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Volume 22 No 6
November – December 1997

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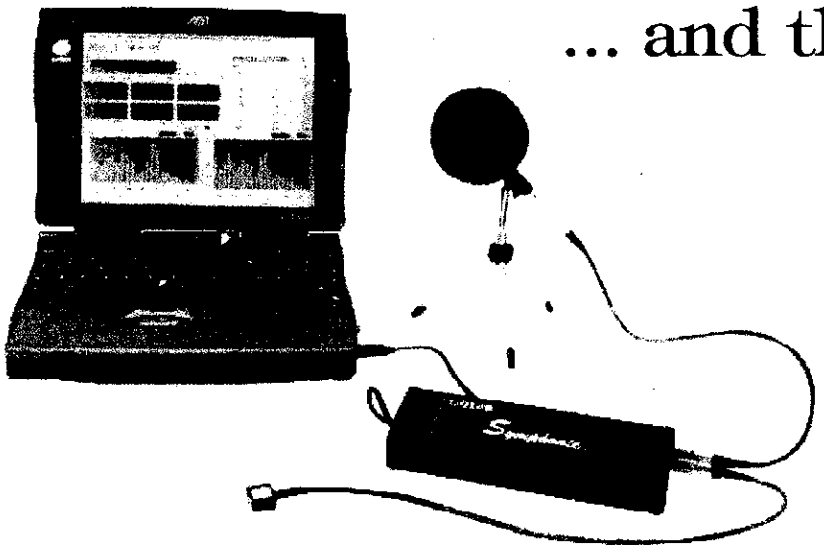

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The Institute of Acoustics, 5 Holywell Hill, St Albans, Herts. AL1 1EU
Tel 01727 848195 Fax 01727 850553
e-mail Acoustics@clus1.ulcc.ac.uk

Printed by:
MPG Rochester Ltd, Neptune Close, Medway City Estate, Frindsbury, Rochester, Kent ME2 4LT.

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Single copy £9.00 Annual subscription (6 issues) £45.00

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Volume 22 No 6
November - December 1997

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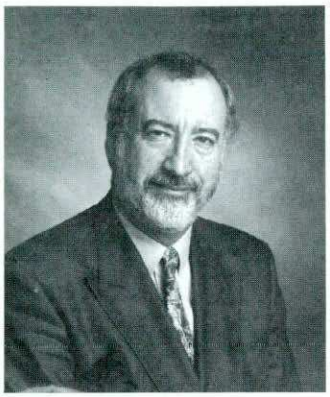

Dear Fellow Member

In the last issue we marked the retirement, as Secretary, of Cathy Mackenzie. I am pleased to note that, since November 1st, her successor Roy Bratby, who introduced himself to you in the last Bulletin, has been working hard at 'getting up to speed' in all aspects of Institute business. He has been of great support to me and the rest of the Executive as we meet a number of current challenges, and plan for the future. As those of you who are involved in Committee work and recent technical meetings will have seen, Roy is already stamping his own mark on Institute affairs. It looks as if Roy's experience with property will be of considerable value to us since it has recently become clear that we will have to leave the Agriculture House premises before too long. As I write, the search for a new home in the St Albans area is progressing well.

We have also recently welcomed another newcomer in the shape of Professor Keith Attenborough. Keith has taken over from Dr John Bowsher as Chief Examiner for the Diploma. John has served the Institute in a variety of roles over the years and I am delighted to have this chance to acknowledge the tremendous debt we owe him. I would also like to thank Jeff Charles for his tireless efforts as Deputy Chief Examiner and also as Chairman of the Meetings Committee from 1994 until just recently.

As I write I am just about to set off northwards to attend the Autumn Conference in Windermere. The committee of the Environmental Noise Group have clearly done an excellent job putting together the programme, since we have a full house at the Hydro Hotel and are having to use additional hotels nearby. A full account of the event will appear in the next Bulletin, and of course the Proceedings are available from the office.

Looking ahead, plans are well under way for the 1998 Spring Conference at Cranfield from March 31 to April 2. The theme is 'Noise on the Move', and I look forward to seeing you there, whatever your mode of transport.

This will be the last Bulletin you receive before the Christmas/NewYear Festivities. May I take this opportunity to wish you and yours a quiet and peaceful holiday.

Sincerely yours

Bernard Berry

Bernard Berry

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THE ASSESSMENT OF ENVIRONMENTAL NOISE – THE REVISION OF ISO 1996

Ian H Flindell MIOA, Nicole D Porter MIOA & Bernard F Berry FIOA

Introduction

Most readers will be aware that the multiplicity of different units and comparisons used for the assessment of environmental and community noise can lead to considerable confusion. For example, which is better, dBA or octave band L_{10}? On the other hand, most people can recognise a noise impact when they hear one, so how is it that we have allowed noise assessment to become so complicated? Notwithstanding the confusion caused by the curious and unnecessary use of logarithmic units, it should be possible to define an amount of noise (however measured) below which residual noise problems are insignificant, and another much greater amount of noise above which noise is unacceptable under any circumstances. The assessment of any intermediate amount of noise is then a matter of trading relative costs and benefits. Any rationalisation of units and methods which can simplify matters while still maintaining a consensus across different approaches must be worthwhile.

This paper sets out such an approach by describing the current development of international standard ISO 1996 *Description and measurement of environmental noise*. The approach is based on practicalities and common sense. It aims to simplify current practices and does not set out to introduce new or complicated procedures.

ISO 1996 – Current Developments

The official UK Government comments (March 1997) on the recent EC Green Paper on Future Noise Policy [1] note that *work has recently begun on a major revision* of the main international standard in this area, ISO 1996, and states *This standard could be regarded as already providing the necessary basis for harmonisation, and any action on harmonisation would be premature until the revision of ISO 1996 is completed.*

ISO 1996 *Description and Measurement of Environmental Noise* Parts 1, 2, and 3 has been adopted in the UK as BS 7445 Part 1: 1991 *Guide to Quantities and Procedures*, BS 7445 Part 2: 1991 *Guide to the acquisition of data pertinent to land use*, and BS 7445 Part 3: 1991 *Guide to application to noise limits*. It is widely used in the UK for the definitions and other guidance contained therein.

It has been agreed that the ISO/TC 43/SC 1/WG 45 working group on environmental noise will carry out this major revision of ISO 1996. The role of ISO working groups is to prepare new and revised draft standards within previously agreed remits. Draft standards are then submitted to a formal voting procedure before they can be officially adopted. Adoption cannot take place unless a general consensus has been achieved. The present authors comprise the entire UK representation on this working group.

A number of preliminary meetings of the working group have been held over the past year. Having made several suggestions at earlier meetings, the UK delegation were invited to make concrete proposals at the most recent meeting held at the Hungarian Standards Institution in Budapest on the 24th August 1997. The meeting was held in conjunction with the Inter-noise 97 international congress. Those present at the meeting substantially accepted our proposals for the main basis of the revision and agreed with our proposal that the title should be changed to 'Assessment of Environmental Noise'. We were then invited to start work on the first draft of the core sections (scope and methodology) of the revised standard, leaving others to work on the remaining detail sections as agreed. It is likely that the final version will go through a number of drafts before it achieves international acceptance.

In addition to this, the ISO working group agreed to include the definitions both in decibel measures and in terms of the underlying quantities such as Pasques.

The main purpose of this paper is to inform the membership of the Institute as a whole of progress that has been made, and to invite suggestions and comment.

A New Approach to a Framework for Environmental Noise Assessment

In the context of an international working group considering a framework for environmental noise assessment, it has been very important to take into account the different ways of carrying out environmental noise assessments in use around the world. These range from the typically German approach of having a precisely defined DIN standard to apply to almost any situation to the other extreme of allowing noise makers and complainants to sort matters out for themselves, if necessary with the assistance of the courts. A too-rigid approach is not always conducive to achieving the best compromise between noise costs and benefits. On the other hand, a too-flexible approach can lead to discrimination against the weak and powerless. By forcing an input-process-outcome structure onto the revised standard, we believe that our proposals can accommodate the best aspects of both approaches successfully.

The concept of a grand 'general noise annoyance model' that attempts to take into account all possible sources of variation is very attractive, and indeed many of us were working towards this objective only a few years ago. However, it now seems doubtful that any such model could ever be developed. This is partly because of individual human variability, and partly because human auditory perception is selective, focusing on whatever is

the most important or interesting component within the overall environment at the time. The selective attention mechanisms involved in human auditory perception form the basis of the acoustic feature approach first described in our 1993 article in Acoustics Bulletin [2]. This approach suggested that, to be useful, any method of assessment should assist in targeting noise control action onto the particular features which are causing the problem in the first place. The acoustic feature approach is likely to prove more beneficial in the long term than any methodology which is too rigidly focused on noise level alone, however many 'adjustments' or 'correction factors' are applied.

Our new approach has two main components:

- First, noise assessment is treated simply as a process, acting on input data, and leading to outcomes. Defining the new standard simply becomes a task of defining the necessary inputs, processes and outcomes to achieve the objective of the assessment.
- Secondly, we recognise that different features, both acoustic and non-acoustic, might be more or less important in different situations, depending on the precise purpose of the assessment. This means that different combinations of inputs, processes and outcomes might be appropriate for different situations. A key issue is that practical and effective noise management depends on clear and unambiguous assessment outcomes. Any methodology that simply predicts, for example, the percentage highly annoyed, is (in isolation of any other information) very difficult to interpret in terms of practical noise management. In plain English, difficulty of interpretation means 'of limited usefulness'.

The Outcomes

The best place to start is to consider the three possible outcome classes listed below;

- Outcome class A, zero or negative noise impact, in which case no action is required. This might be because the specific noise level due to a source under assessment has not increased, or because the noise level is below an identified absolute criterion for zero impact. The actual criteria for zero or negative noise impact are discussed later.
- Outcome class B, intermediate noise impact in the range between zero and unacceptable impact. It will then be important to balance the costs and inconvenience of noise control against the likely benefits to be achieved.
- Outcome class C, completely unacceptable noise impact. This outcome class does not simply mean that some people describe the noise as 'unacceptable'. In this context, it means that effective noise control becomes absolutely imperative regardless of any costs or inconvenience incurred. For example, a noisy factory exceeding the criteria of unacceptability would automatically have to be closed down regardless of any economic and social costs such as unemployment.

Comparison processes to be included in the revised standard are useful only if they select between one of the three outcome classes listed above. Outcome class B (intermediate impact) is possibly the most interesting, because of the scope it provides for trading off increasing noise levels against increasing costs and inconvenience. It is certain that established dose-response relationships, where available, will be relevant to any such debate.

The Purpose of Assessment

It is necessary to consider the different situations in which different combinations of inputs, processes and outcomes might be most appropriate. Two likely scenarios are the assessment of a noise exposure change due to a new or modified source and the assessment of changes to an exposed population in the case of new or modified housing.

These two scenarios are clearly different not least in terms of the possible action that might be taken. For example, the controls that can be applied to new noise sources are different to the controls that can be applied to new houses, and there are also likely to be differences in terms of public expectations. There is an argument which suggests that people should be allowed to develop and occupy houses in noisy areas if they so choose providing that they fully understand all the implications of their choice. On the other hand, to expose existing residents to new, previously unanticipated, and significant noise without giving them any choice in the matter will always require some wider or higher level justification.

In addition, there are at least two other situations to take into account; noise complaints and the strategic assessment of policies and plans.

Noise complaints can arise with existing residents and existing noise. Usually, something must have changed to precipitate the complaint, but the most important issues are then whether or not the complaint is justified and whether or not anything can be or needs to be done. At the other extreme, it would be unusual to consider the effects on individual residents when carrying out strategic assessments of policies and plans. The type of policy that might be considered here would normally be applied on a regional, national, or international basis. Typical examples might be policies that encourage transport users to switch from road to rail or policies to restrict the average speeds of road vehicles in towns and cities. For strategic assessment, it is often sufficient to count the numbers of residents likely to be exposed at defined noise levels due to specified sources, and the possible outcomes of the assessment must then be defined in terms of the policy alternatives under consideration.

Inputs and Processes Within Environmental Noise Assessment Procedures

Having established the possible outcomes in relation to the main purpose of each assessment, we need to consider how to actually carry out the assessments ie what are the processes embedded within environmental noise assessments? Noise assessment essentially consists of comparisons between inputs that are some appropriate measure of the situation being assessed and either a

similarly appropriate measure of the pre-existing situation or against some form of absolute criterion. It is difficult to conceive of any form of assessment which does not involve a comparison of some form.

The three most common types of comparison are listed below.

1. Comparison of specific or ambient noise against pre-existing specific or ambient noise
2. Comparison of specific or ambient noise against residual noise
3. Comparison of specific or ambient noise against absolute criteria

It is important to be clear about the definitions used for specific, residual and ambient noise. The specific noise is defined as the separate contribution to the overall noise from the specific noise source or category of noise sources which is being assessed. The ambient noise is defined as the overall or totally encompassing sound in a given situation and includes the specific noise. The residual noise is the ambient noise when the specific noise is suppressed to such a degree such that it does not contribute to the ambient noise. The residual noise is often referred to as the background noise.

Note that it is not just noise 'levels' which might need to be compared, but in many cases some other acoustic feature might be equally or more important. In the case of noise complaints, particular features of the noise or of the situation in which it is heard can sometimes be more important than the overall noise level.

Some appropriate combination of all three comparison types will probably be relevant where the assessment is of a new noise source or of changes to an existing noise source. Where new houses or strategic policy alternatives are under consideration, then it is likely that type 3 comparisons against absolute criteria will be more appropriate than comparisons of types 1 and 2. It is our intention to provide further guidance in the standard on the most appropriate sequences in which the different comparisons should be applied in different situations.

In accordance with the subsidiarity principle, there should be nothing in the revised ISO standard to prevent decision makers from assessing against outcome class C (completely unacceptable noise impact) by using any of the three comparisons. However, it would seem most logical that only comparison type 3 (against absolute criteria) should be relevant when this outcome class is being considered.

Let us now consider the context and use of each type of comparison process and how we may interpret the outcomes.

Comparison of specific or ambient noise against pre-existing specific or ambient noise

The specific noise level contribution made by a development must be increased for there to be any relative impact of that development. In numerical terms, the specific noise due to a particular noise source or category of noise sources is compared against the pre-existing specific noise due to that same category of noise source. Alternatively the ambient noise post development can be compared against the pre-existing ambient noise. For example, an assessment might show that a new road increases the specific noise level contribution made by road traffic noise above the pre-existing road traffic noise level contribution. The new road might also increase the ambient noise level depending on the dominance of road traffic noise within the overall acoustic environment. The process and outcomes can be different depending on whether it is the specific noise or the ambient noise which is compared. An example of this type of approach is given in the Design Manual for Roads and Bridges (DRMB) [3].

Therefore when assessing change in noise, problems may arise when different noise measures are considered. Sometimes the specific noise attributed to the development is compared and sometimes the ambient noise including the effects of the development is compared. There is no difference between these approaches where the specific noise contribution from the new development dominates the overall noise environment. On the other hand, where other noise sources are dominant a large change in specific noise might be associated with only a small or negligible change in ambient noise.

In considering the impact of a noise, we must also consider the possible benefits. Where the specific noise level contribution is reduced, then this counts as a benefit of the development. For example, improvements to existing roads to accommodate increased traffic will generally increase road traffic noise levels. However if appropriate mitigation is applied at the same time, this can lead to reductions in road traffic noise levels which should then be counted as a benefit.

The rules of thumb are that any change in steady noise levels due to a single dominant source of less than 1 dB is unlikely to be noticeable, a change of between 3 dB and 5 dB is more likely to be noticed, and a change of 10 dB or more is required for it to be really significant. In general, small increases in noise tend to be more noticeable than small decreases in noise. Gradual changes taking place over long periods of time are less likely to be noticed, particularly as people have relatively poor memories for absolute noise levels.

It is however important to understand that even a relatively large change in specific noise levels of 10 dB or more might have only a negligible effect on ambient noise levels, depending on the degree of dominance of that source. In effect, this means that even a small or subdecibel change in ambient noise levels attributable to a change in the noise level contribution made by a specific source could be regarded as significant if the change in the specific noise level contribution was large enough. It is our intention to provide further guidance in the standard on points such as this, and we would certainly welcome comments and suggestions.

Where intermittent noise is concerned the 'rules of thumb' can become more complicated. Averaging over time might not fully reflect the effect of changes in individual event noise levels as compared to the effect of changes in the numbers and temporal distributions of those events occurring within the averaging time. As for

a number of other matters, we plan to provide further guidance on this point in the standard.

Comparison of specific or ambient noise against pre-existing residual or background noise

Where there is a material change in noise environment due to the new noise source, the resulting specific noise due to that source can be compared against the pre-existing background noise or residual noise. Either comparison serves to illustrate the relative importance of the new noise source against the context of the pre-existing noise environment. An example of this type of approach is given in British Standard BS 4142: 1997 [4].

It is a necessary but not a sufficient condition for a new development to give rise to a significant noise impact that the specific noise levels due to the new development are at least comparable with and normally greater than the pre-existing residual or background noise attributable to other noise sources present. Large increases in the specific noise level contribution can occur without being significant if the increased specific noise level remains trivial against the context of all other noise sources present at that time. The precise amount by which the specific noise has to exceed the pre-existing residual or background noise in order to be considered significant in terms of this comparison, might be seen as a matter for national standards authorities or decision makers, but any acoustic features other than noise level alone which are present will probably be relevant here.

The pre-existing residual noise can be defined in terms of the L_{A90} (defined as the background noise level in BS 4142 [4]) or residual L_{Aeq}. The L_{A90} measure requires no manual intervention during measurement but behaves irrationally when used for computations as it does not properly represent any fundamental physical properties of the noise. The residual L_{Aeq} has a clear physical meaning in terms of average intensity and obeys simple logarithmic addition and subtraction rules, but requires manual intervention for its determination. This means that different workers might determine different values of residual L_{Aeq} from the same measurement.

For practical assessment purposes, comparisons against the existing residual or background noise should not be interpreted as indicating audibility, since this depends on the relative frequency content and on the noise level profile against time of both the specific noise and the background noise. The various acoustic features present, such as tonality, impulsivity, relative frequency content, etc, might be important in determining audibility [5], and audibility might also be affected by meteorological variation.

Comparison of specific or ambient noise against absolute criteria

Noise can be compared against absolute noise criteria derived by or from some authoritative source. This comparison allows for the complete range of outcomes from 'no problem' up to 'completely unacceptable' and can be applied to both static and dynamic (changing) situations. An example of absolute criteria is given in Planning Policy Guidance Note PPG 24 [6].

