address the question of environmental noise arising from discotheques, clubs and public houses, nor environmental noise affecting noise sensitive premises which are structurally attached to the venue.

The Definitions have also been expanded primarily to include formal definitions of the various venue types.

Urban Stadia or Arenas: A regular venue for major sporting and similar events in an urban area.

Other Urban Venues: An urban park or similar area which is not normally used for major organised events.

Rural Venue: A park, open space or grounds of a country house in a rural area not normally used for major events.

Noise Control Consultant has also been defined. This person appeared in the draft code as a noise control engineer in the planning section of Noise Control Procedure. It was felt that this function was sufficiently important to warrant a definition; the difficulty was finding a name! The requirement was for someone who understood the noise issues and was recognised by all parties as having the authority to exercise appropriate control at the height of the event. A number of titles were discussed and as a last resort the working party were circulated with a choice of: Noise Moderator; Noise Manager; Noise Control Officer; Noise Controller; Noise Assessor; and Noise Consultant. One vote was cast for each title! An executive decision was taken, therefore, to use Consultant on the grounds that more often than not, it would be a consultant fulfilling that role.

The guideline table was altered to remove the 'more than 12' category. The revised table is reproduced in Table 3 below.

On the question of night events, the inaudibility criterion was retained but the limitations were set out in the form of notes:

1. The use of inaudibility as a guideline is not universally accepted as an appropriate method of control. References 6 & 7 (Appendix 1) set out the various issues. This guideline is proposed as there is insufficient evidence available to give more precise guidance.

Concert days per calendar year, per venue	Venue Category	Guidelines
1 to 3	Urban Stadia or Arenas	The MNL should not exceed 75 dB(A) over a 15 minute period
1 to 3	Other Urban and Rural Venues	The MNL should not exceed 65 dB(A) over a 15 minute period
4 to 12	All Venues	The MNL should not exceed the background noise level by more than 15 dB(A) over a 15 minute period

TABLE 3: Guidelines

2. Control can be exercised in this situation by limiting the music noise so that it is just audible outside the noise sensitive premises. When that is achieved it can be assumed that the music noise is not audible inside the noise sensitive premises.

For low frequency noise, in addition to raising the awareness of the potential problem, an attempt was made to give some guidance as requested:

2. Although no precise guidance is available the following may be found helpful (Ref 8): A level up to 70 dB in either of the 63 Hz or 125 Hz octave frequency band is satisfactory: a level of 80 dB or more in either of those octave frequency bands causes significant disturbance.

The grade of sound level meter to be used has also been specified. After much debate, type 2 was chosen on the grounds that a properly calibrated type 2 meter is perfectly adequate for this application.

A section was also added on volume strategy:

3.10 The nature of many concerts requires the sound volume level to be increased during the event to enhance the performance. The prevailing noise control restrictions should be borne in mind so that the sound volume at the start of the event is not too high, hence allowing scope for an increase during the event.

The code concludes with the procedures section being very much as before.

Conclusion

The Code of Practice has been published and it is hoped that it will be found to be a useful document for those involved in assessing or licensing concert events. It has been designed to cover the various noise issues that can arise at such events, although it must be admitted that definitive answers are not necessarily provided for each situation. For some circumstances there is insufficient data to provide precise guidance. It was felt, though, that the Code should raise the awareness of potential problems, even if the solutions are not clear, rather than having something unexpected arise during an event. Following the Code, therefore, should mean that successful events can be held where noise is an issue but not a problem.

Acknowledgement

This Code could not have been prepared without the contributions from the various members of the working party whose names are to be found in Appendix II of the Code.

References

[1] Guide to Health, Safety and Welfare at Pop Concerts and similar events.

[2] Development of the Code of Practice on Environmental Noise Control at Concerts, S W Turner, National Society for Clean Air & Environmental Protection (1993).

The Noise Council Code of Practice on Environmental Noise Control at Concerts is available from the Noise Council, Chadwick Court, 15 Hatfields, London SE1 8DJ Price £7.50 (including p&p).

Stephen Turner FIOA is a Technical Director of TBV Science.

UPDATE ON THE UNIFICATION PROJECT

Sir John Fairclough FEng

I am pleased to report that all 40 Institutions have signed a Declaration of Intent, pledging to support the establishment of a new body to unify the engineering profession. The Engineering Council has also signed a Declaration of Intent agreeing to adapt its Charter and Bye-Laws to facilitate the implementation of the new arrangements. This is an excellent result which exceeded my expectations.

The way is now clear for us to begin the process of implementation and I consider there is now a mandate to introduce the new arrangements by the end of the year. The timetable is tight and a crucial requirement is to develop appropriate election procedures so that we can have an election to Senate in the autumn. There is a need to integrate the timetable for the election and the work on changing The Engineering Council's Charter so that we can have an approved Charter in time for 'Vesting Day' on 1 January 1996.

We need to set up arrangements for election to the Senate which will ensure that each year a third of the elected members, ie 16, will retire. To start the process we plan to have an election in the Stage II Policy Group, which comprises representatives from the Institutions and The Engineering Council, to select 16 individuals to serve on the Senate for one year only.

We hope to identify this initial group of Senate members as quickly as practical to ensure an orderly transition and secure the early involvement of people whose knowledge, experience and leadership qualities will be widely seen as important to the successful launch of the new Engineering Council. On 1 January 1996 they will begin their term of office in the Senate together with 32 members (of which half will serve a three-year term and the remainder will serve a two-year term) elected through Institution Councils and registrants in autumn 1995. There will also be 6 Privy Council appointees making 54 Senate members in total. On 1 January 1997 the seats of the 16 members elected by the Policy Group will become vacant and will be filled by 16 members elected by Institution Councils and registrants. Thereafter elections will be held for 16 members routinely each year. These arrangements have the advantage of quickly normalising the election process on a three-year cycle.

The Transition Project Group (TPG) has established two working groups to establish the modus operandi for both the Board for the Engineering Profession (BEP) and the Board for Engineers Regulation (BER) consistent with the proposal. They will also consider what transition arrangements are necessary to ensure that all the present activities of The Engineering Council are accommodated under one or other of the two Boards in a way which provides for continuity of supervision during the transition period.

In reviewing the responses to the Unification proposals, the Policy Group focused on the five key issues which were raised. These were the '95% target', the '50 registrants/5 Institutions' rule, the name of the new body, the transition arrangements and the need to bring together the work of the BER, the Engineering Occupations Standards Group (EOSG) and the Executive Group Committees (EGCs) or their successors.

- On the '95% target', the Policy Group endorsed the approach I have put forward in correspondence with a number of Institutions. Namely that there should be a schedule of early meetings between the new body and each nominated Institution to demonstrate good faith and commitment to the target of 95% registration of their eligible membership, but this would not be interpreted as a rigid rule. The Charter and Bye-Laws of the new body will reflect this approach. I hope this will satisfy those Institutions who have expressed concern about this aspect of the proposal.
- On the '50 Registrants/5 Institutions' rule the Policy Group agreed that a reduction in this requirement was appropriate. This reduction was something which many Institutions called for in their responses. The Policy Group supported amending this rule to 30 Registrants from 3 Institutions. I consider this strikes the right balance between setting too low a hurdle with the consequence of encouraging too many unrepresentative nominations and not making the hurdle so high that registrants find it almost impossible to garner sufficient support to submit a nomination. I envisage this is a rule that will be reviewed in the light of experience.
- As regards the question of the name, the responses received showed little enthusiasm for 'UK Engineering Confederation' and there were no other names suggested which captured the imagination. On balance therefore the Policy Group felt a sensible approach would be to keep the name 'The Engineering Council' but to have a new house style including a new logo to demonstrate a new beginning.
- A key requirement for the transition will be to develop arrangements to ensure that all the current activities of The Engineering Council continue during the changeover period. The Policy Group agreed that it would help to facilitate a smooth handover if those Engineering Council members who oversee key Council programmes were given the opportunity to serve on the new body during the transition period which would last for one year.
- Both The Engineering Council and some Institutions drew attention to the lack of clarity in the proposal about how the BER will interact effectively with the nominated institutions over issues relating to registration. There was also the question of how the BER would take on board the work of the EOSG which brings together representatives from the Institutions, Industry, Academe and Government. It is envisaged that the 'standards of competence' which the EOSG and its sub-groups are developing will have much relevance to the 'standards setting' function of the BER. The Policy Group considered that these issues needed further study. It has therefore been agreed that the BER Working Group should review these matters and come forward with recommendations. ❖