The generic curve representing increasing noise effects against increasing noise levels follows a clear S shape, as shown in Figure 1, although it is often only the lower and upward curving part which is shown in the literature. The curve follows the same general shape irrespective of the particular noise effect being considered. At low noise levels there are generally low or negligible noise effects. At increasing noise levels the effects start to increase slowly at first and then more rapidly. Finally, the upper end of the effects scale necessarily flattens out at 100%. It is meaningless to consider further increases in the effects of noise above the point where 100% of the population are affected, or where individuals are 100% affected.

The recently revised WHO guidelines on community noise [7], despite having no official status at the time of writing, provide useful guidance as to the lower threshold levels below which residual noise impacts can probably be considered negligible. These guidelines were agreed by the WHO task force meeting held in Dusseldorf in 1993 in accordance with the principle that, where practicable, targets should be set at the lowest level of exposure below which residual risk can be assumed to be negligible. On the other hand, just because the research data suggests that very few people are likely to be either 'moderately' or 'severely' annoyed during the daytime where the long term average noise levels are below 50 L_{Aeq} and 55 L_{Aeq} respectively, this does not of

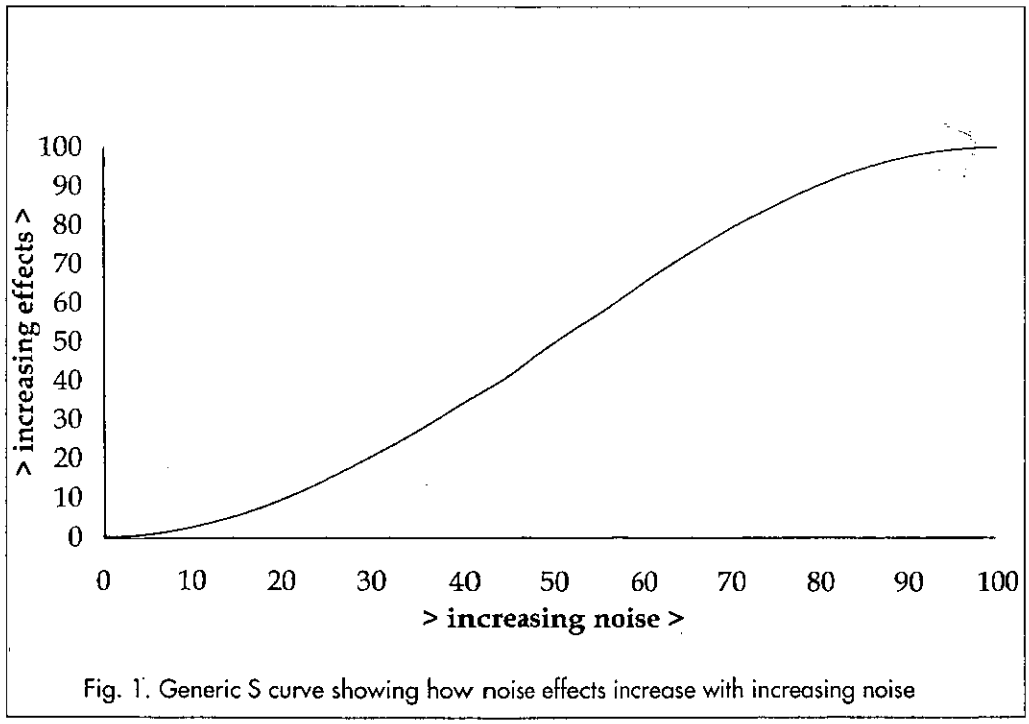

Fig. 1. Generic S curve showing how noise effects increase with increasing noise

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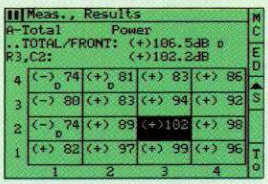

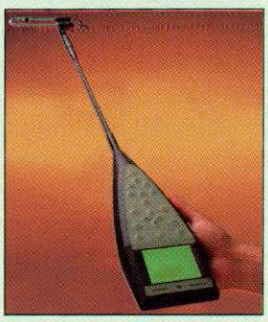

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itself mean that such noise levels can even be achieved in any modern industrialised society without drastically changing the whole nature of economic development. The long term effects of any such changes in industry, commerce and transportation might considerably outweigh the benefits of having effectively eliminated environmental noise annoyance from society.

On the other hand, exposure above the WHO guidelines implies that increasing emphasis should be placed on noise control wherever reasonably practical. According to the definition of unacceptability set out above, noise exposure clearly does not become unacceptable until some much higher threshold of demonstrable harm is reached. Such a threshold might be based on the noise level at which there is a proven risk of noise induced hearing loss. In the context of environmental noise assessment, it is important to remember that the lowest threshold of noise induced hearing loss risk at somewhere above 75 $L_{Aeq,\ 8\ hrs}$ refers to personal noise exposure, not the average noise level measured outside one's house, and this creates further problems for the definition of any such standard. More research is required before any such upper threshold of unacceptability can be set with any degree of confidence.

What we are left with then is a curve of generic noise effects starting from effectively zero at around 50-55 L_{Aeq} (daytime noise levels) and gradually increasing in severity as the noise level increases up to at least 75 or 80 L_{Aeq} as measured outdoors. The perceived severity of these noise effects can then be balanced against the costs and inconvenience of noise control where appropriate. Of course, in many cases the real problem is not noise level alone, but some other acoustic or non-acoustic feature of the environment. In such cases the most appropriate action to take need not depend on noise level either.

Defining the Scope and Methodology of the Revised Standard ISO 1996

Having described the general background to our approach to environmental noise assessment, let us now consider how to proceed in defining the scope and methodology of the revised standard.

It is anticipated that the standard will be made up of several parts. The first part will form an introduction to the standard and will describe the methodology based around a matrix or framework of the different assessment processes or comparisons that apply to different assessment situations ie an input-process-outcome structure. In some cases, more than one comparison might be appropriate and some prioritisation is then required. The preparation of the final matrix will require some effort, as it must comply with a number of at first sight, conflicting requirements.

The remainder of the standard will then be devoted to defining the various input data, comparison processes and outcomes that are required for compliance. This will of course give guidance on the most appropriate methods of measurement.

Perhaps the most difficult requirement to meet is that the new standard will have to be both rational and consistent with the most recent scientific and technical information, while not conflicting with existing rules and regulations already adopted in many countries. Some existing regulations appear to be based on out-moded concepts and ideas in some circumstances. The only way we can see around this difficulty at the present time is to present the standard as a description or overview of appropriate methods of assessment while allowing sufficient flexibility within the standard for individual countries or institutions to set their own criteria for different degrees of acceptability (this is the principle of subsidiarity). We can offer suggestions and guidance but an over-prescriptive approach will be counter-productive.

What Next?

Having established the ground rules on which the revised standard will probably be based, the next step is that the ISO working group have invited the UK delegation to provide a working draft of the scope, a matrix or framework of allowable assessment comparisons and a written explanation with definitions within the next few months if possible. Any constructive comments or suggestions from the membership of the IOA would be most useful at this stage, and we would then propose to update the membership on further progress at an appropriate stage during 1998. It is important to understand that, while we shall be making every effort to find some way of including, or at least allowing for, some of the more obscure noise assessment practices found around the world, there will undoubtedly arise situations where editorial judgement will have to be invoked.

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LOCAL NOISE MAPPING – A VIEW FROM A LOCAL AUTHORITY

John Hinton MIOA

Introduction

The European Commission (EC) published a Green Paper on Future Noise Policy in November 1996 [1]. In this document it is recognised that environmental noise is one of the main local environmental problems in Europe. It is claimed that around 20 percent of the European Union's population (80 million people) suffer from noise levels that scientists and health experts consider to be unacceptable, and in addition, 170 million citizens are living in so called 'grey areas' where noise levels are such as to cause serious annoyance during the day time. These claims have been questioned in several countries including the United Kingdom. However, there is no doubt that the data available on environmental noise exposure across Europe is generally poor in comparison to that collected to measure and assess other environmental problems. That which is available is often difficult to compare due to the use of different prediction, measurement and assessment methods.

Therefore, one of the options for future action outlined in the Green Paper is a proposal for a directive to harmonise prediction and measurement methods for the assessment of environmental noise from different sources across Europe.

Furthermore, the Commission appear to believe that noise mapping, eventually based on harmonised techniques, has the potential to be an effective and relatively inexpensive method for the assessment of noise data, for the presentation of data to the public and politicians, and to serve as a basic planning tool.

In the United Kingdom, the proposals for noise mapping were originally greeted with some scepticism. Doubts were expressed that accurate noise mapping could be relatively inexpensive, and concern was expressed that mapping external noise levels will not give a direct indication of individuals' true exposure to environmental noise which depends on many factors. Considerable debate has been held on the subject but it appears that such doubts and concerns are not widely accepted as reasons for significantly delaying the current mapping proposal. After all, noise mapping is fairly well established in several European countries. In fact many European cities see noise mapping as an essential part of defining and quantifying their noise problems. Such a process, it is argued, enables priorities to be established for action to reduce noise pollution, and for this action to be implemented as a result of raising public and political awareness of the issues.

However, a number of problems still remain to be resolved concerning noise mapping, not the least of which concerns the costs and benefits of mapping. Other issues include the development of harmonised methods of noise assessment across Europe; it has been suggested that such methods may not be available for another 5 to 7 years. The EC now apparently recognises this difficulty, and one of the suggestions put forward at a conference held in Madrid in July 1997, attended by technical representatives of several European cities, was that cities with populations of 350,000 or more should be required to produce noise maps using 'their own' techniques by the year 2002. These cities would then be required to map using harmonised methods by 2005. The mapping would eventually be extended to smaller cities and other urban areas.

Birmingham City Council has welcomed the proposal in the Green Paper, including mapping, as a significant step forward in developing a new framework for dealing with environmental noise pollution at a European level, but has expressed some concern over the costs that mapping could incur for Local Authorities.

This article has been prepared with the following objectives:

- To give some examples of local noise mapping which has already been undertaken.
- To briefly examine 'state of the art' computer based mapping techniques.
- To discuss a local mapping package which is being considered for mapping the City of Birmingham.
- To explore the possible uses of city-wide noise maps.

Examples of Noise Mapping

A review of some large scale noise surveys carried out both in the UK and in other countries was reported in a previous article [2]. Another example of this type of study is the noise mapping of the West Midlands reported in 1979 [3]. On a smaller scale many local authorities must already have undertaken some form of limited noise mapping in their areas, possibly without even realising the fact.

For example, any local authority that compiled a Noise Abatement Zone Register will have produced a form of noise map. Nevertheless, the majority of recent large scale noise mapping exercises appear to have been carried out in European cities outside the UK. A review of the techniques used by these cities and mapping techniques in general has recently been undertaken by Environmental Resources Management Ltd on behalf of the Department of Environment, Transport and Regions (DETR).

At the time of preparing this article the report on the review has not been widely publicised. However, a number of the European cities that have undertaken mapping exercises have made the results of their efforts widely

available. Included in these cities is Stockholm where traffic noise maps of the type shown in Figure 1 have been produced. On these maps the curbside noise levels on major roads are identified by the use of 5 dBA class width colour coding. For example, the roads coloured red have 'daytime' L_{Aeq} levels of 71 to 75 dB.

The information from this type of map has been used as part of a process whereby an Environmental Action Program for the period 1996–2000 has been drawn up for the City. One of the stated intentions of this program is that by the year 2000, noise levels shall have been reduced in residential areas as well as in natural and recreational areas.

Presumably, the noise maps will form an integral part of monitoring progress towards this target. Copenhagen has produced similar maps and has also set environmental noise reduction targets. A long term goal is that dwellings should not be exposed to noise levels >55 dB (presumably daytime L_{Aeq}). In the shorter term, there should be a substantial reduction in the number of dwellings exposed to levels >65 dB. Apparently, the key to monitoring progress towards these goals is the use of noise maps. In Amsterdam, noise maps of a similar nature were produced in 1976 and have subsequently been updated on at least two occasions [4]. These maps, it is claimed, have been used as part of the process of establishing and monitoring environmental targets, such as reducing the number of dwellings exposed to noise levels >65 dB (presumably daytime L_{Aeq}) and ensuring that the number of people 'annoyed' by noise in the year 2000 does not exceed those 'annoyed' in 1985. It is also claimed that the maps have been used, and continue to be used, for prioritising the provision of improved sound insulation in existing residential properties.

It is understood that all the noise maps in the preceding examples were produced by calculation procedures. However, it is not clear precisely how they are being or will be used to monitor progress towards the stated targets and objectives.

Another form of noise map used by some European cities is shown in Figure 2. On this type of map, the noise level in specific areas is identified by colour coding. It is understood that this particular map has been

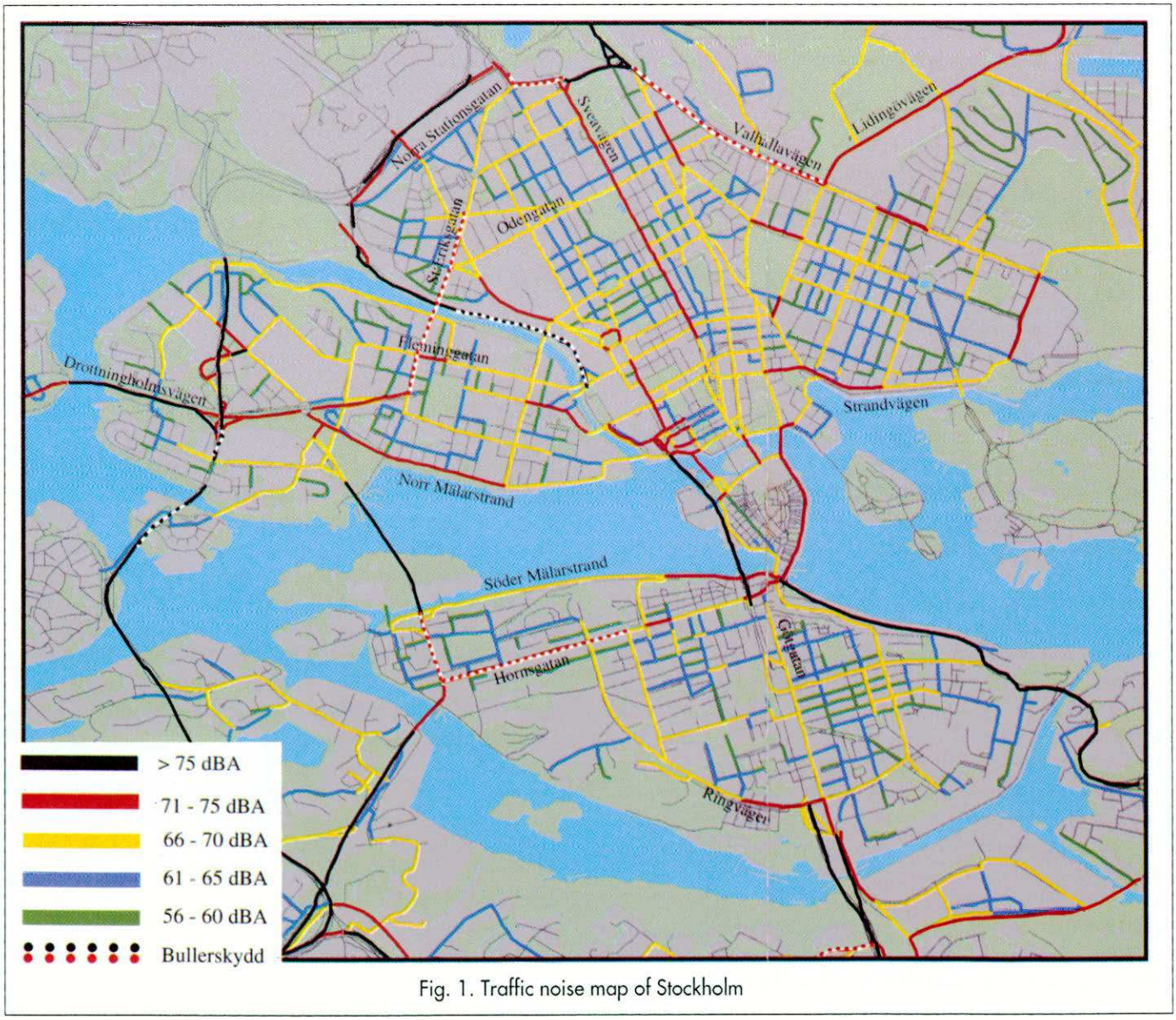

Fig. 1. Traffic noise map of Stockholm

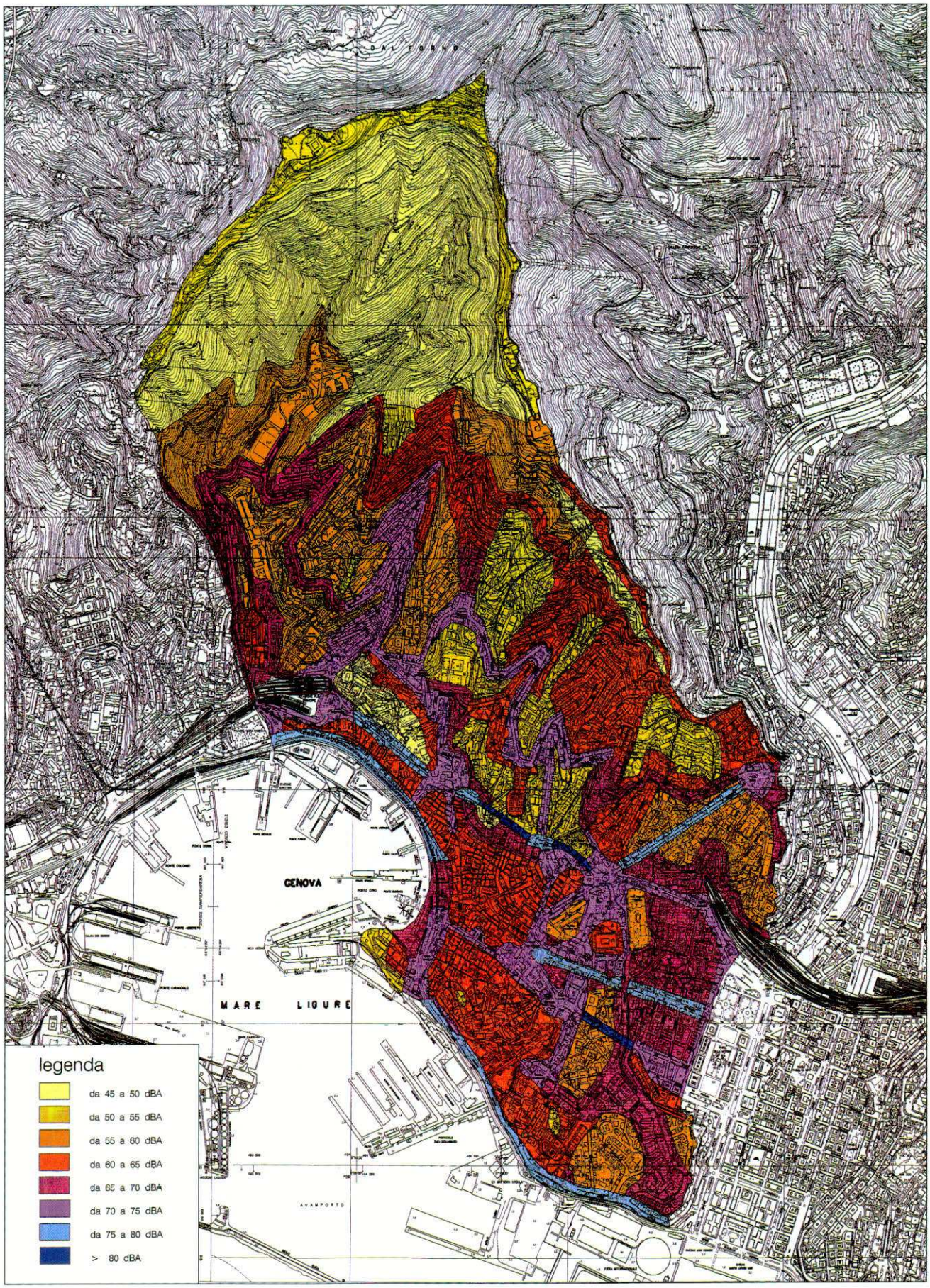

Fig. 2. Noise map of Genoa

produced from actual noise measurements. However, it is difficult to see how such a map can be accurate, suggesting, as it does, that noise levels are fairly uniform over relatively large urban areas. Experience indicates that the difference in noise level outside opposite facades of the same building can often be in excess of 20 dBA.

State of the Art Noise Mapping

Birmingham City Council has been exploring the possibility of noise mapping the City. Such an exercise could form a pilot study for mapping cities and other large urban areas in the UK. The type of mapping discussed earlier has been considered but it has been concluded that the way forward is to produce maps from 'state of the art' computer based prediction and calculation software which has the ability to use the Council's existing Geographical Information System (GIS) database. Attempts have been made to find UK software which can perform this task and which, with additional data on traffic/train flows etc, can produce the required maps. Unfortunately, no such software appears to exist, although the author would be pleasantly surprised if advised to the contrary. The Council has even made some efforts to encourage UK acoustic consultancies and software houses to produce such software, but with no immediate success. However, there are a handful of European companies based outside the UK who apparently market suitable products. Detailed discussions have taken place with one of these companies.

A Local Mapping Package

Birmingham have supplied the company with GIS information, traffic and train flow data and aerial photographs for a 'representative' 2 kilometre square area of Birmingham. The GIS information and traffic/train data have been supplied in a format which permits direct input into the mapping software. This has enabled the company to prepare a quotation for noise mapping the entire City of Birmingham. The quotation provides for modification of the existing software to calculate traffic and train noise levels using UK procedures [5, 6], if required. In addition, the aircraft noise contours around Birmingham Airport and existing noise data from large industrial plants will be incorporated into the mapping model.

The attenuation of sound for outdoor propagation will be calculated using the procedures outlined in ISO 9613 [7], which have been the subject of some criticism. The sound immission maps will be produced using the methods outlined in German Standard DIN 45682 (June 1997), which is currently being translated into English courtesy of the Building Research Establishment.

The first phase of the mapping exercise will be to carry out preliminary noise calculations. This will be followed by a series of control measurements and spot checks to test the accuracy of the results. Any necessary modifications to the prediction/calculation model will then be undertaken before preparation of the maps. The

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maps will be similar to that shown in Figure 3 which indicates the yearly average $L_{Aeq(T)}$ levels using 5 dBA class width colour coding.

Separate day and night maps will be produced for road traffic, rail traffic, air traffic and industry, as well as maps giving the combined noise levels from all these sources. The possibility of producing maps identifying areas by the Noise Exposure Categories (NEC's) in PPG24 [8] is also being considered.

As well as being provided with basic maps, the Council will be able to run the software to produce maps with greater definition. It should also be possible for the Council to modify (and hopefully add to) the initial input data, such as traffic flows, so that trends can be identified, noise reduction plans can be monitored, the impacts of proposed developments can be assessed and so on.

In general terms the cost of the entire exercise, including local authority officer time, is likely to be less than 20p per head of population.

Uses of Noise Mapping

As mentioned previously, the EC proposals on noise mapping were initially met with much scepticism in the UK. Questions were asked about the need for, and the eventual purpose of, such maps. Concerns were expressed that when the maps have been created, the data will be used to identify where 'unacceptable' noise levels are being experienced even though it is widely recognised that more research needs to be carried out to determine what is 'unacceptable'. The view has also been expressed that although maps will highlight areas where noise levels are greatest, little can be done in the foreseeable future, to significantly reduce environmental noise in most of these areas. Concern has even be voiced that large scale mapping will identify quiet areas and consequently people will then want to live in these areas and thus spoil the tranquillity.

There may well be substance to some of these concerns and observations and to others not mentioned here. However, there will always be excuses for putting mapping proposals 'on the shelf' for a few more years. The development of more accurate mapping techniques will always be just around the corner, arguments on the choice of noise mapping units will continue and more research into the effects of environmental noise on health and annoyance will always be demanded.

However, it seems to the author that we are now at a stage where mapping can start to produce some real benefits. Therefore, mapping should form an integral part of a research and development programme designed to produce a quieter environment in general, but particularly in towns and cities. Mapping is no longer an issue that should be postponed until other questions are answered. It is part of the answer to many of these questions. If this argument is accepted, and mapping is to become part of a co-ordinated research programme on environmental noise in the UK, the type of package that Birmingham is proposing may be the best available at the present time.

So, if the Birmingham mapping project goes ahead, what are some of the likely benefits for the City and for others?

Firstly, when the maps are published this should raise public awareness of noise issues, both locally and on a wider scale. It is to be hoped that this will result in a heightened political awareness of environmental problems, which is vital if significant reductions in noise, particularly noise from transportation sources, are to be achieved.

The noise map information could be interfaced with data on building occupancy and population density currently held on a GIS thereby identifying and quantifying the number of people exposed to 'undesirably' high levels of environmental noise. It will then be possible to produce noise reduction targets, and detailed action plans to reduce environmental noise exposures. By periodically updating the maps it will also be possible to monitor the effect of these actions, and through this process derive a form of cost benefit analysis of mapping. Lessons learnt from the entire mapping process and the use of the results, will undoubtably be of value in refining the techniques for more widespread use.

When the maps have been finalised, it should then be possible to carry out some form of accuracy testing to evaluate how useful the maps will be in dealing with both strategic and local planning issues. Finally, providing the accuracy and quality of the map information is acceptable, the data can be used in further research work on noise and health, noise and sleep disturbance and noise and annoyance in the UK.

Concluding Comments

Noise mapping is becoming increasingly commonplace in Europe, particularly in cities. At the moment there is little experience of such techniques and the benefits of such projects in the UK. Should we wait for our European colleagues to develop and enhance the techniques in isolation, or should we, at the very least, attempt to participate in this process?

Birmingham City Council is seeking funding assistance to undertake the first extensive noise mapping exercise to be carried out in this country for many years, using state of the art techniques, not just for the benefit of the citizens of Birmingham, but so that the entire experience can be monitored and evaluated in a national context.

The Council are currently having discussions with the DETR and Birmingham University, the latter being eager to use the results of mapping for academic studies into the health and well-being of the public in general. At this stage it seems unlikely that the project will go ahead without external assistance. In the author's view this would be to miss a great opportunity to put the UK at the forefront of this important area of research and development.

Any views or opinions expressed in this article are those of the author and not necessarily those of Birmingham City Council.

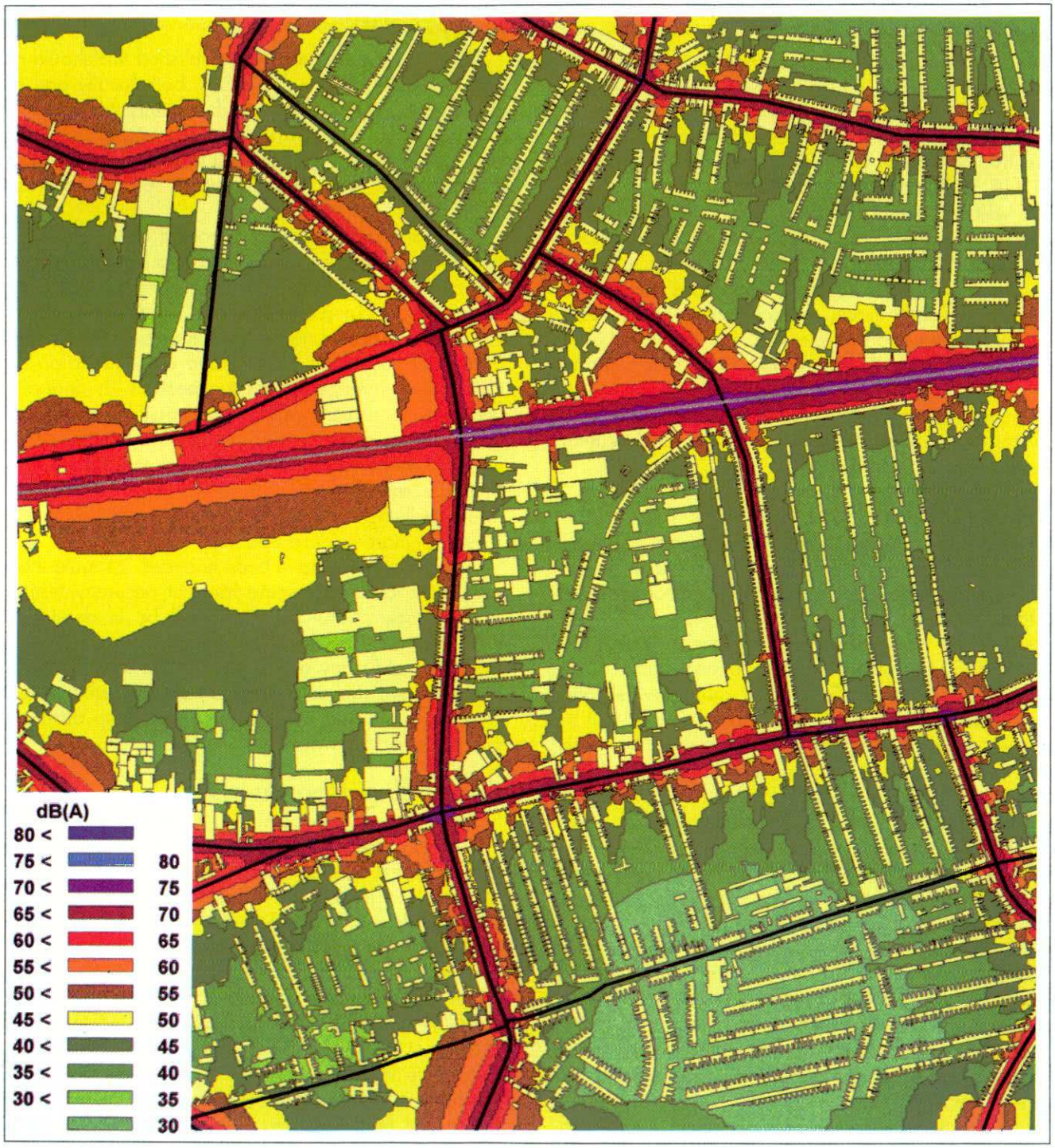

Fig. 3. Ambient noise level road and rail traffic in Birmingham (reproduced with the kind permission of deBakom Gmbh, Odenthal, Germany)

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A LOW BACKGROUND NOISE LEVEL FACILITY FOR DERA

Ed Clarke MIOA

Introduction

A very large scale rationalisation project has been undertaken at the Defence Evaluation and Research Agency (DERA) site in Farnborough. The program has now been completed and the myriad of highly specialised scientific and engineering functions have been centralised, along with their attendant support and administration organisations.

The new site is situated on X-Ball Hill, within the large Farnborough airfield complex comprising 97,000 m^2 of new buildings and represents an investment by DERA of over £100 million. Over 2 million bricks and blocks and 55,000 m^3 of concrete have been used in the construction of the various buildings, many of which posed unique construction and engineering challenges.

Acoustic and vibration research feature strongly in DERA's activities, with a comprehensive suite of anechoic chambers, vibration rigs, reverberation chambers, a speech communications assessment facility and several fixed and rotary wing aircraft noise simulators. Numerous other pieces of large test equipment, such as wind tunnels, are powerful sources of both noise and vibration, as is the building services plant serving offices, and facilities.

The aim of this article is to recount a technically interesting and challenging aspect of the rationalisation program involving the relocation of an anechoic chamber in which very low (sub-audible) background noise levels are required by the client (DERA scientists).

The Task

The small anechoic chamber in question, along with other acoustic and vibration facilities, was originally located in a separate building in a remote area of the site, the only other occupants of which were sensitive to the low noise tests undertaken. Relocation to the new site would house it within one of the several buildings interconnected by a covered concourse. The three storey building houses other noise and vibration test equipment, many items of which are very noisy, and a local plantroom in the roof void. The chamber is also now located directly opposite the largest wind tunnel in Europe.

The rationalisation program was too advanced to tolerate any suggestions for alternative locations, and it was considered desirable within the functional plan for the acoustic department of the Air Systems Sector to keep all of the noise and vibration test facilities under one roof. Within these constraints, the client's requirement for the chamber installation included ensuring that background noise levels were as low as or ideally lower than those at the old site.

The Problem

The relocation was duly carried out by the moves contractor, but the required background noise levels could not be achieved.

The space allocated for the chamber was in a relatively small room on the ground floor of the new building. Practical problems associated with the re-build had resulted in an inappropriate location for the chamber. The customer's requirements for structural isolation could not be fully met, and the chamber was constructed in the corner of this room – directly coupled with two walls. Despite this, airborne sound insulation from adjacent noisy areas was still very good, but the structure borne path was a major problem.

Investigation

To identify existing noise sources which were giving rise to excess background noise levels in the chamber (of around NR 01), exhaustive tests were carried out under a matrix of conditions to eliminate each external noise source from our enquiries. As is often the case for acousticians, these tests were undertaken at a remarkably unsociable hour of the morning to ensure that individual noise sources could be isolated.

To measure such low noise levels, DERA's own very specialised Brüel and Kjær low noise instrumentation was used in the chamber, in conjunction with source measurements using standard sound and vibration measuring and analysing meters.

Contributions from several nearby test facilities and plant installations were evaluated, including the chamber's dedicated air conditioning system. It transpired that the dominant noise sources were this local air handling unit; equipment in the main plantroom; corridor door slams and minor contributions from adjacent test rigs. Even the massive wind tunnel installation, which was run at maximum duty conditions during the tests, had little effect on noise levels in the chamber.

Further narrow band frequency analysis was useful in identifying individual plant items and the nature of the structure borne transmission problem. Specific small pumps and pipework were identified in the main plantroom as sources of problematic vibration, at characteristic frequencies, which were manifested in the ambient noise spectra measured inside the chamber.

Structural response tests were also carried out on the chamber's isolated slab to assess its efficiency and natural frequency.

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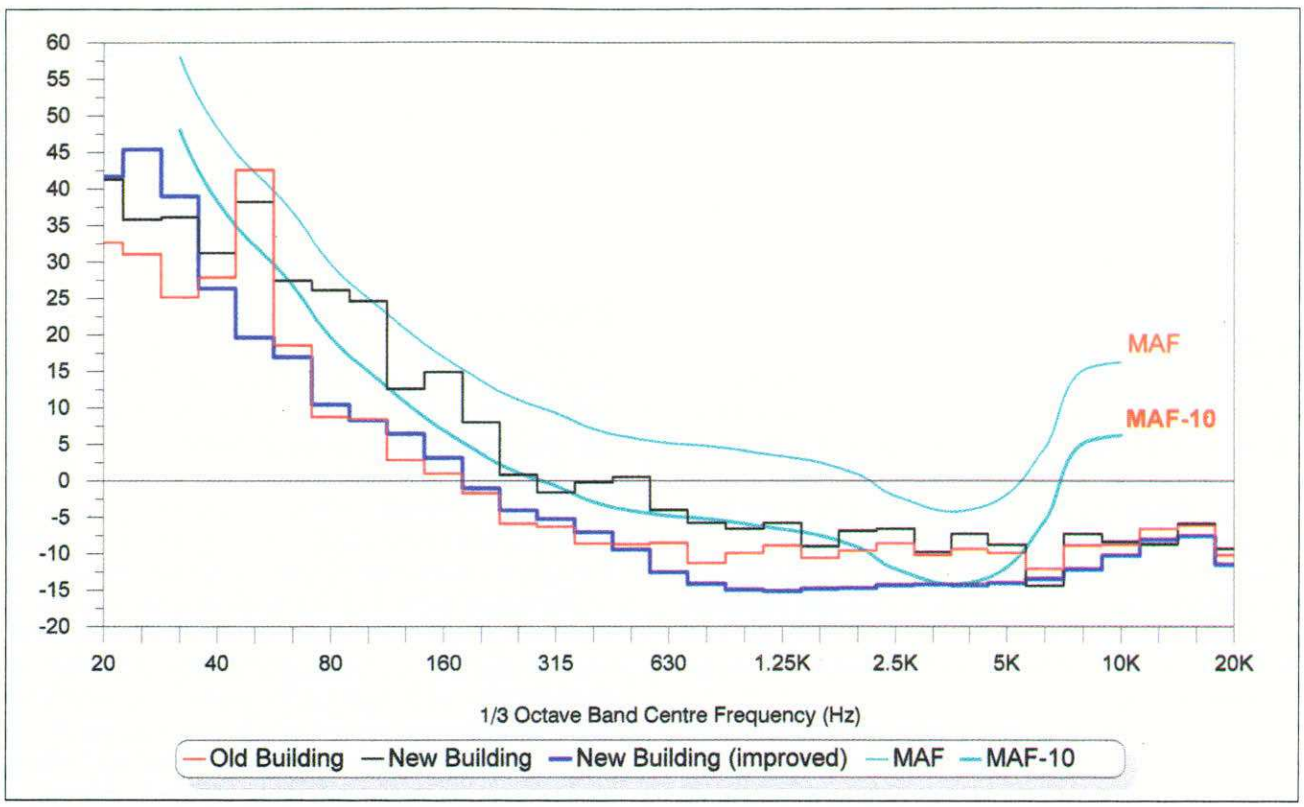

Fig. 1. 1/3 Octave noise spectra inside anechoic chamber. Air handling unit at full duty.

levels 10 dB lower than threshold are considered desirable. To provide a comparison, the NHS guidelines for background noise levels in audiometry rooms equate closely to a threshold of hearing curve.