21st ANNUAL REPORT OF THE COUNCIL 1994

Summary

The Institute is the professional body representing acoustics in the UK. A range of services is provided for members. This includes the six editions per year of the publication Acoustics Bulletin, the organising of meetings and conferences and the provision of courses for the Diploma in Acoustics and Noise Control, the Certificate of Competence in Workplace Noise Assessment and the Certificate of Competence in Environmental Noise Assessment. Overseas activities include the organisation of international conferences and participation in the European Acoustical Association (EAA) and the Federation of Acoustical Societies of Europe (FASE).

A route for members to become registered as Chartered or Incorporated Engineer is provided through the Institute, since it is an affiliated/nominated body of the Engineering Council. Plans are advanced for the provision of a Continuing Professional Development Scheme for members.

In 1994 an initiative was launched to revitalise some of the Branches of the Institute. This has proved successful, with the Midlands, Southern, South West and Yorkshire and Humberside Branches generating a series of meetings.

Thanks are due to the staff at the Headquarters in St Albans for their commitment and enthusiasm which ensure the smooth running of the office and other Institute activities.

Standing Committees

The operation of the Institute is guided by Council through Standing Committees concerned with Membership, Meetings, Publications, Education and Medals and Awards. There is also a Committee of the Engineering Division.

Membership Committee

The membership has continued to grow steadily with a 5% overall increase for the year. The current statistics are given in Tables 1, 2, 3, and 4. The growth of the Corporate grades matches the overall growth but among the non-corporate grades there has been a shift towards AMIOA and a reduction at Associate and Student grades. The Institute is delighted to see an increase in the number of Sponsor Members and thanks these bodies for their support. Progress has been made towards a formal recognition of Open University degrees as satisfying the educational requirements for membership of the Institute. The membership of the Committee has been strengthened and in selecting new members the aim has been to ensure that the Committee is representative of all interests.

Meetings Committee

During the year 11 workshops and meetings were held, including 3 major conferences. (see Table 5). The Spring Conference, Acoustics '94 at Salford was successful, despite concerns at the early stages of planning. Reproduced Sound 10 again featured the training course on Acoustics for Sound System Engineers. Mention should be made of two particularly successful one-day meetings on Windfarm Noise and on Noise Nuisance and the Law. Presentations were made to the Executive Board and to the General Assembly of the International Institute for Noise Control Engineering (I/INCE) at Inter-Noise '94 in Yokohama on plans for Inter-Noise '96 which will be held in Liverpool.

Publications Committee

The Acoustics Bulletin has continued to provide members with a journal having a balance of news, regular features and technical contributions. A lively correspondence has developed during the year on the Letters to the Editor page. The editorial team has been strengthened recently with the appointment of Roger Higginson as Features Editor. The 1994 Register of Members was published in August and circulated to all members. A procedure for the refereeing of conference papers has been established. The reference library is now being set up in a separate room at Headquarters and the books are being catalogued and recorded on a computer database. The library will be the home of the R W B Stephens archive.

Education Committee

In 1994, 175 students completed the requirements for the award of the Institute's Diploma in Acoustics and Noise Control including 5 students from the first intake of the Institute's revised Tutored Distance Learning Programme. At the three examinations held in February, May and October, a total of 135 candidates were awarded the Certificate of Competence in Workplace Noise Assessment; this makes the total awarded so far 1,001. Following examinations in March, June and November, 98 candidates were awarded the Certificate of Competence in Environmental Noise Measurement. This makes a total of 154. A working group of the Committee is developing the plans for Continuing Professional Development provision by the Institute.

Medals and Awards Committee

The Rayleigh Medal in 1994 was presented at the Spring Meeting to Professor E F Evans of Keele University for his work as a physiologist in exploring the frequency selectivity of the ear. The RWB Stephens lecture, Foundations and Application Opportunities of Binaural Technology, was given at the same meeting by Professor J Blauert from Ruhr-University in Bochum. Also at the Spring Meeting, Honorary Fellowships were awarded to Messrs Alan Dove for his contribution to workplace noise control and George Vulkan for his work on environmental noise assessment and control. The Tyndall Medal was presented to Dr Roger Moore who is Head of the Speech Research Unit in the Defence Research Agency during the Autumn Conference. Roger Moore is recognised in the UK and overseas for his work in the field of speech research and technology.

Engineering Division

In 1994, the first three new Incorporated Engineers of the

Institute were registered with the Engineering Council. Demand for registration has remained high with 11 additional members registered as Chartered Engineer and a further 60 under consideration for CEng or IEng. The Engineering Division activities during the year included a technical workshop, a response to the Engineering Council proposals for unification of the engineering profession and a first consideration of the new EC plans for the future of engineering education and training. Members of the Division also contributed to the development of the Institute's Continuing Professional Development scheme.

Specialist Groups

The Institute as a whole reflects the broad span of the science of acoustics and a number of Groups have developed to foster closer contacts between members in various specialisms.

Building Acoustics Group

The Group has sought, in light of the formation of the new Environmental Noise Group, to refocus its aims to concentrate on control of noise from all sources in buildings; criteria for noise levels in different situations in buildings; sound insulation (including measurement, predictions and criteria); and the acoustics of auditoria.

Environmental Noise Group

The first year of activities since its establishment has proved a success with a well attended workshop held jointly with the South West Branch on Environmental Assessment. One of the purposes of this meeting was to assess the views of the membership, prior to the Group formulating a response on behalf of the Institute to the Department of Environment, on the Consultation Draft Guide on the Preparation of Environmental Statements.

Industrial Noise Group

One meeting was held by the Group in 1994. This was organised by Alistair Mackinnon and was on the subject of Sound Power Measurement.

Musical Acoustics

The Group was not active in 1994. Members interested in becoming involved in regenerating the Group's activities should contact Headquarters.

Physical Acoustics Group

The Physical Acoustics Group, which is organised jointly with the Institute of Physics, was involved in two meetings in 1994. The first of these was on the Measurement of the Acoustic Properties of Biological Tissues, held in February at the Institute of Physics in London. The second meeting covered the non-destructive testing interest of many of the Group's members. It was held as part of the British Institute of Non-destructive Testing Annual Conference, at York and was jointly sponsored by British Institute for NDT. As usual a Newsletter outlining the Group's activities was sent to all Group members during the year.

Speech Group

The Group held a one-day technical meeting on Large Vocabulary Speech Recognition at Cambridge in March. About ninety people attended, far more than usual, and eleven papers were presented. The meeting was followed by the AGM. The Autumn Conference at Windermere on Speech and Hearing was another chance for those active in this field to present their work. The editorship of the newsletter SpeakEasy changed during the year. The first issue under the new editors appeared in October. The STAG (Speech Technology Assessment) and SRU-SUG (Speech Synthesis Research) sub-committees continue to operate and provide a focus for these areas within the UK speech community.