Before sanctioning any remedial works, the client stated that a guarantee of resultant background noise levels was required. Although a request of this nature tends to send consultants scurrying for cover in the small print of their PI insurance, there was sufficient confidence in the diagnosis of problematic noise sources to agree an *assured level.*

The level agreed was 5 dB below minimum audible field (MAF–5), representing a significant improvement on the current performance, but not as much as the ideal of MAF–10. The client wished to see MAF–5 bettered.

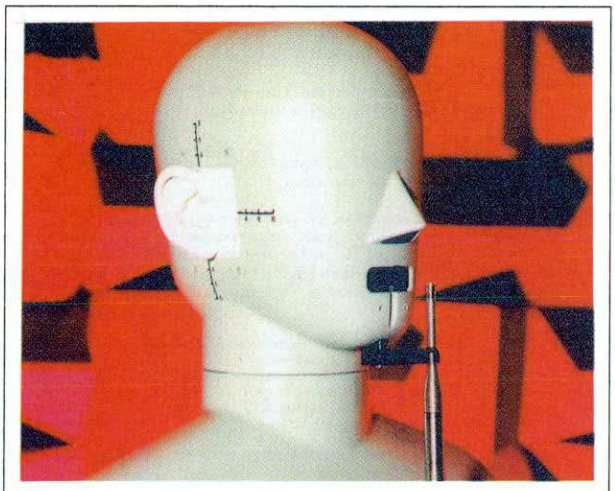

Fig. 2. Measurements in anechoic chamber (Courtesy of DERA).

Best Engineering Solution

To ensure compliance with the assured level, and aim towards the target level, practical measures for both source vibration reduction and improved isolation of the chamber were identified and specified.

The decision to remove and replace the installed chamber slab was taken early, and met with little opposition. This enabled a review of its isolation performance, and respecification of a higher efficiency, lower natural frequency system comprising a much more massive slab on large, high deflection rubber mounts. The suggestion of using a double isolation system with a floor slab floated on a separate inertia base was resisted since an improved single slab isolation could provide the required performance without the attendant cost and space implications of the double system. This also eliminated the requirement for careful consideration of sympathetic responses of the composite proposal in the presence of relatively low frequency forcing terms.

A new dedicated air conditioning system was specified for the refit to reduce noise levels both in the chamber and in the room in which it is housed. A split unit was chosen which removed the condenser element to outside the building and made use of a particularly quiet fan unit. This was fitted with high performance duct silencers, and the air flow into the chamber carefully controlled.

The main plantroom vibration problems had to be treated at source. An installation which would normally

be expected to comply with noise levels of say NR 35 in adjacent labs was under scrutiny for structure borne propagation of dramatically lower noise levels, close to NR −10 had the curves gone down that far. A comprehensive scheme of uprating the existing inertia bases, anti-vibration mounts, pipework isolation and flexible connections was specified. The complexity and scale of co-ordinating these plantroom adaptations, as usual with retro-fit projects, caused a certain amount of initial consternation, but was accepted with good grace.

Results

To give an early indication of the refitted chamber's performance, commissioning tests were carried out prior to the completion of the plantroom isolation works. This enabled a direct assessment to be made of the improvement gained by rebuilding the chamber alone, with further benefits to come once the plantroom work is complete.

The results obtained from these tests demonstrated that compliance with the assured level could be achieved, since the only slight excess of the MAF-5 curve was caused by one of the prime suspect plantroom pumps – soon to be eradicated.

It was also shown that the chamber's air conditioning could now be operated during testing and sub-audible background levels maintained – an improvement over the installation at the old site. It is now considered likely, in fact, that on completion of the remaining plantroom improvements background noise levels can be held consistently below MAF-10 with or without air-conditioning. The client's original design target could well be met, and the *assured* level which was promised will be delivered.

The anechoic chamber will be available to DERA, and their clients, in an ambient noise climate considerably lower than current *state of the art* audiology facilities. Current research activities requiring these ultra low background noise levels are understood to include advanced acoustic design of aircraft helmet and communication systems and free field audiometry.

Lessons Learned

Contrary to our initial reaction to the performance requirement stipulated by DERA, very low sub-audible ambient noise levels are required for some types of acoustics testing, and can be achieved.

Large and seemingly obvious noise sources are not necessarily as problematic as they first appear. Structure borne noise problems particularly can originate from relatively incongruous sources via apparently tortuous routes.

An appropriate and thorough engineering acoustics approach should be applied to all practical consultancy work of this nature, but is particularly important when designing for such high performance – especially when the client has been assured of a guaranteed result!

For details of these and other noise and vibration facilities commercially available at DERA, Farnborough contact Ian Rogers on +44 (0) 1252 392348

Ed Clarke is a Senior Consultant with Alan Saunders Associates, a member of the Association of Noise Consultants. ❖

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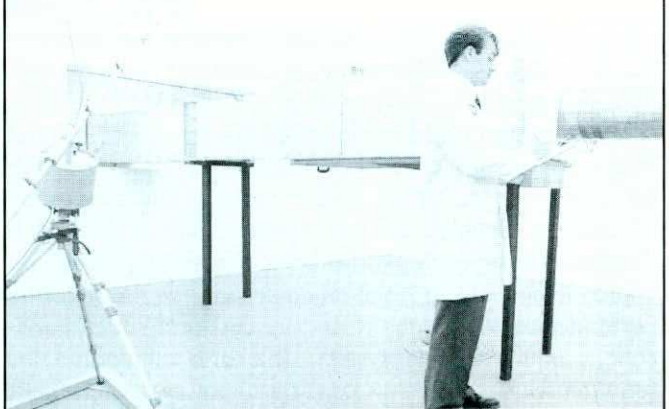

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The course consists of eight taught and practical units on topics including the measurement and assessment of sound, instrumentation, reproduced sound, psychoacoustics, planning and law, architectural acoustics, noise control and environmental noise. In addition to studying the taught units students undertake a project leading to a dissertation which may be in any area of acoustics.

For further information contact the Course Director:
Dr Bridget Shield
School of Engineering Systems and Design
South Bank University
Borough Road
London SE1 0AA

Tel: 0171 815 7658 Fax: 0171 815 7699
email: shieldbm@sbu.ac.uk

ENGINEERING COUNCIL: 1997 SURVEY

Mike Heath

There was a lot of talk earlier in the year, particularly in the run-up to the general election, about the search for the elusive 'feel-good factor'. From the reports in the media and the comments made by politicians, one could have been forgiven for thinking it was a tangible object – like a pair of comfy slippers lost at the back of an over-stuffed cupboard – rather than a state of mind.

But there is no doubting its power to make the whole nation feel better about itself and I am convinced that I have detected a 'feel-good factor' coming over the engineering profession during the past few months. In this Year of Engineering Success there are so many positive things happening in our profession to make us proud to be playing our part and we shouldn't be backward in 'talking-up' the good points.

Many of you, I know, are constantly on the look out for fresh ammunition with which to combat some of the myths that still persist about the engineering profession. So I am delighted to report that the publication of the Council's Survey of Professional Engineers and Technicians 1997 offers a wealth of new facts and figures to demolish the negative arguments of even the most sceptical.

Somehow, we got stuck with the mistaken view that professional engineers and technicians are poorly paid in relation to their colleagues in other professions. In the recent past this has certainly not been the case and the new Survey bolsters the message with hard statistical evidence that I hope you will be eager to relay to the doubters and detractors.

The Survey, which is drawn from the responses of more than 10,000 professional engineers, is the most comprehensive and authoritative of its type and opens a window onto the current employment environment and working conditions of all three sections of the National Register – Chartered Engineers, Incorporated Engineers and Engineering Technicians.

I should explain that the Survey is independently conducted for the Council by Electoral Ballot Reform Services, who send questionnaires to one in seven randomly selected names from the National Register. They typically receive a response of more than 40% – an extremely high rate for any survey.

The value of the data is that it convincingly supports what many of us in the profession have always known and constantly maintained – that engineering is a good job, is well paid and offers excellent prospects. The conclusions provide us with an even stronger platform from which to convince the brightest and most creative young people that engineering can offer them not just a stimulating career but a rewarding future too.

We now have conclusive evidence that engineering is not only a well rewarded career but is also very secure – with unemployment rates low and falling – and that an engineering degree is one of the surest routes to business success and a seat on the Board. It is also heartening that the vast majority of respondents consider engineering to be an exciting and stimulating career and one that they would recommend to others.

Frequency of the Survey has been increased to every two years, which enables trends to be tracked and valuable comparisons drawn. Notable findings this year are that salaries across all three grades are continuing to rise at a rate well above inflation. Over the past two years, average salaries for Chartered Engineers have gone up in real terms by 7.9% to £40,131; for Incorporated Engineers by 7.0% to £29,918; and by 13.7% for Engineering Technicians, whose average salary is now £26,311.

I am very conscious, from the responses of some people to our previous Surveys, that not every professional engineer earns as much as the average. But as engineers we understand the significance of averages and that bitter personal experiences, however regrettable, do not necessarily provide an accurate reflection of the national picture.

In reality the average salaries published in the Survey are, if anything, likely to be on the conservative side because there is some evidence to suggest that the very highest earners do not to respond to survey questionnaires. An indication of the earnings potential in the profession, however, is revealed by the 23 Chartered Engineers whose annual earnings were £250,000 or more.

There is an equally positive message from Registered engineers on their employment status. In our 1995 Survey we were able to show that unemployment among professional engineers was around 2%, which at that time was well below the rate among the general working population and in most other professions. The new Survey shows that the rate has now fallen still further and, at a rate of 1.4%, is probably at or below the 'churning' rate.

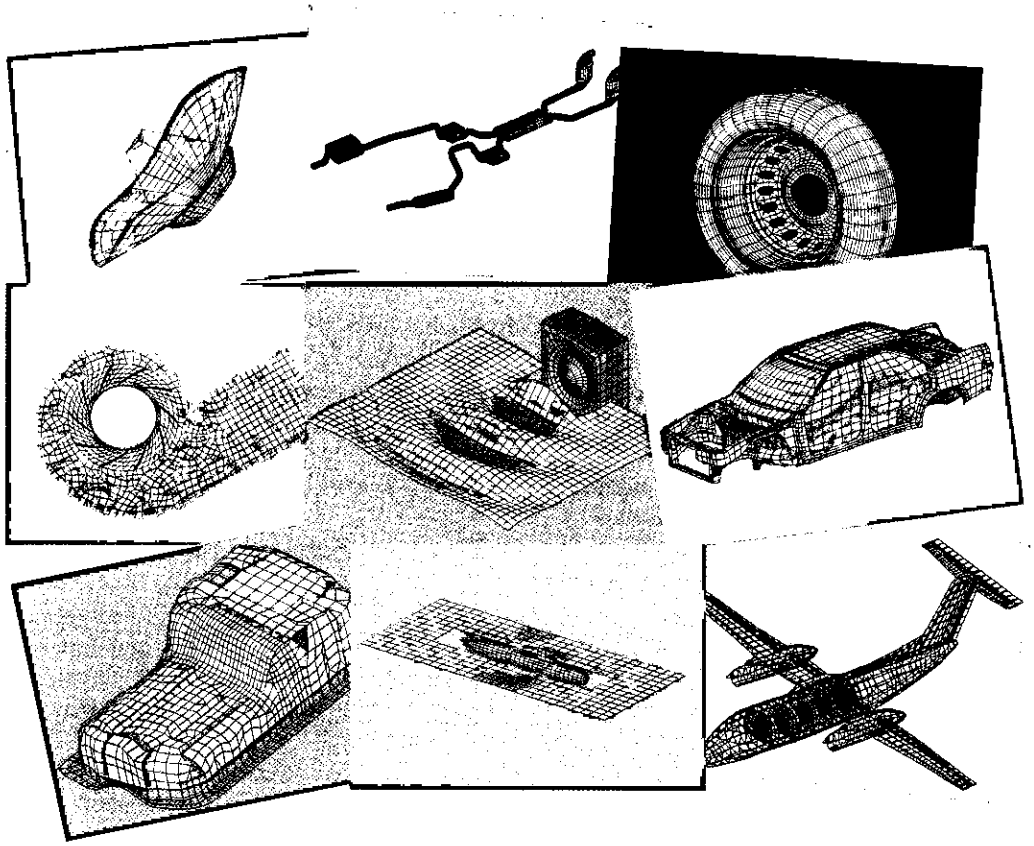
The rate of response means that the results are statistically sound. They are not Panglossian wish-fulfilment from a profession searching desperately for some good news. Far from it: the new findings merely confirm the results of the two previous Surveys, in 1995 and 1992, and equally positive trends are being flagged up. They support a wealth of anecdotal evidence that engineering is on the way up in terms of status and reward.

Personally, I regard the Survey as an accurate and crystal clear reflection of this dynamic profession's health and a fitting endorsement of all that we have claimed are its strengths in the Year of Engineering Success.

Mike Heath is Director General, Engineering Council

FROM STRUCTURAL RESPONSE TO ACOUSTIC CONTROL

5.3



Automotive analysts
- Prediction of engine/powertain noise
- Transfer path analysis of structure/airborne sound
- Modeling of multi-layered absorption panels
- Acoustic radiation from automotive components
- Prediction of road/tire noise and its perception
- Muffler analysis
- Door slam assessment
- Body compartment noise
- Tools for sound quality engineering

Aerospace engineers
- Interior cabin noise modeling
- Trim panel optimization
- Payload integrity under launch conditions
- Passenger comfort during long-duration space flights
- Airport noise mapping

Underwater acousticians
- Submarine and ship hull radiation
- Propeller noise modeling
- Interaction of sound waves with structures
- Sonar design and transducer modeling

Electrical engineers
- Transformer noise modeling
- Environmental impact of powerplants
- Turbine hall layout

Audio designers
- Loudspeaker radiation pattern
- Concert hall and sound studio acoustic modeling
- Design of electro-acoustic enclosures

Appliance manufacturers
- Modeling of compressor and blower noise
- Case radiation analysis
- Positioning of sound absorption material

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NEW CHARTERED ENGINEERS

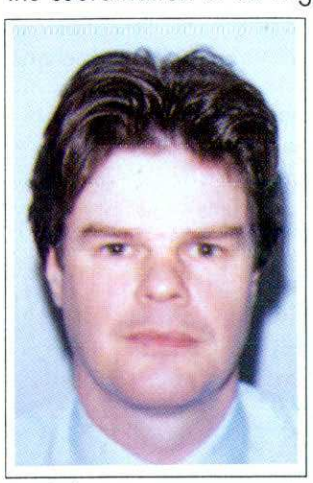
Dr Christopher Feuillade is a research physicist in the Ocean Acoustics Branch of the US Naval Research Laboratory.

Dr Feuillade, who grew up in Harrow Middlesex, joined NRL at the Stennis Space Center in Mississippi, USA, in 1991. He specializes in research on the nature and causes of biological volume scattering and bottom boundary scattering, and the effects of reverberation, clutter, and false targets on the performance of naval active sonar systems. A major part of the present effort concerns the acoustical scattering behavior of fish schools. The objective of the research is to analyse the impact of acoustical effects on current technology, and facilitate the development of standards leading to the design and engineering of improved sonar systems.

Dr Feuillade received a BA degree in physics from Oxford University in 1972, and a PhD degree in physics from the University of Manchester in 1977. He has published 35 scientific papers, and has given many presentations, both invited and contributed, at scientific conferences. In 1995 he received the Alan Berman Research Publication Award from NRL.

Dr Feuillade is also a fellow of the Acoustical Society of America.

Mark A Hines is a Proposals Engineering Manager with GEC ALSTHOM Power Generation Division involved in the coordination of all Engineering Design activities for a Tender; being responsible for setting goals, defining objectives, planning resources, monitoring progress and ensuring effective communication to facilitate the design on programme.



Mark's development over the past 15 years has been characterised by a gradual move away from a reliance on specialist knowledge towards practically based learning. Initially trained as a Physicist, he undertook a second degree in Acoustics while working for the National Coal Board.

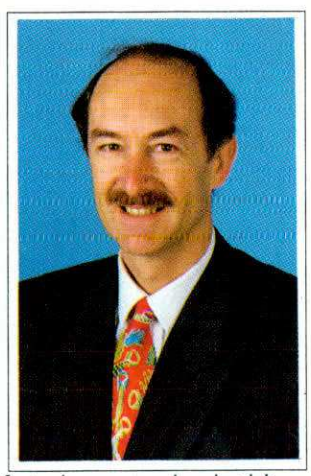
Ian Rogers obtained a BSc (Hons) degree in Electronic Engineering from Southampton University in 1988. He was sponsored throughout his course by the Ministry of Defence, and spent two summer vacations working in the communications group at the Royal Aerospace Establishment (RAE), Farnborough.

After graduation, Ian returned to RAE (now Defence Evaluation and Research Agency, DERA) to join the speech applications group with research interests in the development of speech recognition and synthesis systems for use in military environments.

Ian moved to the acoustics & vibration group at DERA in 1992, where he now leads the research in speech communications assessment and manages the Communications Assessment facility. He also conducts research into noise alleviation technologies and robust communications systems for use in acoustically severe environments (such as military vehicles).

Recently, Ian has studied part time for an MSc in Environmental Acoustics at South Bank University, which he was awarded this year.

Paul Royle is the manager of The Building Test Centre which he formed in 1992 by amalgamating the Acoustics, Fire and Structures Departments at British Gypsum into one multidisciplined unit offering a service to the BPB group of companies and commercial clients.



Paul originally studied aeronautical engineering at Loughborough University and followed this by gaining a higher degree in aeroacoustics. His familiarity with a well known make of acoustics measuring equipment enabled him to make the transition from the aircraft industry to the building industry when he started his career at British Gypsum twenty three years ago as an acoustics engineer. Work involved testing and developing building acoustics products and noise control at the company's factories including noise prediction work which led to the approval and construction of two major factories within the BPB Group on what had originally been greenfield sites.

Although Paul is now very active in the passive fire protection industry, he continues to work in the acoustics field on sound insulating and absorbing products. ❖

Reproduced Sound 13

Windermere, 24 – 26 October 1997

Contrary to the expected influence of the number 13, the weather for this annual sonic get together was mostly dry and sunny which no doubt enhanced the enjoyment of both those working and those families and friends who come along for the ride. This also made the almost obligatory lake steamer trip on Saturday a pleasant experience rather than the Lakeland equivalent of a North Sea force nine gale.

This conference also marked the point at which Roy Lawrence, who initiated these conferences and has up to now masterminded each one, has taken a comparatively rearward seat, in view of his impending retirement from all but the educational and Acoustic Bulletin sides of his Institute activities, and allowed a loose rein to the organising committee.