Underwater Acoustics Group

The major conference organised by the Group in 1994 was on the subject of Underwater Acoustic Scattering held in December at Weymouth. The conference had an international flavour with a substantial American contingent. The A B Wood medal for 1993 was presented to Dr Michael D Collins of the Naval Research Laboratory, Washington, at this meeting. Preparation of a second book sponsored by the Institute through the Underwater Acoustics Group entitled Sound in the Sea was well advanced in 1994.

Regional Branches

The Regional Branches of the Institute of Acoustics have been established to further the technical and social activities of the Institute at a more local level.

Eastern Branch

The Eastern Branch was again very active in 1994. One afternoon and one evening meeting were held jointly with the Chartered Institute of Environmental Health Officers. Four other evening meetings were held including the 1994 Annual General Meeting at Stansted Airport which followed a visit to the Airport's noise tracking division. In addition, the Branch Dinner was held at Tannington Hall in Suffolk. The meetings covered the topics of: Noise from Windfarms, Ground-borne Vibration, Low Frequency Noise Survey, Acoustic Design of Broadcasting Studios and Sound Quality.

Hong Kong Branch

Five technical talks were organised by the Branch and were attended by an average of 30 members. 11 members joined the Branch and HKIOA joint exchange programme to Shanghai in May. They visited convention centres, theatres, recording studios and factories to see the application of noise control technologies in Shanghai. A full coverage of the programme was reported in the November issue of Sounding Board, a newsletter of the Branch. A delegation of 6 from Shanghai Acoustical Society visited the Branch in December. An annual Meyer Poon Memorial award has been established for the outstanding student report on vibration, acoustics and noise control. Mr M K Kwan of the University of Hong Kong who wrote a report on an experiment on structural dynamics won the 1994 award.

London Branch

A change in the London Branch's year resulted in two annual dinners being held in 1994 as well as nine evening meetings in addition to a half-day visit to the Royal Academy of Music and a one-day conference on Noise and the Law. At the evening meetings railway noise figured large, attracting speakers and delegates from different points of view in connection with various Channel Tunnel operations. A wide range of other topics were

covered including loudspeaker design, a review of the Design Manual for Roads and Bridges and a very close look at noise propagation. The experiment of using some out of town venues for meetings proved popular.

Midlands Branch

The reactivated Branch held its first meeting in Rugby on 7 December with an encouraging attendance of 56 people and an ad hoc committee was formed. Talks were presented by Bernard Berry and Nicole Porter on BS4142 and by Stephen Turner on his experiences in the presentation of evidence at Public Enquiries.

North West Branch

In March, following the AGM, David Oldham gave a talk entitled Streets, Sheds and Spoilers which covered some of the diverse range of topics studied by his research students. A well attended meeting was held at Vibronoise's premises where a talk on the application of BS6472: 1992 to rail induced ground vibration measurements was given by Ian Melling. The third meeting of the year was a visit to Shotton Paper Mill to view the facilities and to learn of the methods taken to control noise and vibration.

Scottish Branch

A combined AGM and Branch meeting were held at Hillwood Quarry, Ratho in June. The manager, Robert McNaughton spoke about noise and vibration problems with regard to health and safety of the employees and nuisance at the site perimeter. This was followed by a tour of the quarry. In September a visit was made to the Jetstream aircraft production facility at Prestwick. Paul Robinson spoke about the reduction of noise intrusion into aircraft cabins.

Southern Branch

The Branch was revitalised at a meeting in November organised by Dawn Langdown at which a new Branch Committee was formed. At a further meeting in December a provisional programme of events for 1995 was arranged.

South West Branch

March 1994 saw the relaunch of the SW Branch with over 200 people indicating interest and an attendance of around 60 at the first meeting at UWE Bristol, the topic being Noisy Neighbours. The first year's programme consisted of a visit to Nuaire, Caerphilly with a meeting on Fan Testing, the hosting of the Environmental Noise Group's Workshop at UWE Bristol, and an Underwater Acoustics evening at BAeSEMA, Filton. There are currently about 150 members in the Branch plus a further 60 people in Local Authorities on the unofficial mailing list.

Grade	1993	1994	Applied	Elected
HonFellow	13	13	–	2
Fellow	219	228	14	10
Member	1137	1193	73	60
Associate Member	394	472	119	119
Associate	226	208	32	32
Student	44	42	19	19
Totals	2033	2156	–	–
Key Sponsor	3	3		
Sponsor	18	21		

Table 1. Details of Institute Membership.

	1993	1994
Building Acoustics	506	514
Electroacoustics	136	138
Environmental Noise	484	582
Industrial Noise	617	555
Musical Acoustics	138	130
Physical Acoustics	102	89
Speech	103	108
Underwater Acoustics	152	150

Table 2. Group Membership.

	1993	1994
Eastern	163	171
London	461	469
Midlands	187	210
North East	57	51
North West	236	234
Scottish	86	85
South West	139	146
Southern	310	308
Yorks/Humberside	97	104
Hong Kong	152	143
Overseas	139	140

Table 3. Details of Branch Membership.

	1993	1994
Architectural Practice	18	17
Consultancy	498	523
Industry/Commerce	329	320
Education	215	224
Public Authority	415	454
Research & Development	218	217
Other	65	66
Retired	57	67

Table 4. Details of Employment Category.

Topic, Date & Venue	Attendance
Prediction and Assessment of Structure Borne Noise from Underground Railways 10 January, London	32
Windfarm Noise 17 February, London	106
Acoustics '94 18–21 April, Salford	169
Noise Nuisance and the Law 18 May, London	112
Environmental Noise Assessment Workshop 20 September, Bristol	35
Reproduced Sound 10 3–6 November, Windermere	104
Miniature Microphones Workshop 9 November, Salford	12
Current Issues in Standardisation 11 November, London	21
Autumn Conference: Speech & Hearing 24–27 November, Windermere	104
Sound Power Measurement 30 November, London	38
Underwater Acoustics Scattering 20–22 December, Weymouth	70

Table 5. Meetings Attendance.

Chairmen of Committees and Sub-committees
EDUCATION: Dr R Lawrence FIOA
Certificate of Competence in Environmental Noise Measurement Advisory Board: Dr J C Goodchild FIOA
Certificate of Competence in Workplace Noise Assessment Advisory Board: Dr R J Peters FIOA
Diploma in Acoustics and Noise Control, Board of Examiners: Dr J M Bowsher FIOA
ENGINEERING DIVISION: Professor P D Wheeler FIOA
MEDALS & AWARDS: Mr A N Burd FIOA
MEETINGS: Mr B F Berry FIOA
MEMBERSHIP: Mr A N Burd FIOA
PUBLICATIONS: Mr J M Sargent MIOA
Specialist Groups
BUILDING ACOUSTICS: Chairman Mr J G Charles FIOA
ELECTROACOUSTICS: Secretary Dr J A S Angus FIOA
ENVIRONMENTAL NOISE: Chairman Mr S W Turner MIOA, Secretary Ms D G Langdown MIOA
INDUSTRIAL NOISE: Chairman Dr R J Peters FIOA, Secretary Mr D G Bull FIOA
MUSICAL ACOUSTICS: Chairman Dr B E Richardson MIOA, Secretary Dr J H Zarek MIOA
PHYSICAL ACOUSTICS (Joint with the Institute of Physics): Chairman Dr D Almond, Secretary Professor R Challis
SPEECH: Chairman Dr S J Young FIOA, Secretary Dr B J Williams MIOA
UNDERWATER ACOUSTICS: Chairman Dr P F Dobbins MIOA, Secretary Dr P D Thorne FIOA
Regional Branches
EASTERN: Chairman Mr D G Bull FIOA, Secretary Mr T A Metcalfe MIOA
MIDLANDS: Elections awaited; Organisers Mr J F Hinton MIOA & Mr J Magrath MIOA
LONDON: Chairman Mr J Simson MIOA, Secretary Mr J G Miller MIOA
NORTH EAST: Chairman Mr B Oakes FIOA
NORTH WEST: Chairman Mr M S Ankers FIOA, Secretary Mrs N J H Alexander MIOA
SCOTTISH : Chairman Mr P J Corbishley MIOA, Secretary Mr R B McLaughlin MIOA
SOUTHERN: Chairman Mr G A Parry MIOA, Secretary Dr I H Flindell MIOA
SOUTH WEST: Elections awaited; Organiser Mr N J Pittams MIOA
YORKSHIRE & HUMBERSIDE: Chairman Mr R F Scott MIOA, Secretary Mr J Bickerdike FIOA
HONG KONG: Chairman Mr D P Chan MIOA, Secretary Dr W M To MIOA

Table 6: Institute Personnel 1994.

Obituary

J W R (Roy) Griffiths 1921–1995

Professor John William Roger (Roy) Griffiths FIOA died on 4 May 1995 at the age of 73.

After military service during the second world war Roy joined Bristol University from where he graduated in 1949. He then joined the Royal Naval Scientific Service where he started his association with communications and sonar. In 1955 Roy joined Birmingham University where he obtained a PhD, in 1958, and continued in teaching and research until 1967 when he took up appointment as Professor of Electronic Engineering at Loughborough University of Technology bringing his considerable wealth of practical and academic experience.

His varied background and international reputation as an innovative researcher were of enormous value to a University which had just received its Royal Charter. He was beyond doubt the key figure in developing Electronic and Electrical Engineering into the major research and teaching department it is today. In particular he was largely responsible for developing the department into an internationally accepted centre for research in communications and sonar.

Soon after his arrival at Loughborough Roy took over as Head of Department, a post he was to hold for the next 13 years. During this time he guided the Department through a period of enormous expansion. He was also to serve as Dean of Engineering for 3 years and Senior Pro Vice-Chancellor for 2 years. His energy and dedication to the University has had a fundamental effect on the shape of the institution we see today. He was also one of the main founders of the NATO ASI (Advanced Study Institute) and he organised a series of conferences in Sonar Signal Processing and in communications the latest of which will be held in Loughborough this December.

In 1984 Roy 'retired' and took up a part time appointment with the Department, which ended with his sad death. Retirement for Roy meant that he could devote all of his prodigious energy to his research group which he built into one of genuine international renown and which was instrumental in his election as a Fellow of Royal Academy of Engineering in 1991. He was also heavily involved in many national and international activities as a widely known character at major conferences, including Institute conferences, both at home and overseas. He was known, not only for his evident intellectual abilities, but also for his great personal charm and infectious sense of humour. He took particular delight in the social side of life and is remembered with affection by many colleagues and former students throughout the world.

The overall contribution that Roy Griffiths made to Electronic and Electrical Engineering at Loughborough University during his almost 30 years of service is unlikely ever to be equalled. The greatest loss is of course that of his family, however, his great personal warmth and charm will be sorely missed by all who knew him as an inspirational colleague and valued friend.

Tahseen Rafik

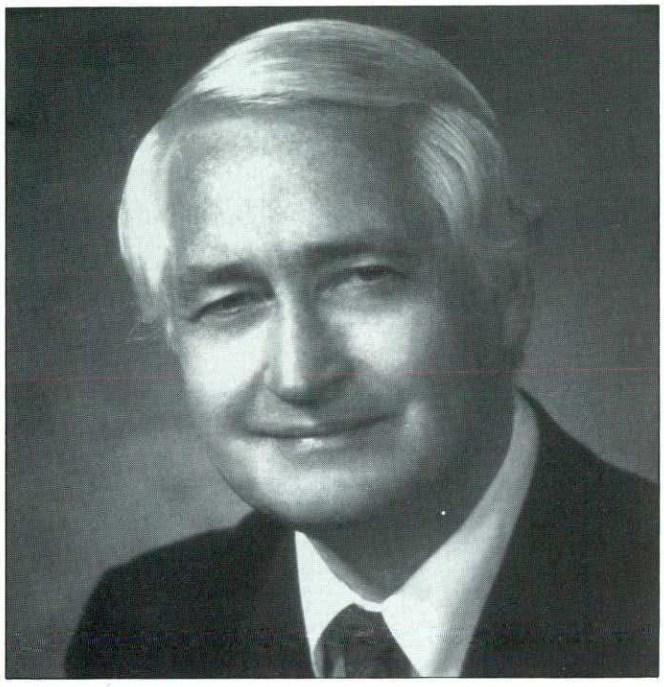
MEDALS & AWARDS

1995 Rayleigh Medal

Professor Richard H Lyon

Richard Lyon has enjoyed a long and distinguished academic and professional career in acoustics.

He graduated in physics, Magna Cum Laude from Evansville College, now the University of Evansville in 1952. Entering the Massachusetts Institute of Technology as a graduate student he was awarded a PhD in 1955 for a study of the turbulent excitation of strings. He was appointed Assistant Professor of Electrical Engineering at the University of Minnesota and in the summer of 1959 he visited the UK, working at the University of Southampton on random vibration. This was followed by a nine-month Fellowship at the University of Manchester carrying out research on the statistical energy analysis of interacting vibrating systems.



In 1960 he joined the staff of Bolt, Beranek and Newman working on a variety of problems including sound-structure interaction and the excitation of structures by turbulence. He rose to become a Division Director and Corporate Vice-President of the Company.

Richard Lyon was appointed Professor of Mechanical Engineering at the Massachusetts Institute of Technology in 1970 and has served as the Head of the Division of Mechanics and Materials. He is a consultant to industry and government and was founder and principal in Cambridge Collaborative Inc, a consulting firm and is now President of R H Lyon Corp, a diagnostics systems and product development company.

He has made outstanding contributions to research in many areas of engineering acoustics and noise control including pioneering work on statistical energy analysis, acoustical modelling techniques, vibroacoustics, machinery acoustics, sound propagation, condition monitoring, ship acoustics and, recently, product improvement through noise control. He is the author of four books and over 130 technical papers.

Professor Lyon has served the profession of acoustics in a wide range of offices in the Acoustical Society of America, as President, Vice-President, Member of the Executive Council, Editorial Board and Committee on Medals and Awards. He has also served as member of the organising committees for Noise-Con and Inter-Noise Meetings of the Institute of Noise Control Engineering.

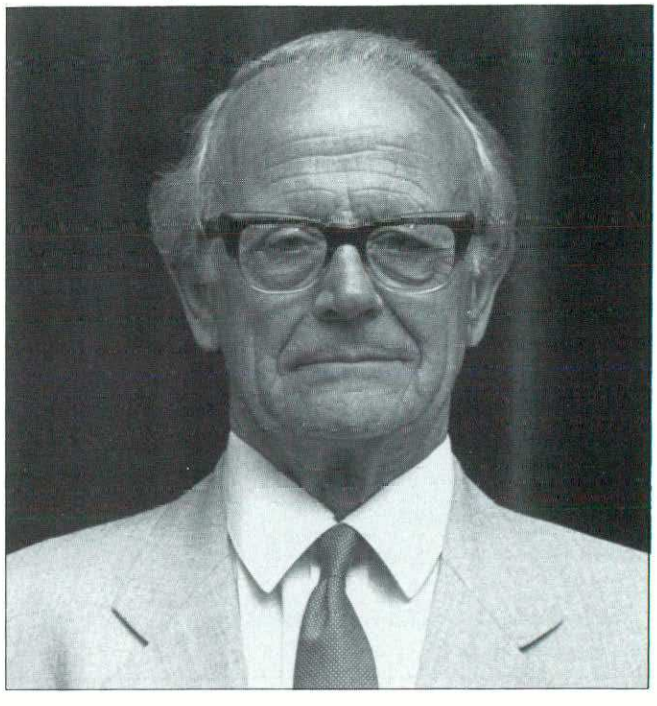
The Institute of Acoustics is pleased to award the Rayleigh Medal in 1995 to Richard Lyon for distinguished academic and professional contributions to the discipline of acoustics.