This committee, an exceptionally strong one, ensured a Reproduced Sound conference second to none and has ensured the continuation of this successful series. The committee comprised: Ken Dibble, Chairman; James Angus (University of York); Mark Bailey (Arbiter Pro Audio); Peter Barnett (AMS Acoustics); Robin Cross (BT); Paul Darlington (University of Salford); Guy Hawley (Arbiter Pro Audio); Peter Mapp (Peter Mapp Associates); Allen Mornington-West (IBTA); Julian Wright (Celestion). As usual this conference was organised in collaboration with AES, ISCE, APRS and ABTT.

There were a few changes to the structure of the Reproduced Sound conference, mostly concerned with the workshops which were more numerous than previously. The period allowed for presentations continued at 30 minutes as initiated at RS12. This allows speakers more room to breath and results in a more relaxed and more effective transfer of information than the 20 minutes that used to be the norm. Another new feature was the continuous availability of an audiometer which enabled delegates to have their hearing tested at any time during the weekend; the results were provided as a printout and the equipment was kept very busy. In view of the sensitivity felt by people who earn their living in an audio world and would not want it known that their hearing was deficient, the equipment was situated in a separate room and the results regarded as confidential!

Another notable event was the re-launch of the Institute's Electroacoustics Group together with an inaugural meeting.

Although there were many admirable presentations during the technical sessions, most would agree that the highlights of the conference were the Plenary Paper given by Professor Wolfgang Ahnert of ADA Acoustic Design of Berlin and the Invited Presentation given by Professor Richard Gregory, Emeritus Professor and Research Fellow in Neuropsychology in the University of Bristol. On Saturday Wolfgang Ahnert's lecture prefaced the session on Auralisation and Speech Intelligibility by giving a comprehensive review of auralisation techniques and related computer modelling methods. On Sunday morning Richard Gregory delighted the audience with a refreshing change of topic; visual and aural illusions. Admittedly the emphasis was on visual illusions since that was the core of much of Richard's research in neuropsychology but he skilfully introduced similar concepts involving sound. The content of the slides and projected computer graphics coupled with an enthusiastic manner of delivery ensured that all of the substantial audience had a thoroughly enjoyable time; the duration of the applause was a measure of this.

Technical Sessions

Friday: Loudspeakers

After an opening welcome by Roy Lawrence the conference started with a session on loudspeakers, chaired and introduced by Mark Bailey of Arbiter Pro Audio.

The first paper, '*High power performance of direct radiating cone loudspeaker drive units*' by Ken Dibble of Ken Dibble Acoustics, reviewed the progress of a loudspeaker test programme, Speakercheck 2000 currently underway for *Sound & Communication Systems International* magazine. Testing, carried out at the BT Research and Development Centre, is aimed at measuring the actual high power performance of loudspeakers in relation to the manufacturer's published characteristics. Factors measured and considered are voice coil temperature, rated impedance and power compression. Power compression (the fact that the SPL at rated maximum power is less than the theoretical value) is related to temperature rise and if the voice coil temperature could be reduced then the loss of SPL might be reduced. Volt Loudspeakers have attempted to achieve this effect with their 'inside out' design. Photograph 1 illustrates the design feature where the chassis, mounting flange and

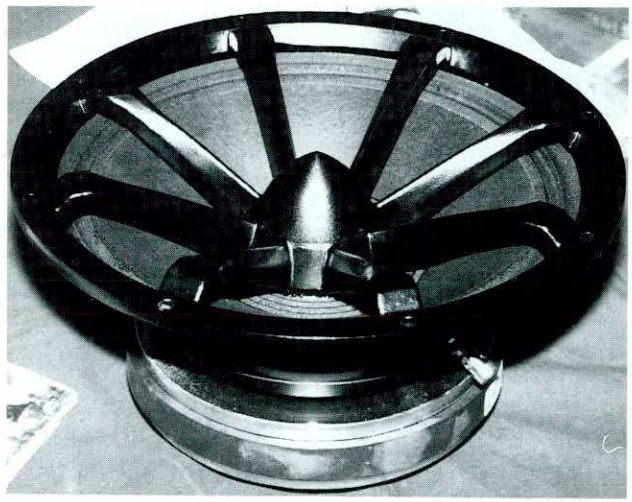


Photo 1: Volt Loudspeakers novel inside out design.

FURTHER CALL FOR PAPERS

Your 1998 Spring Conference

Acoustics '98

TRANSPORTATION NOISE: NOISE ON THE MOVE

(Organised by the IOA and the ANC)

Cranfield University

31 March - 2 April 1998

The 1998 Spring Conference re-establishes the event at which Institute members can meet to discuss their latest concerns, findings and discoveries. This conference will also celebrate the 25th anniversary of the Association of Noise Consultants. This Second Call for Papers seeks wide-ranging contributions. To complete the Conference planning, we need now your contributions in order to resolve the final programme of our annual Spring meeting.

Further offers of contributed papers should be sent with a 100-word abstract to the Institute office before 9 January 1998. Written papers will appear in the Proceedings of the Institute of Acoustics which will be available to delegates upon arrival. Completed manuscripts, normally no more than eight pages long and typed on the camera ready paper provided, must be with the Institute before 1 March 1998. Intending authors should indicate if it is their intention to have their paper refereed under the new procedure.

Initial contributions to date include: *Airport noise - modelling and mitigation methods; Heathrow departures noise study; Predicting noise from airport ground operations; Acoustic effects of railway ballast; Acoustical identification of aircraft at monitoring sites; European traffic noise calculation method; Vehicle accessory noise; Characterisation of acoustic devices for apertures; Automated measurement of electric motor noise; Low frequency response of small rooms; Structure borne sound from pumps; Railway vibration propagation; Light rail system noise; Significance of transportation noise changes.*

The meeting will include, as well as your lecture presentations, student poster sessions and two ANC workshops. Current plans are for these to concentrate on *General Aviation Noise and Small Airfields - Environmental Concerns* on the Wednesday; and *Vibration - BS 6472 and its Practical Use for Railways and Other Sources* on the Thursday.

Those who are presently unlikely to submit a paper should make a note of this important event in their diary now. It is intended to offer advice later about CPD credits for attendance.

PLEASE ADVISE THE CHAIRMAN NOW OF THE TITLE OF YOUR CONTRIBUTION.

Organising Committee:
Chairman:
Jeff G Charles FIOA, Bickerdike Allen Partners, 121 Salusbury Road, London NW6 6RG
Tel: +44 (0)171 625 4411 Fax: +44 (0)171 625 0250 email: mail@baplondon.demon.co.uk
Members:
Ralph Weston MIOA (RAF Halton), Sue Bird MIOA (Bird Acoustics), Jeremy Newton MIOA (Arup Acoustics)

Institute of Acoustics, 5 Holywell Hill, St Albans, Herts AL1 1EU
Tel 01727 848195 Fax 01727 850553 email Acoustics@clus1.ulcc.ac.uk Registered Charity No 267026

ANNOUNCEMENT & CALL FOR PAPERS

Underwater Acoustic Calibration and Measurements

(Symposium organised by the Underwater Acoustics Group)

National Physical Laboratory

20 – 21 July 1998

In underwater acoustic systems, electroacoustic transducers are commonly used to generate and/or detect sound. The performance of these transducers can be of crucial importance in determining the overall system performance. To characterise these transducers requires that underwater acoustic measurements be made. Such measurements include: calibration of standard reference hydrophones, measuring the transmitting response of projectors, matching of elements of arrays for phase response, determination of directional response and beam-widths, and measurement of the acoustic properties of materials.

The advent of quality schemes has led to a greater requirement for traceable calibrations both during product development and for quality assurance during production. Many of the methods and techniques for calibrating underwater acoustic transducers are well established, but recently attempts have been made to improve accuracy and to overcome difficulties inherent in some of the methods. The impracticality and expense of sea-trials have led to the use of laboratory tanks for measurements. Although providing a more controlled environment, such tanks introduce their own restrictions, for example when attempting to calibrate high-Q projectors at low frequencies. In addition to the variation in response of a transducer with frequency and angular orientation, information is often required on the variation with temperature and with ocean depth (and hence elevated static pressure), providing yet more challenges to overcome.

Papers are invited on the following topics:

- Free-field calibration of hydrophones and projectors
- Pressure calibration of transducers at low frequencies
- Measurement of directional response/beam widths
- Calibration of transducers in reverberant environments (eg small laboratory tanks)
- Calibration of transducers at high static pressure
- Measurement of transducer phase response
- Near-field calibration methods
- Measurement of the acoustic properties of materials
- Measurement of underwater radiated noise

Papers given at this conference will be published in the Proceedings of the Institute of Acoustics.
Submission of Abstracts: Abstracts in the form of summaries of about 200 words, should be submitted by post or e-mail (with hard copy by post) to either convenor, no later than 23 January 1998.
Completed manuscripts, for publishing in the Proceedings of the Institute of Acoustics and for which page layout details will be provided, must arrive by 24 April 1998.

Joint Convenors
Victor Humphrey, Department of Physics, University of Bath, Bath BA2 7AY, UK Tel: +44 (0)1225 826826 ext 5439 Fax: +44 (0)1225 826110 e-mail: v.f.humphrey@gdr.bath.ac.uk

Stephen Robinson, National Physical Laboratory, Teddington, Middlesex TW11 0LW Tel: +44 (0)181 943 7152 Fax: +44 (0)181 943 6161 e-mail: spr@npl.co.uk

ONE-DAY MEETING NOTICE

The Noise Act 1996

(Organised by the Measurement and Instrumentation Group)

Leeds Metropolitan University

3 March 1998

The Noise Act 1996 introduced a new night noise offence and a new procedure for the confiscation of noise-making equipment. Since the IOA held a One-Day Meeting on the Act in February 1997, the new night noise offence has become available for local authorities. In contrast to statutory nuisance, the night noise offence is based on the exceedance of an objective standard, the *permitted level*, The permitted level is established by reference to the *underlying level of noise*. The noise complained of must be measured using an approved device in a specified manner.

The meeting will include invited presentations about the origin and development of the measurement protocol, views on the merits of adoption of the offence by local authorities, and the relation of the offence to other neighbour noise issues. The afternoon session will comprise demonstration exercises, run by instrument manufacturers, of the measuring techniques required by the Act. There will be ample opportunity for discussion of the issues raised by the Act, and the meeting will be valuable for all those involved in the Act's adoption and enforcement. Certificates of attendance for CPD purposes will be available.

Meeting organiser:

Richard Tyler FIOA (Chair, Measurement & Instrumentation Group)
CEL Instruments Ltd
35-37 Bury Mead Road
Hitchin
Herts SG5 1RT
Tel: 01462 422411 Fax: 01462 422511 Email: richardt@cel.ltd.uk

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The Noise Act 1996, Leeds Metropolitan University, 3 March 1998

Name:

Organisation:

Address:

Tel: Fax: email:

☐ Please register me as a delegate to the one-day technical meeting and invoice me for the meeting fee which includes lunch & proceedings

☐ Members £95.00 + £16.63 VAT = £111.63

☐ Others £125.00 + £21.88 VAT = £146.88

INSTITUTE DIARY 1998

30 JAN - 1 FEB
IOA Diploma Distance Learning Laboratory Weekend 97/4
St Albans

JAN
North West Branch Evening Mtg - Sound Insulation Around Manchester Airport
Manchester

5 FEB
IOA Publications, Meetings Committee
St Albans

6 FEB
IOA CofC in W'place Noise Exam
Accredited Centres

6 - 8 FEB
IOA Diploma Distance Learning Laboratory Weekend 97/5
St Albans

12 FEB
IOA Membership, Education Committee
St Albans

26 FEB
IOA Medals & Awards, Council
St Albans

27 FEB - 1 MAR
IOA Diploma Distance Learning Laboratory Weekend 97/6
St Albans

3 MAR
The Noise Act 1996
Instrumentation & Measurement Group One-day Meeting
Leeds Metropolitan University

6 MAR
IOA CofC in W'place Noise Ass't Advisory Committee
St Albans

10 - 12 MAR
Health & Safety Exhibition, Olympia, London (IOA exhibiting)

18 MAR
Construction Noise
London Branch One-day Meeting
London

31 MAR - 2 APR
Acoustics '98 IOA Spring Conference
Cranfield University

23 APR
IOA Publications, Meetings Committee
St Albans

30 APR
IOA Membership, Education Committee
St Albans

12 - 14 MAY
RoSPA Exhibition, NEC, Birmingham (IOA exhibiting)

14 MAY
IOA Medals & Awards, Council
St Albans

15 MAY
IOA CofC in W'place Noise Exam
Accredited Centres

5 JUN
IOA CofC in Env Noise M'ment exam
Accredited Centres

9 JUN
How to Make Measurements in Difficult Circumstances
Instrumentation & Measurement Group One-day Meeting
London

12 JUN
IOA CofC in W'place Noise Ass't Advisory Committee
St Albans

18 - 19 JUN
Diploma examinations
Accredited Centres

9 JUL
IOA CofC in Environmental Noise M'ment Advisory Committee
St Albans

20 - 21 JUL
Underwater Acoustic Calibration and Measurements Symposium
Underwater Acoustics Group
National Physical Laboratory

17 SEP
IOA Publications, Meetings Committee
St Albans

24 SEP
IOA Membership, Education Committee
St Albans

1 OCT
IOA Medals & Awards, Council
St Albans

9 OCT
IOA CofC in W'place Noise Exam
Accredited Centres

22 - 25 OCT
Reproduced Sound 14
Electroacoustics Group Conference

30 OCT
IOA CofC in Env Noise M'ment exam
Accredited Centres

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

10 NOV
Measurement Protocols: Noise Measurement in Buildings
Instrumentation & Measurement Group One-day Meeting
London

12 NOV
IOA Publications, Meetings Committee
St Albans

12 - 15 NOV
Autumn Conference: Speech & Hearing
Speech Group

3 DEC
IOA Membership, Education Committee
St Albans

4 DEC
IOA CofC in Environmental Noise M'ment Advisory Committee
St Albans

10 DEC
IOA Medals & Awards, Council
St Albans

15 - 16 DEC
Sonar Signal Processing
Underwater Acoustics Group Conference
Loughborough University

Association of Noise Consultants Council Meetings
26 January 1998
23 March 1998

The United Engineers' Exuberant Summer Ball

London, 30 May 1998

This unique social occasion aims to bring engineers together for the first time at a national social event and provide a chance for engineers to meet with others in a relaxed environment while enjoying a splendid occasion. Offers of assistance with organising the event and requests for further information should be directed to:

Gavin Palmer, Co-chairman UEEBC
27 Mapledale Avenue, East Croydon, Surrey CR0 5TG Tel: 0181 654 2712

Photo 2: James Angus makes his point in his inimitable way.

pole piece are mounted in front of the cone instead of at the rear with the result that the air moved by the cone cools the metalwork and hence, it is claimed, the voice coil with a resulting reduction in power compression.

Nick Merricks of Loudspeaker Technology Ltd in his comprehensive presentation entitled '*Harmonic distortion in loudspeakers due to magnetic hysteresis and eddy currents*' considered the sources of non-linear behaviour in certain types of loudspeaker. Prime sources of non-linear behaviour come from the interaction of the magnetic field produced by the voice coil, induced eddy currents and the hysteresis of the material used to form the magnetic circuit of the drive system. An analytical model of the electromagnetic processes occurring in the magnetic drive system of the loudspeaker was then described which aimed to explain the harmonic distortion. This model sought to predict the variation of voice coil impedance with frequency taking into account the effect of eddy currents and also the electric and magnetic field strengths as functions of position within regions surrounding the voice coil.

James Angus of University of York presented a paper entitled '*Analysing loudspeaker polar pattern measurements using surface spherical harmonics*' which was produced with Michael Evans of the University of Reading. As the delegates have come to expect from James, the presentation of a serious and somewhat difficult subject was lightened by some novel and very amusing party tricks. After the gin bottle trick in 1995 we were not too surprised to be treated to the spectacle of Dr Angus firstly blowing up a balloon to illustrate a point after which the balloon was allowed to deflate whilst performing aerial manoeuvres over the audience and, subsequently, holding aloft a bunch of four coloured balloons to demonstrate a further point (see photograph 2). One possible drawback of this technique is that, like BBC's Ian McAskill giving the weather forecast, we are so fascinated by the manner of presentation that we do not listen to, and take in, the information! Fortunately James is such a skilled lecturer that this does not happen in his case; perhaps he should also take up weather forecasting! His message concerned the use of surface spherical harmonics (SSH) in representing the variation in sensitivity of a loudspeaker (or microphone) with direction (polar pattern). His presentation defined SSH and explained how they can be calculated from polar pattern measurements. Don't ask me to explain the purpose of the balloons; I was too busy enjoying the spectacle to take in the message! Buy the Proceedings and read about it.

Patrick Macey of Pafec Ltd, in his paper '*Contribution analysis from loudspeaker radiating surfaces*' compared the use of coupled and uncoupled models in finite and boundary element methods in the vibroacoustic modelling of loudspeaker drive units. His conclusion was that for accurate results a fully coupled model was best. He described the PACAN joint project on this topic which involves PAFEC, Celestion, MIRA and PAC.

S Siegel introduced the concept of Phased Point Source Technology (PPST) to enable the designer of large scale sound reinforcement systems utilising multiple source arrays to produce high levels of clear, undistorted sound. By providing individual drive signals to each element within a loudspeaker array, a phased array can be developed with acoustical performance which closely approximates a point source. The technique for predicting array response and determining the optimum drive signals for each array element is called PPST. The paper dealt in some detail with the techniques involved and made a convincing case for the new methods.

In his contribution '*Loudspeaker specifications, fact or fiction, a manufacturers perspective*', M A Hudson of HiQ Sound spoke from the point of view of a designer of sound systems to meet customers' requirements using drive units and components from other manufacturers whose product specifications may not always speak the truth. He dealt with the various types of driver units, bass/midrange cone units, compression drivers and constant directivity horns and their various shortcomings in relation to the published specifications. He finished with an honest expression of the dilemma of the designer specifying his finished product, 'do you specify as others do, or do you tell the truth'. One got the impression that he would always tell the truth!

Graham Bank, lately of Celestion International and now with New Transducers Ltd, gave the paper '*An introduction to distributed mode loudspeaker(DML) technology*' in place of H Azima who was unable to attend. Graham described the new type of loudspeaker which has been intriguing the industry this year – the distributed mode loudspeaker. This is a slim panel unit which has resulted from a new understanding of the relationships between the mechanical and acoustical properties of vibrating panels. NXT, a registered trade mark of New Transducers Ltd, itself a subsidiary of Verity Group plc (shades of Quad and Mission) have developed optimisation techniques, whereby stiff, light panels can be designed to have very uniform modal density, the pre-requisite for distributed mode behaviour. Gra-

Photo 3: Graham Bank demonstrating a DML panel. The surround sound tv set-up can also be seen.

ham described this novel design and showed the audience a typical small panel.