Honorary Fellowships

Dr J N Holmes

John Holmes graduated in mathematics from Imperial College, London, in 1950, and then spent two years on research in speech analysis in the College's Electrical Engineering Department, for which he was awarded the MSc Degree and the Diploma of Imperial College. In 1982 he was awarded the DSc(Eng) Degree by London University for his published work on speech research.

He entered the Scientific Civil Service in 1952, joined the Joint Speech Research Unit (JSRU) on its formation in 1956, and became Head of the Unit in 1970. During this period his research was on speech analysis, coding and synthesis. In 1960–61 he spent four months at the Speech Transmission Laboratory of the Royal Institute of Technology in Stockholm on an OEEC Senior Visiting Fellowship. Since 1985 he has worked as an independent speech technology consultant for a variety of clients. His recent personal research has been on automatic speech recognition, mainly involving an unconventional approach to connected word recognition which is capable of giving speaker-independent recognition of varied accents while still being economical computationally.



THE NOISE LABORATORY *on a* NOTEBOOK!

For the first time, the capabilities of a sound level meter, level recorder, environmental noise analyzer, frequency analyzer and digital tape recorder are combined into one notebook PC-based system. With no compromise to accuracy, the new Concerto system from 01dB is all you will ever need for Environmental Health noise investigations. Using advanced Microsoft Windows based software, Concerto is a dream to use, and makes reports and graphs a breeze using integrated data transfer to word-processors and spreadsheets.

Already in use at many UK local authorities for noise nuisance, planning and traffic noise investigations, Concerto is the future of noise measurement instrumentation, available today!

Concerto

FEATURES

- SPL with F,S and I time weightings
- Leq & Peak with independent A or C frequency weightings
- Digital audio recording to disk (no DAT recorder needed) using manual, triggered or timed control
- Easy playback of noises for identification of source of nuisance
- Frequency analysis in octaves and third octaves using digital filtering
- Fully Type 1 approved to IEC804
- Virtually limitless datalogging capability for long-term measurements
- Calculation of any value of Ln over any period, or regular periods
- Full cumulative or probability distributions
- Coding of data for identification
- Easy transfer of data as values for e.g. MS-Excel or Lotus 1-2-3
- Export of time history or spectrum graphs for word-processors

OPTIONS

- Building acoustics software including reverberation time analysis
- Advanced FFT narrow band analysis software to 3200 line resolution

APPLICATIONS

- Noise nuisance investigations
- BS4142 background measurements
- Traffic Noise
- Clay pigeon shooting, windfarm sites, low frequency tones, railway noise, aircraft noise, in fact, you name it, Concerto has measured it!

AcSoft

6 Church Lane, Cheddington, Leighton Buzzard, LU7 0RU
Tel: 01296 662852 Fax: 01296 661400

During the course of his career he has maintained close contacts with speech research groups in the UK and overseas and has been external examiner for a large number of PhD degrees, most of which have been from electrical engineering or similar departments. He has published over 40 technical papers and the university textbook 'Speech Synthesis and Recognition'.

John is a Fellow of the Institution of Electrical Engineers, the Institute of Acoustics, the International Society of Phonetic Sciences and the Acoustical Society of America. He is also a Senior Member of the Institute of Electrical and Electronic Engineers. John has been active in the affairs of the Institute of Acoustics. He was the first Chairman of the Institute's Speech Group for four years after it was formed in 1976. He was on the Institute's Council for most of the 1980s, and also served as a Vice-President and Chairman of the Membership Committee.

The Institute is pleased to award John Holmes an Honorary Fellowship in recognition of his contributions to speech research and technology.

Dr J M Bowsher

John Bowsher is fortunate in having combined a professional career in acoustics with a talent and interest in music. He was awarded his first degree in physics from Imperial College and continued his studies there under the supervision of Dr R W B Stephens, obtaining a PhD in 1957. Following a Post Doctoral Fellowship with Dr Hugh le Caine at the Electronic Music Laboratory of the National Research Council in Ottawa he spent a 5-year period in the Acoustics Section at the National Physical Laboratory. He carried out research on the perception of short duration sounds and low frequency tones and also on the perception of the noise from aircraft.

In 1966 John was appointed lecturer in Acoustics at the University of Surrey. He played a major part in the design and establishment of the Physics with Modern Acoustics Degree and also the Tonmeister Course in Music, involving consultation with many people concerned with broadcasting and sound recording throughout Europe. His research has resulted in many publications and was mainly on the physical behaviour of wind instruments and their subjective assessment. Later research was related to the central auditory processing carried out by the brain. This work has links with current

programmes on information technology and speech communication.

John is convenor of a CENELEC working group developing standards for electromagnetic compatibility of various types of audiovisual professional equipment and is a member of the Editorial Advisory Board of Acustica. He has supported the Institute of Acoustics over many years. From 1978 to 1986 he was a member of the Council, acting for part of this time as Vice-President and Chairman of the Membership Committee and has been involved in the organisation of several conferences. He is, at present, the Chief Examiner for the Institute's Diploma course.

John has a long standing interest in photography, producing competition winning photographs and was the patentee of a design of automatic light meter. He is a keen and active player of the bass and tenor trombone in many orchestras. During his time in Canada he played professionally but now plays primarily as an amateur.

The Institute of Acoustics is pleased to award an Honorary Fellowship to John Bowsher for his contributions to musical acoustics. ❖

Hansard

5 April 1995
Railway Noise Barriers
Mr Gordon Prentice: To ask the Secretary of State for Transport what is the cost per metre of (a) reflective and (b) absorbent railway noise barriers of a common height.
Mr Watts: Railway noise barriers vary in height, but the most commonly used are 2m high. The comparative costs per linear metre at this height are £210 for a reflective barrier and £340 for an absorptive barrier. The costs quoted are for barriers alongside a new railway line and include installation.

9 May 1995
Noise Pollution
Mr Chidgey: To ask the Secretary of State for Transport what consideration his Department gives to minimising noise pollution when selecting the type of surfacing for a motorway under construction or repair.
Mr Watts: This is an operational matter for the Highways Agency. I have asked its chief executive to write to the hon. Member.
Letter from Lawrie Haynes to Mr David Chidgey dated 9 May 1995:
As you know, the Minister of Railways and Roads, Mr John Watts, has asked me to reply to your Parliamentary Question asking the Secretary of State for Transport, what consideration his Department gives to minimising noise pollution when selecting the type of surfacing for a motorway under construction or repair.

The permitted alternatives for the surfacing of motorway construction schemes are constrained where noise is a matter of concern. Concrete surfaces are not currently used where traffic is expected to exceed 75,000 vehicles per day, although quieter concrete surfaces are undergoing trials. In particular sensitive situations, porous asphalt may be specified as a noise mitigation measure when the additional cost of construction and maintenance are considered to be justified. But porous asphalt is not technically suitable for use in all cases.

It is not the Agency's policy to apply mitigation to existing roads.

18 May 1995
Motorway Noise
Mr Chidgey: To ask the Secretary of State for Transport, pursuant to his answer of 9 May, Official Report, column 345, what is the definition adopted by his Department of noise levels being unreasonably high at adjacent properties to a motorway; and what consideration is given to the expected increase in noise levels due to the future growth in traffic.
Mr Watts: This is an operational matter for the Highways Agency. I have asked the chief executive to write to the hon. Member.
Letter from Lawrie Haynes to Mr David Chidgey dated 18 May 1995:
The Minister for Railways and Roads, Mr John Watts MP has asked me to write to you in reply to your recent Parliamentary Question concerning the definition adopted of noise levels being unreasonable adjacent to motorways and what allowance is made for traffic growth.