On Saturday evening, after the conference dinner, NXT demonstrated a typical DML panel producing music from both sides whilst Graham Bank was waving it about in the air (see photograph 3). The demonstration also included the use of several DMLs in a surround sound television set-up where the picture was projected on to one white DML as a screen while it produced the centre channel sound (seen in same photograph). The other panels provided front and rear sound channels; a very impressive demonstration of the potential uses of this design. Another application which was on display was a lap top computer which had side panels behind the LCD screen which could slide out and produce good quality sound (see photograph 4).

In the next presentation, given by N Harris also of NXT, the theory and mathematics of the distributed mode loudspeaker were explained although the methods of producing them remain a trade secret. A DML is identified by the fact that its radiation is due to uniformly distributed free vibrations in a stiff, light panel and not to pistonic motion as in conventional loudspeakers. NXT showed that it is possible to design a single DML to be substantially flat in both pressure and power response over a very wide bandwidth without any electrical filters, something which is impossible to achieve with conventional loudspeaker technology.

Open Session

Peter Barnett of AMS Acoustics spoke on '*Implications of amplitude compression on RASTI performance*' in which he described experiments at several locations to examine the potential benefit on speech intelligibility, in terms of achieved RASTI values, by the application of amplitude compression. It was found that a worthwhile improvement in RASTI can be achieved.

Allen Mornington-West, ITVA, in his usual thorough and clearly expressed manner of delivery, explained the consequences of the United Kingdom Parliament 1996 Broadcasting Bill which put in place the legislative framework to introduce in the UK the digital terrestrial television (DTTV) multiplexes. His paper was entitled '*Implementing a national federal digital terrestrial television network*'. Preliminary frequency planning exercises by both BBC and NTL (National Transcommunications Ltd) had identified that satisfactory coverage of the UK could be provided for up to six multiplexes. The long term aim of United Kingdom Government is that digital terrestrial broadcasting using Ultra High Frequencies (UHF) will replace the current analogue UHF PAL system. The timing of the switching off of the analogue service has not been fixed but the implication of what Allen was saying is that it could be as soon as five years depending on a satisfactory penetration of DTTV within the UK.

In his paper '*Driver position frequency response information for a range of car and audio equipment combinations*', Robin Cross of BT Acoustics and Dynamic Analysis Laboratory, described methods used to measure the frequency response, at the driver's head position, of several in car audio systems. Using a single CD music track as a stimulus, the measurements were made using a linear averaging $^1/_{12}$ octave Frequency Response Analyser and a Head and Torso Simulator. As expected, the larger cars with more panel damping and interior damping, including better quality loudspeakers perform better than the smaller cars. The main conclusion was that panel damping and speaker placement were the keys to improvement in audio performance.

M S Pettersen of Shure Bros Inc explained, in '*Automatic microphone mixers: solving the audio problems caused by multiple open microphones*', that in situations

Photo 4: Use of NXT, DML panel loudspeaker in a lap top computer.

Photo 5: Demonstration of stereo dipole.

where multiple microphones are used, for example in council chambers, conference centres, churches etc, high quality audio becomes progressively more difficult to achieve as the number of open (in use) microphones increases. The problems are a build-up of background noise, reduced gain before feedback and comb filtering. The solution is to keep the number of open microphones to a minimum by reducing the gain of those microphones not in use at a particular moment. This can be done manually at a central control desk but is much better achieved by employing an automatic microphone mixer. These devices, first introduced in the mid 70s are designed to keep unused microphones attenuated and to activate any microphone spoken into within milliseconds. The speaker detailed the problems caused by multi-miking and went through the various solutions to alleviating the problems based around the use of automatic microphone mixers.

Thus finished the technical sessions for Friday. During the evening the IOA Electroacoustics Group had their re-launch and inaugural meeting followed by the first workshop of the conference, also convened by the Electro-acoustics Group in collaboration with ISCE; Real-world performance and specification of paging/PA loudspeakers.

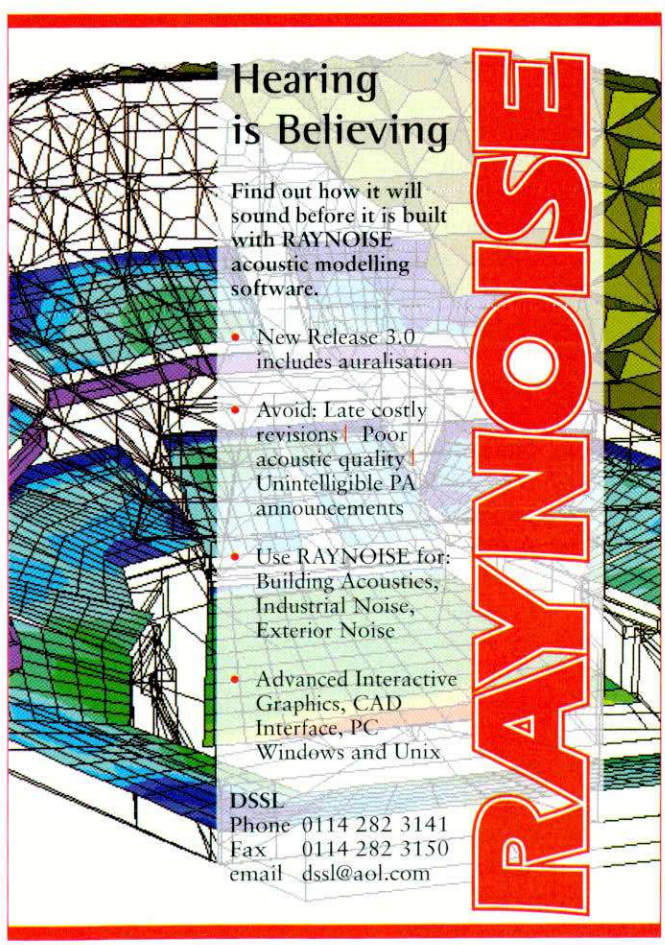
Technical Sessions: Saturday

Auralisation and speech intelligibility

After the invited presentation by Professor Ahnert mentioned earlier, there followed five papers.

The first, given by Andrew Rimell and co-authored by Mike Hollier, both of BT Laboratories, was entitled '*Design and implementation of 3-dimensional spatial audio for immersive environments*'. Immersive environments, that is those providing sensory immersion as in virtual reality and Telepresence systems, can be achieved with wrap around screens and spatial-audio systems. BT are currently developing such systems for virtual-meetings, education, medicine, training and entertainment. As Andrew explained, to maximise naturalness and immersion it is necessary to use high quality spatial audio. It is the authors' view that in many multimedia systems more effort has been invested in the video component than in the audio, and the work at BT reflects the fact that audio is at least as important as video, particularly in communications. The speaker then discussed the design and implementation of several immersive environments under development at BT Laboratories. Design considerations such as multiple listeners and difficult acoustic environments have been considered. Binaural, transaural and adapted ambisonics techniques have been investigated to provide spatialisation of virtual audio sources for a variety of applications. An interesting and thought provoking presentation particularly with the possibility of reduction of travel by all modes following the successful implementation of teleconferencing.

'*Virtual source imaging over loudspeakers*' was presented by O Kirkeby and co-authored with P A Nelson both from ISVR and H Hamada from Tokyo Denki University. The speaker explained that ISVR in collaboration with Tokyo Denki University in Japan have been working for more than five years on using digital signal processing to improve the quality of sound reproduction systems. Their ultimate goal is to be able to produce the illusion in a listener of being in a 'virtual' acoustic environment which is entirely different from that of the space in which the listener is actually located. Although a common term for such systems is 'surround sound' or 3D-sound systems, the authors prefer to use the term 'virtual source imaging systems'. The presenter outlined the progress made to date and considered such associated sciences as binaural technology, crosstalk cancellation systems using two and four loudspeakers (the two loudspeaker system provided a most impressive demonstra-



tion which was available in a separate room during the conference, and digital filter design.

Peter Mapp of Peter Mapp Associates brought the audience down to earth from the heady heights of virtual reality and high fidelity with his contribution '*Some effects of equalisation and spectral distortion on sound system intelligibility*'. Here the author spoke about the very important topic of understanding speech messages delivered by public address sound systems such as those used in churches, cathedrals, city halls and public places.

Discussed in this paper was the effect that equalisation (controlling the frequency response) has on speech intelligibility. Peter described a series of experiments to measure this effect as there appeared to be very little information on the subject. The experiments were carried out both in real locations and in the laboratory using both a reverberant test room and electro-acoustic simulations in order to isolate particular variables and characteristics. It was clear from the results that significant improvements in intelligibility can be achieved by appropriately equalising a sound system.

Photo 6: Workshop 2, Loudspeaker demonstration.

Angelo Farina of University of Parma presented a paper on '*Subjective evaluation of the sound quality in cars by the auralisation technique*' which was co-authored with Emanuele Ugolotti of ASK Automotive Industries. Angelo explained that the evaluation of car sound systems is usually done by means of objective measurements and by listening tests. This can take up a considerable amount of time as it involves seating the subject in the car to listen to a pre-defined music track; also the noise due to engine and tyres cannot easily be taken into account. By employing an auralisation technique it is possible to prepare sound samples for making comparative subjective tests by convolving the original music sample with the binaural impulse responses previously measured for each channel of the car sound system and adding synthesised car noises. The author described the techniques used and presented the results of tests on a range of cars.

In his paper, '*Conversion of RASTI to $\%AL_{cons}$: a robust and reversible process?*' Peter Barnett of AMS Acoustics dealt with methods of objective prediction of speech intelligibility. Peter raised a number of concerns about logical weaknesses in widely accepted methods of predicting $\%AL_{cons}$ from a knowledge of RASTI.

During the afternoon when the less dedicated folk were enjoying a bracing lake trip or a leg stretching walk on the hills, three workshops, all well attended, were being held in separate rooms in the hotel. These were concerned with

a) Room equalisation led by Peter Mapp,

b) Loudspeaker demonstration given by Mark Bailey of Arbiter Pro Audio and

c) The demonstration of a stereo dipole (close spaced loudspeaker pair) mentioned in the paper by O Kirkeby of ISVR. Photograph 6 shows the speaker demonstration (speakers covered by a fair cloth to retain their anonymity) and the stereo dipole demonstration (this picture did not capture the looks of amazement and disbelief on the face of the subject!).

During the evening Ken Dibble Acoustics invited delegates and guests to join them in celebrating their 20th anniversary. During an introductory address, Ken Dibble pointed out that his company had survived two periods of recession and were now busier than ever. Congratulations to Ken and his team.

As mentioned earlier, after the conference dinner NXT Ltd demonstrated their Distributed Mode Panel Loudspeakers.

Technical Sessions Sunday

Recording and listening environments

Philip Newell, consultant, gave a summary of his very comprehensive paper entitled '*From mono and stereo, through quadrophony to surround – a review of control room requirements and practices*', which is well worth a read, highlighting the development of recorded sound and the effects on the requirements of control rooms. The title of the paper outlines concisely the subjects covered and Philip provided a fascinating survey of the problems of compatibility between earlier recording formats and subsequent ones which had to be manufactured in parallel; for example producing a mono version of a stereo recording was not just a matter of the electrical summation of left and right channels. We were given an insight into the changing requirements of control room design as recording techniques developed from mono through to surround sound; not just the mixing desk changes but also the acoustic design of the control room which affects the monitoring process. Also considered were the different surround sound mixing requirements when moving pictures were involved. The sound level of the mix, and the appropriate balance, must relate to the picture size

and hence is different for large screen film and small screen television.

Keith Holland of ISVR spoke to '*Mutual coupling in multi-channel loudspeaker systems*', a paper which was co-authored by Philip Newell. The concept of mutual coupling between loudspeakers was defined and the complex effects of multiple loudspeakers, as in surround sound systems, discussed in relation to reverberant and non-reverberant rooms. Also considered were the problems concerning the design of control rooms; the extent to which they should be anechoic or semi-anechoic. An interesting paper which followed on naturally from the previous presentation; which is of course what the programme planners intended it to!

Before the four final papers in this session Professor Gregory gave his invited presentation which was described in the introduction to this report.

For assistance with the notes for these papers I am indebted to the Chairman, Allen Mornington-West

A paper on '*Localisation of sound with a multi-speaker reinforcement system*' was given by Robin Whittaker of Out Board Electronics Ltd. The subject was the problem occurring in theatres and concert halls where sound reinforcement from multi-speaker arrays have to provide the audience with a convincing impression that the sound is coming from where they expect it to, and this over all audience locations. The same principals can be used in other environments as diverse as council chambers and shopping centres. Of course the visual experience needs to be considered as it strongly assists the brain in the overall perceptual illusion. Conventional panning modulates the level but a significant improvement can be obtained using delays to the audio channels.

The principles are underpinned by the Haas effect. The relative loudness and the delay are interdependent. The work of Kutruff extends and confirms these principles which have been incorporated into a DSP based product TiMax which is based around the Analogue Devices SHARC DSP. TiMax is among the first audio matrix systems that makes time delay panning and therefore the use of the Haas effect possible in any distributed or surround sound system and thus can extend functionality into the production of theatrically valid effects.

Two papers, '*Optimisation of sound system design for large film mixing theatres and auditoria*' and '*Acoustic modelling of film dubbing and mixing theatres*' by Andy Munro and Amber Naqvi, both of Munro Associates, are considered together in view of their similar subject areas. The impetus for this topic arises from the observation that recordings made in a music recording studio would sound different in a sound dubbing control room. The differences are misleading and arise despite the application of high quality design principles. Further factors include the much larger size of film music dubbing rooms with consequent air loss and the effect of projecting sound through the screen. Also affecting the issue is the increasing sound power levels in use, 102 dB in any octave band being quite common, and the increasing use of high power sub-bass effects channels.

Munro Associates were commissioned to improve the sound system in a film mixing room at Shepperton Film Studios. An improvement in the frequency response flatness was obtained by using a three-way system in place of the conventional 2-way system of bass cabinet and horn loaded mid and upper range driver. This overcame the distortion problems which arise when a horn loaded driver is overdriven to produce certain sound effects. The Shepperton theatre was modelled using commercially available room acoustic software (CATT-Acoustic), based on the ray tracing method, and measurements were carried out to ensure conformance.

The design brief required joint requirements as a preview theatre as well as a sound dubbing control room. The existing superstructure was originally a sound stage and yet required a fully isolated shell in order to allow adjacent soundstages immunity from the 110 dB SPLs typical of LF effects. The guidelines for the reverberation times of the room is determined by THX and Dolby standards – for example for a room of 1000 m^3 the RT at 500 Hz should be about 400 ms. Additional design constraints included the need to work with MPEG 5.1, Dolby AC3 surround sound formats.

The modelling was stabilised and the RTs calculated after suitable absorptive materials had been incorporated into the model. The MLSSA measured results agreed within 10%. There is agreement here that the centre loudspeaker performance is very important. (For confirmation of this point the reader could refer to Keith Holland's paper reviewed above).

Angelo Farina of the University of Parma, speaking to a paper '*Spatial equalisation of sound systems in cars by digital inverse filtering*', co-authored by E Ugolotti, explained the particular problems of listening to sound within a car. Firstly the environment is 'strange' and the listener cannot be optimally placed between the loudspeakers. The target is to devise an equalisation which will use DSP and inverse filters to make it possible move the virtual position of the sound sources. The frequency response equalisation can be achieved by the Mourjopoulos least squares approach and this overcomes the problem of being in a car and provides the illusion of being in a much larger space. As a challenge to test the system the 'ideal' impulse responses of two listening environments were measured; in the stalls of La Scala, Milan and in a hemi-anechoic test room. These responses were convolved with the responses of a dummy head placed in the target motor car. Subjective tests showed that for La Scala the equalisation assisted the appreciation of the sound but that the hemi-anechoic room was not so easily improved. The work will continue with trying to use filtering to improve the basic performance of the system.

After due thanks were given to the presenters, the organisers of the conference and the workshops, to the staff of the IOA office, to the exhibitors and to the staff of the Hydro Hotel for their usual high standards of service and catering, the 13th Reproduced Sound conference came to an end. We look forward to Reproduced Sound 14.

John W Tyler FIOA

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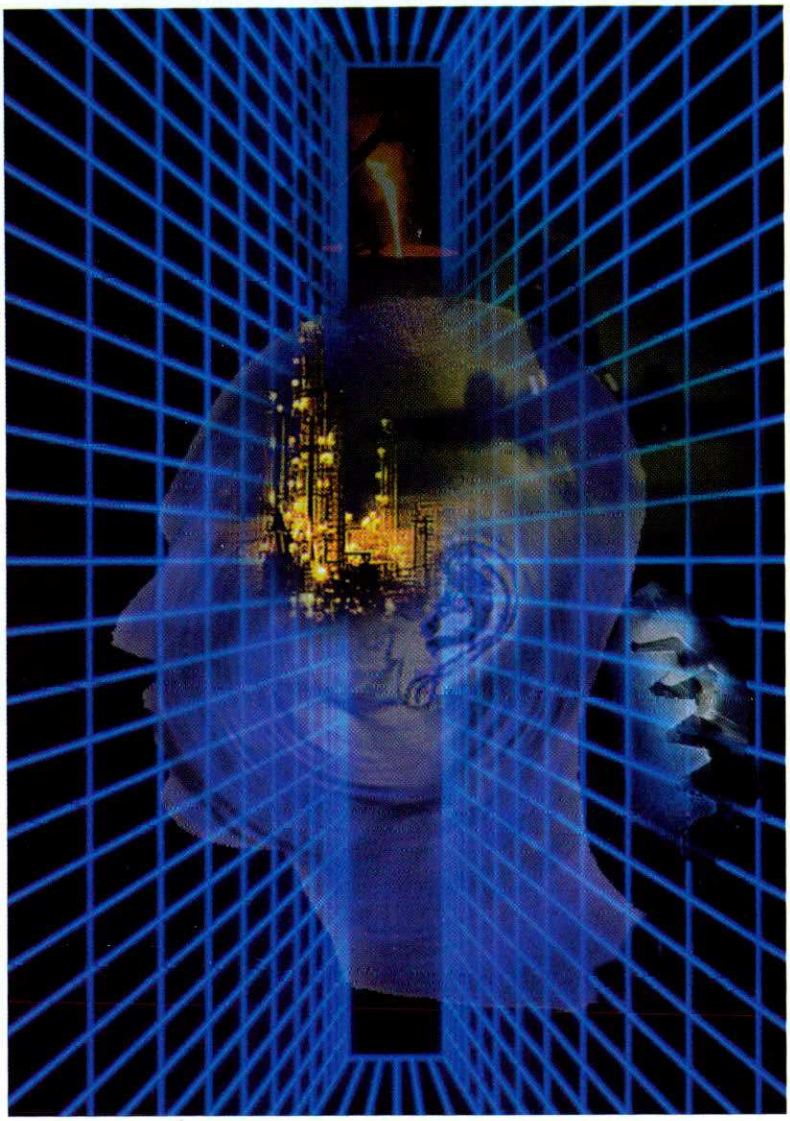

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Branch News

Irish Branch

Inaugural Meeting

The inaugural meeting of the Irish Branch of the Institute was held on 10th October 1997 at Belfast Institute of Further and Higher Education. It was most encouraging to have a large attendance of about 50 from all parts of Ireland, some travelling over 200 miles to be present. Dr Paddy Murphy, Director of the Belfast Institute, extended a very warm welcome to all those attending.

The meeting was chaired by Dr Gerry McCullagh, known to many members of the Institute, who has played a major role in encouraging and organising the establishment of an Irish Branch of the IOA. Gerry had brought together the ad-hoc steering group consisting of Kevin Chambers (Belfast Institute), Oliver Hetherington (University of Ulster), Robin Mark (F R Mark & Associates) and Ivan Gregg (Belfast City Council), which undertook the responsibility of organising and publicising the meeting.

Presentations were made by two speakers – Robin Mark and the President of the Institute, Bernard Berry. Robin, besides serving on the Steering Group, is a well known local singer, musician and acoustic consultant. His talk on *Modern Myths and Mysteries of Acoustics* demonstrated not only his in-depth knowledge and experience of acoustics but also his ability to entertain an audience.

This was followed by Bernard's presentation on *Acoustical Reflections from the NPL: from Lord Rayleigh to the Internet* which, supported by a very impressive slide presentation, highlighted both the work of the NPL from its creation almost 70 years ago and the important contribution that it has made in the development of acoustic standards in the UK and abroad. His talk finished by looking to the future and the acoustic challenges that lie ahead.

After the presentations, a general discussion regarding the formation of an Irish Branch was held under the auspices of Dr Bob Peters (Vice-President, Groups and Branches). On the proposal by Oliver Hetherington, seconded by Gary Duffy, members unanimously agreed to form a Branch and to supplement the ad-hoc group with two members from the South of Ireland, so ensuring an all Ireland representation. Gary Duffy (Brüel & Kjær) and Frank Clinton (Environmental Protection Agency) were duly nominated and elected.

The Steering Committee was empowered both to organise an AGM early in 1998 and to arrange an initial programme of professional and social activities. Branch Committee appointments will be made by members at this first AGM.

Before the meeting closed, Kevin Chambers proposed a vote of thanks to the speakers, the caterers and sponsors, Dr Murphy and the Belfast Institute and indeed, to to all those who had contributed to the success of the evening.

Ivan Gregg MIOA

Irish Branch Inaugural Meeting: Standing, from left, Gerry McCullagh, Oliver Heatherington, Gary Duffy, Kevin Chambers, Ivan Gregg. Sitting: Bob Peters, Bernard Berry

North West Branch

Joint Meeting

A joint meeting was held between the IOA and United Kingdom Environmental Law Association on 1st May 1997.

The speakers were Peter Hepworth of Hepworth Acoustics, Warrington, and Andrew Gilbart QC of Kings Street Chambers, Manchester and they were introduced by Peter Sacre, Chairman of the North West Branch.

Covering the consultant's angle Peter used the example of a hypothetical new 24 hour operation factory to be built by dwellings and a railway line. He dealt with the measurement of the existing noise climate, prediction of future levels, choice of assessment criteria, and if noise levels were found to be excessive what remedial measures were available.

Peter's preference was for agreement with the local authority, where acceptable, from initial work through to and including any public inquiry.

As a witness it was important to examine areas of disagreement and provide a reasoned rebuttal. Comments should be concise, kept to proof, and be as simple as possible for the ben-

efit of non-technical people.

Andrew commenced his contribution with three fundamental rules for a witness and these were to avoid advocacy; to adhere to professionally held views and to express views in the context of the proceedings.

Evidence, he argued, must be presented in such a way as to explain its meaning clearly to the tribunal – there was indeed 'a mission to explain'. In giving evidence it was important to address all relevant considerations, including those that have a negative impact on the case being presented. This would avoid an evasive or forgetful appearance under cross-examination.

Andrew stressed that detail was important and that it can win cases, particularly at planning inquiries and particularly in acoustic evidence. If comprehensive, it can help avoid embarrassment over disputed data and means that arguments can be about principles and impact. Findings backed with sound data were very hard for advocates to break down. The ground rules for giving evidence were covered with the two contributors being in agreement that it was useful to agree elements where possible. Andrew went on to offer some hints about how to survive cross-examination and comments on the problems of re-examination.

Both speakers gave interesting and helpful talks. The venue and an excellent buffet were kindly provided yet again by the Building Design Partnership.

Paul Michel MIOA

Evening Meeting

Rupert Taylor addressed members of the North West Branch at their evening meeting on 24 September 1997. The meeting was very well attended and was kindly hosted by BDP Acoustics at Sunlight House, Manchester.

The topic selected for the talk was The Application of PPG 24 (Planning Policy Guidance Note 24), a topic on which Rupert was well qualified to speak as he had conducted a research project on behalf of the then Department of the Environment on that subject.

He expressed some concern that although his report was submitted some 12 months ago, due to changes in personnel at the Department, there appears to have been no action thus far on his recommendations. As part of his research he had contacted all local authorities in the country and received responses from 40% of them, which was considered a surprisingly high rate of return.

He refreshed our memories on the main sections of PPG 24 and pointed out the criticisms and the areas that he considered in need of clarification. These included such issues as whether or not account should be taken of barriers and whether assessments can be made on the basis of predicted noise levels.

His best advice was to read the guidance carefully to determine what it actually says rather than what it is thought to say.

Paul Freeborn FIOA

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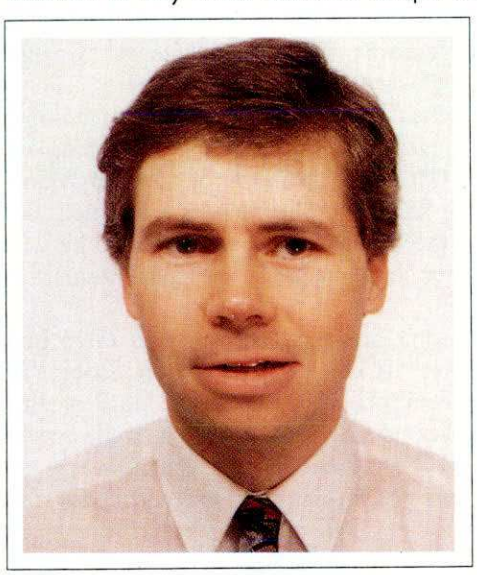
CITATIONS

1996 Tyndall Medal

Dr Simon N Chandler-Wilde MIOA

Simon graduated in mathematics from Imperial College and, after studying for a MSc in Engineering Mathematics at the University of Newcastle, carried out research for his PhD at the University of Bradford. During this period he became interested in the use of the boundary integral equation method to solve the problem of propagation over multi-impedance planes. He introduced several new approximations which improved the efficiency of the method and allowed its application to long distance propagation. Practical predictions were produced for the propagation of noise from traffic streams. Following a brief period at Coventry Polytechnic, Simon was appointed as lecturer at the University of Bradford. Here he began to develop the boundary element method for a study of the effects of outdoor noise barriers, a robust code was produced which allowed the propagation over barriers of any cross sectional shape and surface cover to be studied. With co-workers, many practical configurations have been considered including T-shaped barriers, absorbing barriers, multiple-edge barriers, parallel noise barriers and propagation from cuttings. He is a co-inventor of a patented multiple-edge barrier design. The codes have been used extensively by the Transport Research Laboratory to investigate barrier designs prior to full scale testing. Simon moved to Brunel University in 1994 where he is presently a Senior Lecturer in the Department of Mathematics and Statistics.



In collaboration with researchers at the Open University, Simon was able to use the boundary integral equation method to describe scattering by an obstacle buried in a porous half-space. He is currently extending the boundary integral equation method to model sound propagation in city streets.

In support of these activities, Simon has undertaken various mathematical studies including the numerical analysis of boundary element methods and the development of efficient approaches for computing the fundamental solutions essential for the implementation of these methods. He has also used novel techniques, based on integral equation formulations and functional analysis, for investigating the behaviour in the far-field of many previously intractable acoustical problems. He has carried out fundamental studies, including important new uniqueness existence results, of the mathematical formulation of problems of scattering by effectively infinite surfaces.

Recently, he has shown that for a sound-soft finite or infinite obstacle in a lossy medium the reflected wave from a single incident plane wave contains enough information to recover the shape of the obstacle. He has also found that for single plane wave reflection at a homogeneous impedance plane, arbitrarily small perturbations in surface impedance can cause large perturbations in the reflected wave at distances from the plane which are large in comparison to the wavelength.

Simon's work is recognised world-wide. Several institutions in the UK and abroad have acquired his numerical models and he has currently active research collaborations with various institutions overseas, in particular the universities of Karlsruhe, Gottingen and Erlangen-Nurnberg. His research has been continuously supported by research council funding and he has in excess of 50 research publications.

In his work Simon has shown a fertile balance between research in fundamentals of acoustics and the production of robust numerical models which enable practical problems to be considered.

The Institute of Acoustics is pleased to award the Tyndall Medal for 1996 to Dr Simon Chandler-Wilde for his outstanding contributions to the development and implementation of numerical methods for the modelling of sound propagation.

1997 Rayleigh Medal

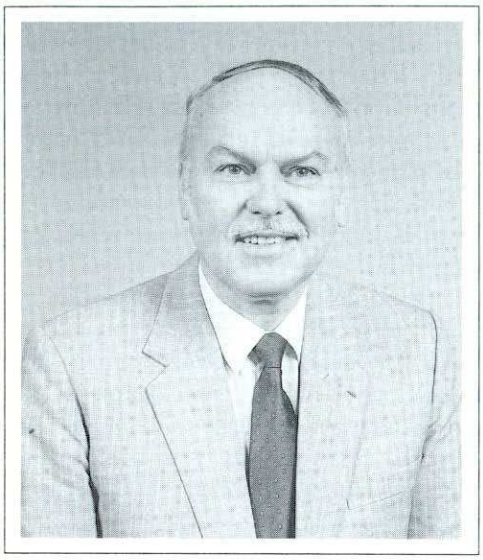
Professor Leif Bjørnø MIOA

Leif Bjørnø received his MSc in Mechanical Engineering from the Technical University of Denmark in 1962. Then followed a two year period of national service in the Royal Danish Navy, when he carried out research into the protection of ships from underwater explosions. After this he returned to the Technical University of Denmark to undertake research in fluid mechanics/acoustics for his PhD which was awarded in 1967.

From 1967 to 1969 Leif was Assistant Professor of Fluid Mechanics at the University where he continued his research in underwater acoustics, underwater shock waves and ultrasonics, extending his interests into transducer developments and oceanography. In 1969/70, he was appointed Visiting Professor to the Physical Acoustics Group headed by Dr R W Stephens at Imperial College of Science and Technology, London, where he carried out research in acoustical waveguides and taught underwater acoustics and finite amplitude waves in liquids. He was awarded the Diploma of the Imperial College in Physics – Acoustics in 1971.

Back at the Technical University of Denmark in 1970, the now Associate Professor Bjørnø became Head of the Physical Acoustics Research Group where his research interests were in nonlinear acoustics, parametric acoustic arrays, underwater transducers, the study of the acous-

tical qualities of seabed materials, high power ultrasonics and biomechanics. His teaching duties covered acoustics, fluid dynamics and boundary layer theory. During this period Professor Bjørnø had visiting appointments at the University of Cape Town, South Africa, where he researched parametric acoustic arrays in shallow water,



and at the University of Texas at Austin, USA, where he participated in research studies of sound propagation in deep water.

In 1978, Leif was appointed Professor of Industrial Acoustics at the Technical University of Denmark, and from 1984 Head of the Department of Industrial Acoustics. From then to the present, his already established research and development interests in the field of underwater acoustics were continued and expanded to also include flow noise, ambient noise in the sea, sound propagation modelling, underwater communication, acoustic wave propagation in inhomogeneous media, scattering and absorption, shallow water acoustics, noise and vibration in ships, ocean engineering, rain induced noise in the sea and synthetic aperture sonar. His other research subjects included high power ultrasonics, nonlinear acoustics, focused ultrasonic fields, transducers and arrays, robotics and biomechanics. Whilst managing the Department's extensive research programme, Professor Bjørnø has also continued to teach theoretical, underwater and nonlinear acoustics, and high power ultrasonics.

Over the years, Professor Bjørnø has lectured at Universities and Research Institutes around the World; he has supervised more than 40 PhD students and published over 300 papers in national and international journals, books and conference proceedings. He has been active on the editorial boards of a variety of scientific journals, and acted as reviewer and referee for journals and NATO Science Committees. He has been appointed to numerous national and international research and advisory committees, as well as programme committees for several congresses and conferences including the Presidency of the 3rd World Congress on Ultrasonics to be held in Copenhagen in 1999. Professor Bjørnø has devoted much of his time and efforts to international scientific co-operation, leading to more than 20 European Union funded research and development projects. Leif has maintained his connection with the Royal Danish Navy having been their consultant since 1970, and currently he is also Chairman of six industrial companies and a Director of two others.

Professor Bjørnø has been honoured as a Knight of the Order of Dannebrog, and has received an Honorary Doctorate and Professorship from Universities in China and Greece. He is a Member of the Danish Academy of Technical Sciences, of the New York Academy of Sciences and of Sigma Xi. He is a Fellow of the Acoustical Society of America, of the Institute of Acoustics, of the South African Acoustical Institute and of the Institute of Electronic and Electrical Engineers, and a Member of several other professional bodies. He was the Institute's R W B Stephens Lecturer in 1985 and was awarded the Foreign Acoustician Medal by the French Acoustical Society in 1995.

The Institute of Acoustics is pleased to award the Rayleigh Medal in 1997 to Professor Leif Bjørnø for distinguished academic and professional contributions to the discipline of acoustics.

1997 R W B Stephens Medal

Eur Ing Prof Robert C Chivers FIOA

Robert Chivers graduated in Physics from Exeter College, Oxford University, in 1969 and received his MA in 1973. He was awarded a PhD in Radiation Biology in 1973 following research at the Institute of Cancer Research, London University.

In 1973 he worked at the Institute of Ophthalmology, London University, with the responsibility for setting up and running the Ultrasonic Holography Unit at Moorfields Eye Hospital. Following this, he was appointed Lecturer in Physics at the University of Surrey, where he was promoted to Senior Lecturer in 1987 and Reader in 1993.

He retired from the University of Surrey in 1996 and is currently occupied as a Visiting Research Scholar at the University of Cambridge and as a Visiting Professor at the Institute of Sound and Vibration Research, Southampton.

Professor Chivers has taught both undergraduate and postgraduate students. At undergraduate level the subjects have included classical physics, an electroacoustics laboratory course for Tonmeister students and medical physics for nursing degree students. His postgraduate teaching has covered medical ultrasonics, environmental noise and wave propagation. During 1984 – 85 he was appointed Visiting Professor in Theoretical and Applied Mechanics

at Cornell University USA, where he taught dynamics, experimental mechanics and elastic wave propagation. Over the last twenty five years Professor Chivers has had many other Honorary and Visiting Appointments, most of which were at overseas Universities and Institutes, and has been an external examiner for numerous Universities.

Professor Chivers' novel teaching methods have included tape and slide programmes in medical ultrasonics, a book on audio visual aids in medical physics and the use of the Socratic method for science teaching which received a commendation in the UK 1992 Partnership Awards for innovation in undergraduate education.

Professor Chivers has been involved in a wide range of acoustics research, including physical acoustics, ultrasonics, underwater acoustics, musical acoustics, and perceptual acoustics. His core research interests have been the interaction of ultrasonic waves with inhomogeneous media and the behaviour of ultrasonic transducers, involving both theoretical and experimental work. As a result of this work over 250 papers have been published, 3 patents granted, and 32 MSc and 11 PhD students have been supervised. Professor Chivers was himself awarded a DSc by London University in 1992. For his work in underwater acoustics, Professor Chivers received the Medal in the name of the Heroes of Westerplatte from the Polish Naval Academy in 1995.

In addition to his teaching and research work, Professor Chivers has been appointed as a technical consultant by various British and overseas organisations, is a Fellow or Member of numerous professional and learned societies, has participated in committee work for national and international bodies including the Presidency of the Federation of the Acoustical Societies of Europe (1995 – 97), and has been an active member of the editorial boards of several scientific journals.

Although he never worked with Dr R W B Stephens, Professor Chivers has other connections with Dr Stephens. He succeeded Dr Stephens as the English Editor of Acustica, as the Institute's representative on the British National Committee for Non Destructive Testing and as the Institute of Physics' representative on the British Standards Institution Committee EPC/1 Acoustics. He presented the Institute's R W B Stephens Lecture in 1991, and has collected together and commenced the collation of Dr Stephens' papers which it is intended to incorporate into the Institute's library. He and Dr Stephens share the distinction of being the only British citizens to have been awarded Honorary Membership of the Polish Acoustical Society.

The Institute of Acoustics is pleased to award the inaugural R W B Stephens Medal to Professor Robert Chivers for his outstanding contribution to research and education in the field of acoustics. ❖

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The meeting will also be followed in the afternoon by the AGM of the IOA Speech Group. This will be an important meeting to determine the future course of the Group and all are encouraged to attend.