The level of traffic noise which is taken to be unreasonable is that prescribed by the Noise Insulation Regulations, namely a level which is predicted to exceed 68 dB(A) at the facade of a residential property, of which an increase of at least 1 dB(A) is attributable to traffic on the new or improved road. Future growth of traffic, both on the new road and associated roads in the area, is taken into account by basing predicted noise levels on the most adverse combination anticipated within 15 years of the new road or improvement being open to traffic.
Mr Chidgey: To ask the Secretary of State for Transport, pursuant to his answer of 9 May, Official Report, column 344, for what reasons only motorways which had a start of works prior to April and which are still under construction are considered for the provision of acoustic fencing.
Mr John Watts: This is an operational matter for the Highways Agency. I have asked the chief executive to write to the hon. Member.
Letter from Lawrie Haynes to Mr David Chidgey dated 18 May 1995:
As you know, the Minister for Railways and Roads, Mr John Watts, has asked me to reply to your Parliamentary Question asking the Secretary of State for Transport for what reasons only motorways which had a start of works prior to April and that are still under construction are considered for acoustic fencing.

The provision of acoustic fencing is considered for all new motorways and motorway widening schemes as the noise mitigation part of a package of environmental measures. But how much is provided in any one year depends on when the particular scheme starts and the contractors programme of work on that scheme.

Thus in answering your previous question, we could only give details of fencing for schemes which had started and therefore had a known contractors works programme. Information for schemes which are due to start this year will become available when the contractors submit their programme and I shall write to you again.
Mr Chidgey: To ask the Secretary of State for Transport, pursuant to his answer of 9 May, Official Report, column 346, how he allows for the cost of compensation for loss in property values under Part 1 of the Land Compensation Act 1973 in making a cost benefit analysis of proposals for acoustic fencing and other noise mitigation measures for motorways in the absence of specific figures.
Mr Watts: This is an operational matter for the Highways Agency. I have asked the chief executive to write to the hon. Member.
Letter from Lawrie Haynes to Mr David Chidgey dated 18 May 1995:
The Minister for Railways and Roads, Mr John Watts MP, has asked me to write to you in reply to your Parliamentary Question concerning how costs of compensation for loss in property values under Part 1 of the Land Compensation Act 1973 are taken into account in cost benefit analysis of proposals for acoustic fencing.

Composite estimates of the likely amount of compensation payable are provided by the District Valuer at various stages of development of a road proposal. Estimates of the element of compensation attributable to loss in property value under Part 1 of the Land Compensation Act take into account the mitigating effect of any protective measures included in the options or alternatives which the District Valuer is asked to consider.

Extracts provided by Rupert Taylor FIOA ❖

Speech Synthesis for the Handicapped

CSTR, University of Edinburgh, 8 June 1995

About 33 people heard ten short talks, covering the fields of speech training aids and AAC (Augmentative and Alternative Communication). Those present included speech technology researchers, speech therapists, and communication aid researchers. The organiser was Briony Williams (CSTR).

The first talk, by Alison MacDonald (Queen Margaret College, Edinburgh) was on 'The contribution of technology to speech-impaired people: an overview'. This paper set the scene for the day by giving a general overview of the field, for the benefit of the non-specialists present. It was followed by Eddie Rooney (CCIR, Edinburgh), who spoke on 'A multimedia speech training aid for hearing-impaired people'. This talk presented the HARP project under development at the CCIR, and demonstrations of it were given later to interested people. The third talk was by James Angus (York University), who spoke on 'Speech training aids', with the focus on suitability for very young children. Next was a talk by Alan Wrench (CSTR, Edinburgh), on 'A speech therapy workstation for patients with intra-oral cancer', which presented a system for assisting post-surgical patients to improve their intelligibility. The fifth talk was by Ken Robinson (Communication Disorders Technology, Inc), on 'The Indiana Speech Training Aid: A computer-based speech training aid for children and adults with speech production difficulties'. This presentation included a video showing the system being used by children under the guidance of a speech therapist. The next talk was by Paolo Rosso (Universidad Politecnica de Valencia, Spain), who spoke on 'A Computer-Assisted Metalinguistic Approach for Managing Intelligibility in Children with Down's Syndrome'. This system was intended to be adaptable to any language, not only English.

After a break for lunch, the next paper was given jointly by Christine Cheepen (Institute of Acoustics) and James Monaghan (Hertfordshire University). They spoke on 'Developing a speech recognition system for physically handicapped people: what happens in the real world'. They reported many practical and logistic problems that would not have been foreseen by researchers, as well as some successes. The next talk, by Jan Noyes (Bristol University) and Sharon Nix (RNIB), was on 'Experimental Investigation into Memory for Synthesised Speech by Visually Impaired Individuals'. This was a report on an investigation into the intelligibility and usefulness of synthetic speech as against natural speech, using the Modified Rhyme Test. The following talk, by Iain Murray (Micro Centre, Dundee University), was on 'The use of predictive techniques in augmentative communication'. This showed how research in predictive techniques had been incorporated into actual products. The final talk, by Antonio Bonafonte (Universitat Politecnica de Catalunya), was on 'DRAGO: a project to facilitate communication for handicapped users in Spanish and Catalan'. This was unusual in that it focused on Spanish rather than English, and aimed to incorporate a minority language (Catalan) in future work.

The lively questioning showed the level of interest in this subject among a wide range of professionals. The meeting ended with an optional demonstration.

Briony Williams MIOA

PC Programs in Acoustics

South Bank University, 31 May 1995

Approximately forty delegates attended this very successful meeting organised by John Seller of South Bank University.

In the morning 13 speakers from manufacturers' and consultants' companies made short presentations about acoustics software that is currently available for use on PCs. The software discussed is for a wide range of applications including environmental noise measurement, noise control, structural and underwater acoustics, and room acoustics.

Packages for environmental noise calculation and prediction were discussed by several speakers, Tony Charles of Kirby Charles Associates described SoundPlan, a package for calculating road traffic, railway and aircraft noise using standard British and international procedures. Judith Moore of W S Atkins explained the development of the Roadnoise, Sitenoise and Railnoise packages which are also based on standard calculation procedures and updated and validated as necessary.

Bob Lorenzetto of Quantitech Ltd described eNVi (Environmental Noise and Vibration Instrumentation), a PC package for carrying out a range of environmental noise and vibration analyses. Andrew Rumble of Anthony Best Dynamics and Richard Tyler of CEL showed the new SABRE Spectral Analysis Based Real Time Environment) package which is designed to act as a real time analyser on a PC, and can be used to measure all the usual environmental noise parameters.

Software for use in room acoustics was described by Matthew Gascoigne of Dynamics Structures and Systems, who showed the RayNoise and SysNoise prediction packages; and Phil Pyatt of Munro Associates who discussed the MLISSA system for measurement of room acoustics parameters.

Martin Armstrong of Brüel and Kjær and Ian Campbell of Cirrus Research talked about the applications software that is available to carry out data analysis both within sound level meters, and on PCs for storage and post processing of data.

Other speakers gave examples of applications of PC software in noise control. Geoff Leventhall of Digisonix described the Digiware package which consists of both hardware and software for use in active noise control.

Peter Davies of ISVR described software that he has been developing for the past 25 years for use in research into flow noise and for the acoustic design of flow ducts. He emphasised the importance of personal experience in understanding a problem when using software to arrive at a solution. Also in the area of problem solving, Russ Brown of PAFEC described packages for solving acoustics and structural dynamics problems using finite element and boundary element methods.

The final speaker of the morning was John Shelton of AcSoft who brought the presentations to a close by summarising the current situation in acoustics software packages and giving some indication of likely future developments.

The afternoon session consisted of an exhibition of the programs, and gave the delegates the opportunity to have individual discussions and demonstrations of the software in which they were interested.

The meeting was agreed by all who attended, both speakers and delegates, to have been very interesting and informative, and to have provided an ideal opportunity for demonstrating what software is currently available for a particular application.

Bridget Shield MIOA

❖

New Products

SAMPSON WINDOWS

Low Noise Window

Sampson Windows of Ipswich have introduced the MODUL A20 – a new window specifically designed to address the problem of noise control in the most demanding applications.

The proportion of the external envelope of a building occupied by glazed windows has an appreciable effect on the total level of airborne noise passing into the building from outside. The continued requirement for more natural light in homes, public buildings and places of work, is resulting in a great deal of attention being focused on the acoustic performance of windows.

Sampson Windows have introduced a new side-hung open-in, window to offer the very highest levels of noise attenuation in extreme situations. The Sampson MODUL A20 Acoustic window uses a double sash arrangement combined with exacting attention to air tightness to reach the highest performance levels without resorting to special glass or gas-filled units. With a 150 mm air-gap and standard 6 mm and 4 mm glass the A20 achieves an R_w sound reduction figure of 56.0 dB.

Each of the sashes is mounted on its own discrete frame with an intermediate acoustic barrier giving a 'discontinuous construction' effect. The single-glazed outer sash is separated from the double glazed sealed unit in the inner sash by an air-gap of up to 200 mm. The differential thickness glazing panes of the A20 eliminate noise ingress from coincidence resonances. Multi-point espagnolettes and EPDM seals ensure a tight closure.

The A20 is manufactured from Upper Gulf Swedish Redwood frames and sashes with bonded and pinned comb joints for strength. The external facet is clad in powder-coated aluminium for maximum durability and can be supplied in any standard RAL colour.

The A20 complements Sampson's existing range of coupled-sash windows and doors.

Sampson Windows are part of the MODUL group of Sweden.

For further details call: John Lawrence, Sampson Windows Ltd Maitland Road, Lion Barn Business Park, Needham Market, Ipswich IP6 8NS. Tel: 01449 722922 Fax 01449 722911.

CIRRUS RESEARCH plc

Sound Level Meter CRL 252

Cirrus Research announce their digital sound level meter – the Cirrus CRL 252 – which has a backlit LCD display allowing it to be read in dark locations. The display may be frozen in the presence of louder noises thus locking the reading so that it may be read at leisure.

This British-made instrument is capable of measuring from 30 to 140 dB with 'Fast', 'Slow' and 'Impulse' responses on both A and C weightings. The CRL 252 covers the wide measurement range in three overlapping 60 dB dynamic spans so that the CRL 252 can be used for both industrial workplace noise and for environmental boundary measurement duties. It is particularly useful for safety officers who routinely monitor noise levels to ensure they do not change.

Measuring fluctuating sound levels on digital instruments can be problematic as readings change so rapidly that the numbers become a blur and so the Cirrus CRL 252 has a maximum hold circuit to measure such noise events.

Every CRL 252 is computer tested prior to shipment to ensure full compliance with type 2 of BS 5969. Additionally, the meter is housed in a robust die cast metal case to withstand the ardours of industrial life. Hence, the CRL 252 will meet all new European and American radiation specifications.

Codes of Practice advise calibration of an instrument before and after each measurement; the CRL 252 can be supplied in a compact carrying case containing a Cirrus CRL 511 E calibrator to provide a comprehensive noise measurement system.

For further information contact James Tingay, Cirrus Research plc, Acoustic House, Hunmanby, YO14 0PH. Tel: 01723 891655 Fax: 01723 891655.

Cirrus Research is a Key Sponsor of the Institute

SUNNYSIDE SYSTEMS

HAWK - Multi Channel Frequency Analysis System

Hawk is a powerful instrumentation system for the measurement of sources of noise and vibration. With its modular multi-channel architecture and Windows™ software, HAWK has the power and flexibility to address a wide family of applications. High speed data acquisition and transient capture operating modes extend HAWK's uses to structural testing and modal analysis.

Gain stages and low pass filters remove the need for external conditioning. An internal 4mA current source (24 Volt compliance) is provided for voltage mode accelerometers and high gain amplification for low voltage sensors such as microphones.

16-bit resolution and 90 dB dynamic range enable small signal differences to be seen. 24-bit DSPs maintain high dynamic range with large FFTs. Digital filtering gives very accurate bandwidth control for third octave analysis.

Modules can be added at any time and data storage and pro-

cessing power scales with channel count.

Powerful Windows™ software gives total control over instrument set-up, data acquisition, real-time data display and applications specific post processing.

Further details are available from Sunnyside Systems Ltd, Kirkton Campus, Livingston, West Lothian EH54 7AN. Tel: 01506 460345. Fax 01506 460314. email: sales@sunny.demon.co.uk.

BRUEL & KJÆR (UK)

The 2260 Investigator

Brüel & Kjær has introduced new Multi-DTM analysis technology to provide an enhanced 'sound picture' with its Type 2260 Sound Level Analyser.

Multi-D is a multi-faceted analysis technique which measures a wide range of parameters, including statistical parameters, with all the necessary time and frequency weightings. At the same time it performs real-time parallel octave-band frequency analysis. By making all the measurements necessary to a detailed description of a noise problem in parallel, Multi-D saves time and improves the coherence of results.

Brüel & Kjær calls this new combination of its advanced Type 2260 with the Multi-D sound analysis system the 2260 Investigator™, and adds powerful new software to control the parallel measurements, real-time $^1/_1$ and $^1/_3$ -octave analysis, storage of the full statistical distributions for the broadband channels and each $^1/_1$ -octave frequency band, and display of a 15-second level versus time profile updated in real time.

In addition, new Evidence™ PC software is available to import results recorded in the field and provide extensive post-processing, graphical display, and documentation facilities. Evidence can create time histories and distributions from the measurements and generate L_n values. The results can be edited to find, for example, the L_{eq} of particular parts of the measurement sequence. A zoom function affords a closer look at results, with user-definable backerasure of unwanted sounds.

Although providing the functionality of an analyser, the 2260 Investigator offers the portability and ruggedness of a sound level meter. For example, it uses Brüel & Kjær's new Falcon range of microphones which come with a three-year guarantee. Investigator's flexibility is enhanced through the innovative use of PCMCIA cards, which enable a variety of sound measurement applications to be stored within the instrument and provide convenient storage for hours of measurement results.

For further information contact Maria Marianni, Brüel & Kjær (UK) Ltd, 92 Uxbridge Road, Harrow HA3 6BZ. Tel: 0181 954 2366. Telex: 934150 BK UK G. Fax: 0181 954 9504.

Brüel & Kjær UK is a Key Sponsor of the Institute

News Items

Personnel news

Sound Attenuators Ltd of Colchester, part of the Salex Group Ltd, report that they have appointed Cameron McKay as the new Managing Director with effect from 1st March 1995. He has had many years' experience in the engineering industry concerned with the noise and vibration markets

Brüel & Kjær has appointed Mr Graham Turgoose as Sales and Marketing Manager in the UK. He joins B&K from Ling Dynamics Systems where he was Sales Manager. Based at the company's Harrow headquarters, Graham Turgoose will be responsible for all sales of vibration monitoring, acoustic measurement, telecommunications and audio measurement products.

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Letter to the Editor

Dear Sir

It is important for the acoustics community to take advantage of opportunities such as Science Engineering and Technology Week **set95** (see President's letter in April's Bulletin). The more that acoustics is mentioned in the media, giving the subject a higher profile, the better it is for everyone.

We can think of many occasions, particularly in the academic world, where acoustics has been overlooked simply because it falls between different disciplines: Science, Engineering and Medicine. Fortunately, the cross-disciplinary nature of acoustics can also work to our advantage as it is an ideal subject for raising the profile of science and engineering among the general public. Not many people have seen a quark, but we've all suffered a noise nuisance.

We held five events during **set95** entitled 'Concert Hall Acoustics, Art or Science?'. These included talks about what makes a good concert hall, as well as questionnaire surveys of the audience and musicians in three halls where the City of Birmingham Symphony Orchestra were playing the same programme: St David's Hall Cardiff, Symphony Hall Birmingham and Royal Festival Hall. The talks were well received and gave us an ideal opportunity to stress the importance of acoustic science to the arts. We also had an excellent response to the questionnaires with over 1500 being returned, including two posted from America!

Although it will be difficult for tangible benefits to be quantified, the University may well gain from the publicity generated through press coverage, word of mouth and a booklet on concert hall acoustics which we wrote to accompany the talks. Taking part in **set95** was fun, provided us with an interesting research opportunity, and hopefully raised the profile of the acoustics community.

Yours sincerely

Dr Trevor Cox MIOA
Dr Bridget Shield MIOA
South Bank University
London

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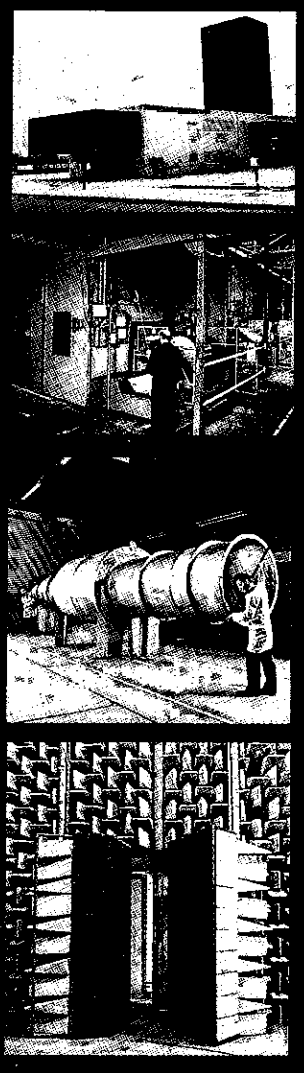
The Salex Group Limited

Noise Control Engineers



Quietly in control

30 years' comprehensive practical experience has gained the Salex Group the status of leader in all aspects of noise and vibration control for all applications. This has given the Salex Group a name and reputation second to none, not just in the U.K, but Worldwide.

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Acoustic & Aerodynamic Laboratory

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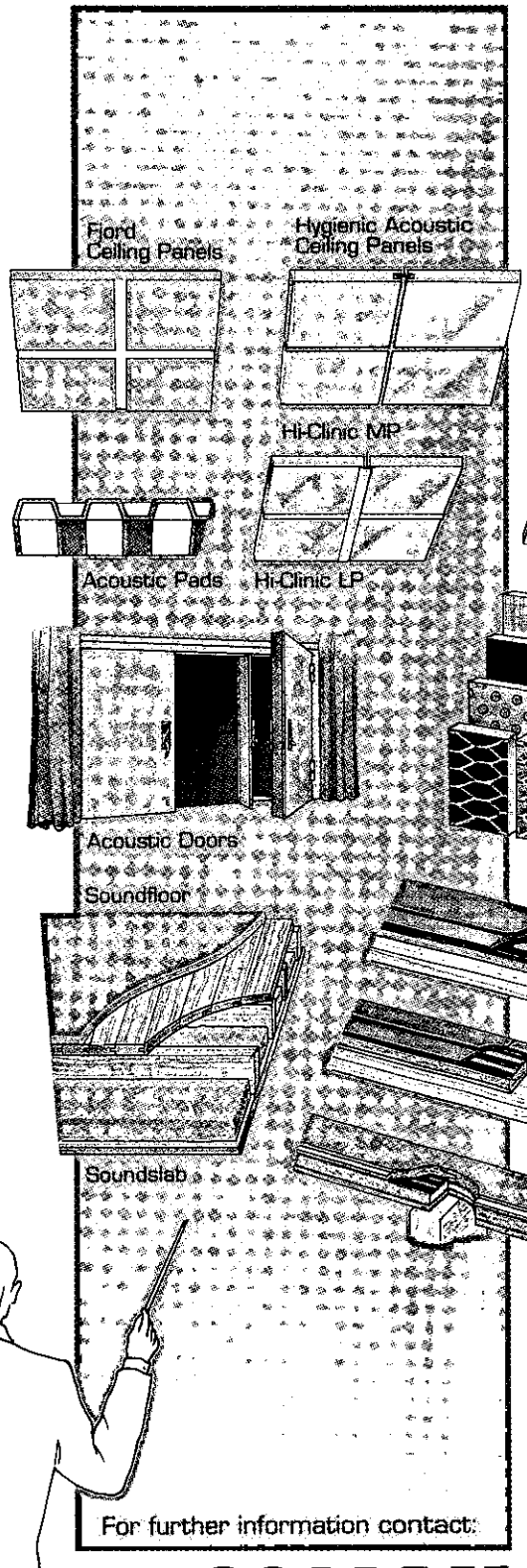

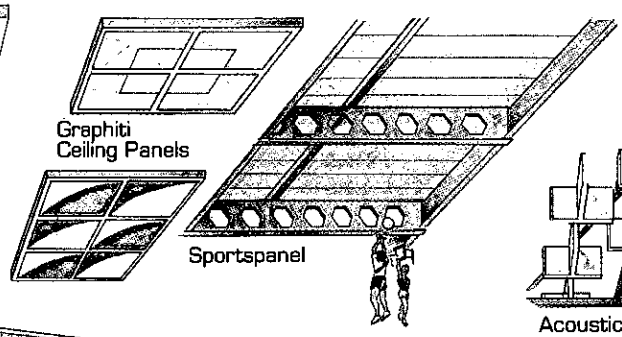

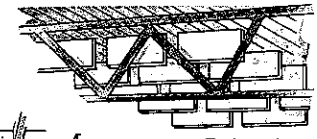

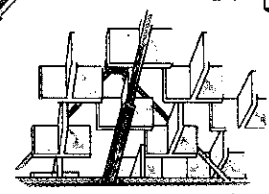

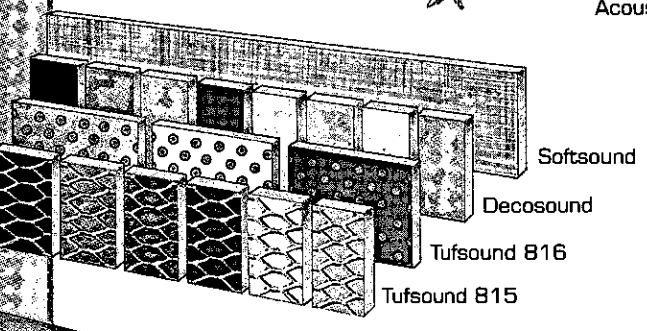

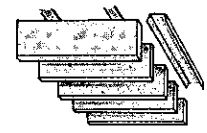

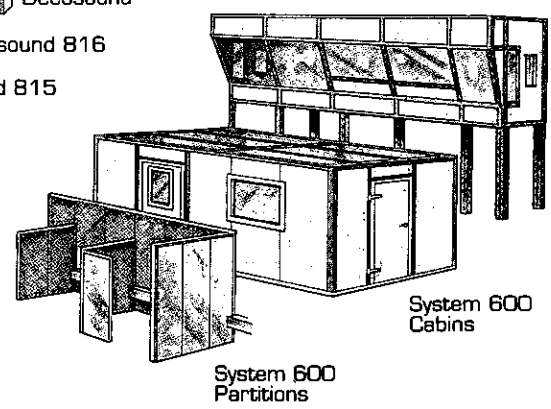

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