If you would like to present the work of your group/establishment at the meeting, please contact the organiser by DECEMBER 31st:

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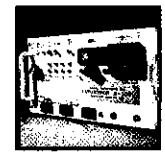

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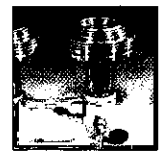

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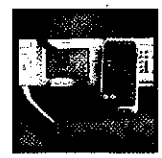

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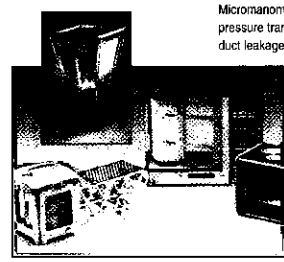

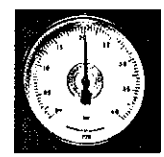

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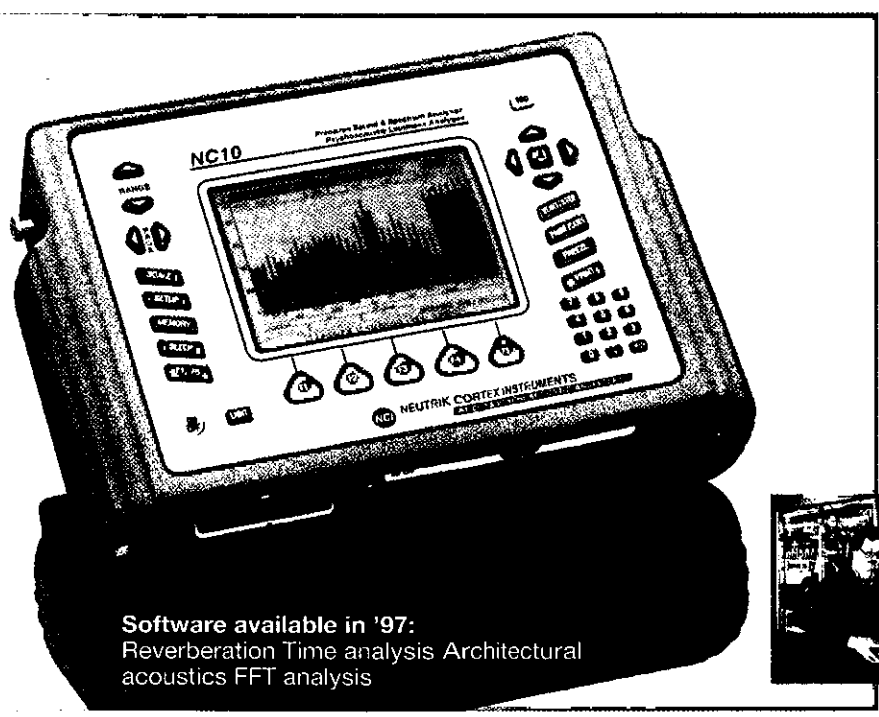

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Aircraft Noise (South-west London)

Mr Tony Colman (Putney): Mr Deputy Speaker, I know that this Adjournment debate is about a subject close to your heart, as you have an interest in Stansted airport. I look forward to hearing the Minister for Transport in London respond to the debate, clarifying Government policy in this area.

I have spent much of the past three years espousing the cause of sustainable development as set out in the Rio treaty. I was particularly pleased to see that the consultation paper for the Greater London authority defines the key function as: 'sustainable development, giving all Londoners an improved and lasting quality of life, combining environmental, economic and social goals'.

I read under the proposals for an integrated transport strategy for London that there is a need for action 'to take forward London-wide measures to reduce air traffic pollution.'

In that context, I speak tonight on behalf of my constituents and all those who suffer noise pollution both in south-west London and on the approaches to Heathrow. There are now more than 1,200 flights a day into Heathrow and, despite efforts such as runway alternation – which I applaud – many of those flights bear down in a cone of appalling noise across swathes of central Putney, Sheen, Richmond, Isleworth, Hounslow and on into the airport. When the northern runway is used, Fulham, Barnes, Kew, Brentford and Hounslow are affected.

Two years ago, the hon Member for Windsor (Mr Trend) told the House that the aircraft instrument landing system required a precise line of approach, which was undeviating in the hardship that it delivered to residents below. The microwave landing system, which offers a variation of approach, has still not been advanced in the two years since the previous debate. Thus, there has been no improvement. There are noise limits only for departing aircraft and not for incoming aircraft – an oversight which has prevailed for years, despite assurances about a change.

Night flights continue to plague the sleep of the people of Putney and elsewhere. Why have such flights not been banned? In respect of the last consultation, a constituent wrote:

'Our three-year-old son comes into our bedroom at 4 am terrified by the noise of the large jets screaming overhead in the middle of the quiet night.'

Another constituent counted 39 aircraft coming in over his house between 4.30 am and 8 am on a Sunday – when Sunday restrictions should have made that impossible.

Why cannot the departure times of flights from the far East be rescheduled so that they arrive at Heathrow at a suitable time?

Putney suffers doubly as it is also under the flight path for helicopters that use the Battersea heliport. Routes H10, H3 and H7 converge over Putney common, and thus all helicopters from the north, west and south fly over Putney and Fulham at very low levels. The noise can be excruciating. I of course exclude the need for helicopters to bring badly injured patients to Queen Mary's university hospital regional burns unit, a unit that I am fighting to retain at that hospital.

It is widely accepted that one way to reduce aircraft noise is to limit that noise at source. International agreement is essential, and I welcome the International Civil Aviation Organisation's phasing out of the noisier chapter 2 aircraft by 2002. I also welcome the checks instituted by the Civil Aviation Authority, leading to the grounding of aircraft if they do not meet the necessary standards.

As the Minister is aware, Cranfield University in Bedford recently undertook a series of experiments on a digital, pneumatic actuator, and I am pleased that the Department of Trade and Industry, British Airways and the British Airports Authority are working together in sponsoring the device that claims to eliminate most noise. Aircraft construction companies will need to adapt aircraft engines to control carbon dioxide emissions to ensure that the Kyoto agreements against global warming are not breached. It is important that noise pollution is tackled at the same time as air pollution is dealt with. Developments such as that which I have outlined are the way forward for an innovative Britain, finding solutions to problems.

This debate is particularly urgent because of the events of 16 October. On that day, Miss Elizabeth Duthie of the aviation environmental division of the Department of the Environment, Transport and the Regions told the terminal 5 planning inquiry: 'Government now believes that a continuing improvement (in aircraft noise) cannot be guaranteed indefinitely' – a statement that appears to signify a change to the previous policy, which was 'to do

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everything possible to ensure that the noise climate improves.'

Alarm has spread through west London, especially as the inspector for the terminal 5 planning inquiry – Roy Vandemeer – believes that the Government have moved the goal posts. That will materially affect his work on the inquiry.

In July, Miss Duthie said: 'night flights cause negligible sleep disturbance'. I invite my hon Friend the Minister to spend the night at the home of one of my constituents in Putney to discover how wrong that statement is.

We thus have a catalogue of woe, and an environmental and social disaster. Of course, there are economic gains in employment and wealth creation, thanks to the superb success of BAA and Heathrow Airport Ltd and the many airlines and companies involved with the workings of the airport. Heathrow is the stepping stone to Europe for the rest of the world and is a world-class industry in its own right. I am not suggesting anything that would harm that success story but, in the spirit of local Agenda 21, for which I lead in London, all the stakeholders – businesses, local government and local people – need to plan for the sustainable development of the airport. That must mean that the social and environmental damage currently inflicted must be reduced.

The need to work with the community is doubly important with the terminal 5 inquiry. Local people and I see terminal 5 as an environmental disaster, yet business states that it is essential for the continued pre-eminence of Heathrow. The battle line has been drawn up for three years – the Minister will have to decide, although I am not expecting her to express a view this evening.

My hon Friend the Member for Hayes and Harlington (Mr McDonnell) has passed to me the response of his local residents association to the consultation by the Department of the Environment, Transport and the Regions on the integrated transport policy. The association puts forward the concept of airport environmental limits. I commend the document as a way forward which will enable BAA and local residents associations to sit down and work out, within the framework of the Greater London authority, a future for Heathrow.

The hon Members for Windsor and for Richmond Park (Dr Tonge) have asked to be allowed to intervene to support my argument. I have agreed that they should do so to emphasise the cross-party concern about the matters that I have outlined.

I ask the Minister to come to the rescue of the people of Putney and of all those suffering from aircraft noise on the Heathrow flight path by agreeing to the following points.

First, let the people decide about noise limits. In my response to the Greater London authority consultation, I strongly recommend that the authority and the mayor, not the Government, should decide about noise limits, just as they will decide about other London transport issues. The United States Government do not make decisions about JFK airport in New York; local government does. That is also the case for noise controls for all other United Kingdom airports, except Gatwick and Stansted. Only the mayor of London can bring together all the stakeholders involved. I look forward to the new consultation period on noise limits. I shall recommend stiff limits from 1998.

Secondly, let there be noise limits on incoming as well as departing aircraft and proper fines for miscreants, not the £500 fine currently levied.

Thirdly, let there be a ban on night flights between 11.30 pm and 6 am. That works elsewhere, so why not here? Consultation is due to start shortly. I ask that that should be an option that the people can vote on.

Fourthly, let controls cover all aircraft – small as well as large – including helicopters. Often smaller aircraft – and certainly helicopters – are noisier and fly lower.

Fifthly, I commend the Cranfield research project into noise reductions in aircraft engines. Noise pollution should be discussed together with air pollution controls at Kyoto. It is a worldwide problem.

Sixthly, let there be an unequivocal statement this evening that the Government are determined to reduce noise pollution on the Heathrow approaches, repudiating the views expressed by Elizabeth Duthie of the aviation environmental division. Let there be a target for reductions between now and 2010.

I was proud to be at the United Nations on 23 June to hear the Prime Minister make such a strong commitment to sustainable development and to a 20 per cent cut in carbon dioxide emissions by 2010. The people of south-west London want a similar commitment on aircraft noise. They have suffered long enough.

Mr Michael Trend (Windsor): I am grateful to the hon Member for Putney (Mr Colman) for allowing me to add briefly to his remarks. I agree that landing rather than take-off is now the significant problem. Unlike those living in west London, those who live in my constituency to the west of the airport have no alternation of runways. When the misery occurs, it is constant rather than infrequent.

The hon Gentleman put the case for a ban on night flights very well for his constituents and I agree most strongly with him on that. I have said this before in the House and I shall go on saying it until the Government listen; it is essential that my constituents get the good night's sleep to which they are entitled. That can be achieved in Windsor only if there is a total ban on night flights. As the hon Gentleman has said, that is done in other parts of the world. It is high time it is done here.

Dr Jenny Tonge (Richmond Park): I thank the hon Member for Putney (Mr Colman) for allowing me to speak. I am interested in the effects of noise on health. I live in my Richmond Park constituency, where we have had an escalating noise problem over the past 20 years. I am particularly concerned about health issues because I was a doctor in the health service before my election to Parliament.

There is an enormous, accumulating mountain of evidence on the effects of noise on people's health. Evidence on noise is being given to the terminal 5 inquiry. Paper after paper has shown how people suffer sleep deprivation because of aircraft noise – which has already been mentioned and how people with mental health problems or heart problems are badly affected by aircraft noise. Their conditions may not be caused by aircraft noise, but

they can be made significantly worse by it.
There has been a recent survey of attainment levels, particularly in terms of the reading ages of children living around large airports, which was initiated by people in Frankfurt. When it was planned to build a new airport, the people there decided to test a large cohort of several hundred children to find out what their reading age was while the old airport was in operation. They found that the reading age of those children was six months below average. The people involved had the good sense, once the airport had moved to its new site, to retest the same group of children and they discovered that their reading ages had returned to normal within a year of the noise being removed.
As well as affecting the population's health, aircraft noise affects the attainment of children in our schools, and the problem could get worse. I have been in schools in my constituency where, in the course of a lesson, teachers have repeatedly had to stop completely while an aircraft has gone overhead. The lesson is disrupted until the noise subsides.
I do not suggest that the problem is overwhelming at the moment. Twenty years ago, however, we doubted the evidence that was emerging on the link between smoking and lung cancer. That is how medical evidence emerges. The evidence that is emerging on the effects of noise on health and on children's attainment in schools around airports is at a similar stage to the evidence on smoking and lung cancer 20 years ago. We do not want in 20 years time to have gone down that road and to have discovered that aircraft noise really is dangerous and that we should have acted earlier.
I urge the Government to look seriously into the problem and to take measures, as the hon Member for Putney suggested, to do something about the problem before it is too late.
The Minister for Transport in London (Ms Glenda Jackson): I congratulate my hon Friend the Member for Putney (Mr Colman) on obtaining this Adjournment debate and on affording the House the opportunity to discuss the important issue of aircraft noise around Heathrow. I also congratulate him on his generosity in affording time to the hon Members for Windsor (Mr Trend) and for Richmond Park (Dr Tonge) for them to present cogently, albeit briefly, their concerns on behalf of their constituents.
As my hon Friend the Member for Putney acknowledged, Heathrow airport is an important national and European asset. It is the largest international airport in the world and in 1996, it handled almost 56 million passengers and 1 million tonnes of freight. In terms of value of trade handled, it is Britain's largest port. It is no less important to the local economy, providing 50,000 direct jobs and a further 26,000 in support services. It contributes directly to the prosperity of west London, which includes my hon Friend's famous and historic constituency, and to the prosperity of neighbouring counties.
The airport also has a major environmental impact on the surrounding areas and on those living under its principal arrival and departure routes, an impact most of us tend to overlook when we go on holiday or travel abroad on business. The main impact comes from aircraft noise and the Government acknowledge that it is a cause of annoyance to many people and of more serious concern – indeed, distress – to some.
The Government intend to tackle aircraft noise in two ways. First, we will seek further reductions in noise at source through international negotiation and agreement. Secondly, we will set a framework for the control and mitigation of operational noise around airports.
The Government will do everything practicable to ensure that the noise climate around Heathrow continues to improve. There has been a substantial improvement in the noise climate around the airport over the past two decades and the improvement is expected to continue for the remaining years of the phase-out of chapter 2 aircraft. The noise climate thereafter is now expected to be much more favourable than was expected before the phase-out was agreed in 1990. As I hope all hon Members will agree, that was a real achievement.
This success makes the securing of further improvement all the more challenging. After chapter 2 phase-out, we cannot be sure of achieving continuing improvements year on year, every year. However, the Government are determined to take all practicable steps to prevent a deterioration in the noise climate around the airport after the phase-out of chapter 2 aircraft is completed. Indeed, I restate our policy that we will continue our efforts to do everything practicable to improve the noise climate over time. In giving that assurance to the communities around Heathrow, the Government recognise that additional regulatory measures may become necessary to achieve the target.

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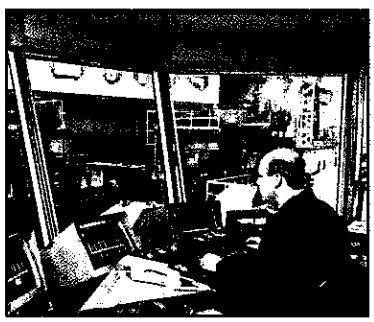

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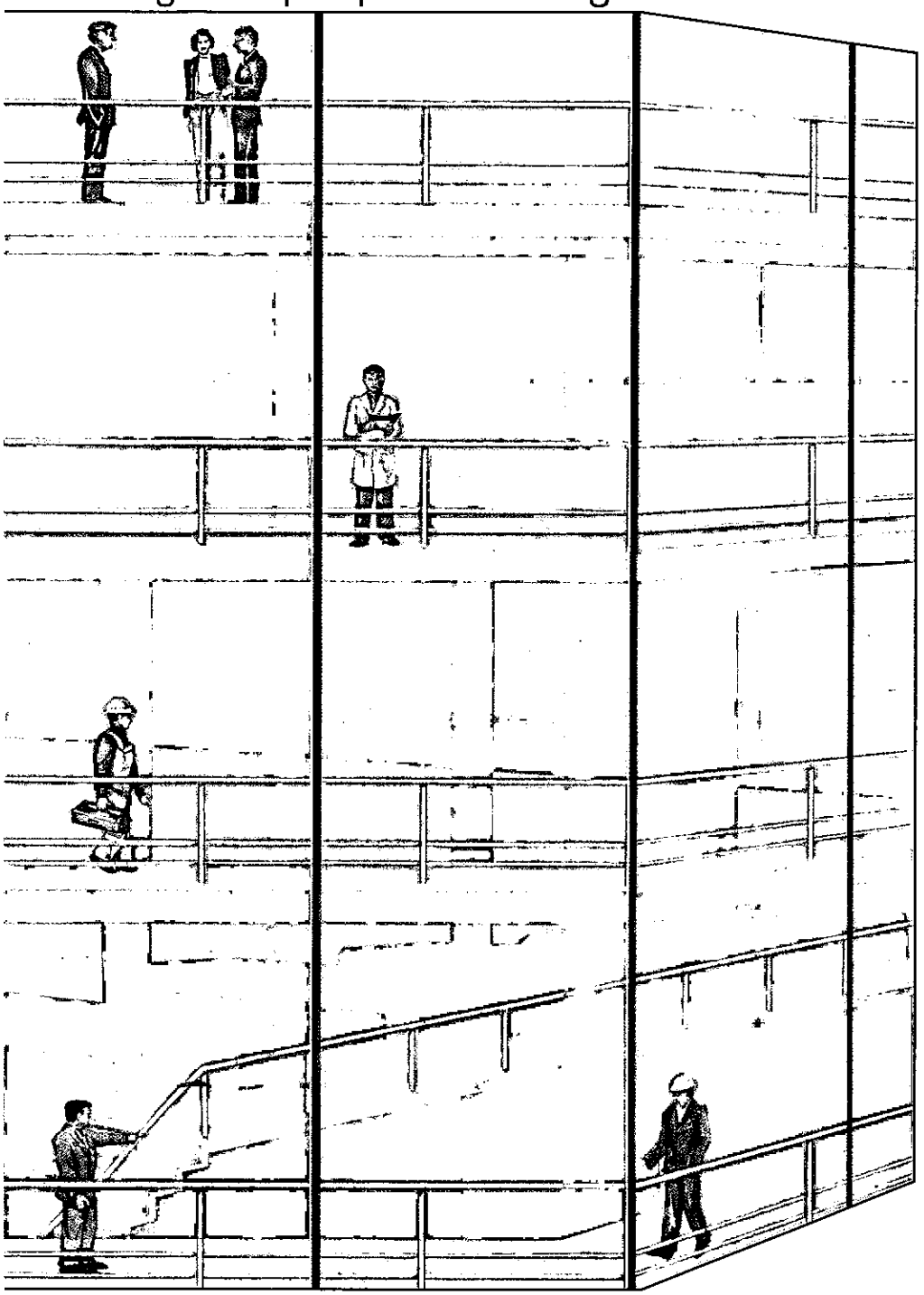

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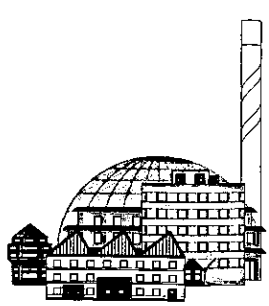

In the longer term, we can expect further improvements from the retirement of Concorde and from incremental improvements in technology which together should more than offset the trend to larger aircraft.

Our aim, like that of successive Governments since the impact of aircraft noise became a cause for concern, is to strike a balance between the considerable economic benefits of the airport and the effect on the communities around it.

It is widely recognised that many factors other than the level of noise itself influence sensitivity to aircraft noise. For my hon Friend's constituents, the alignment of Heathrow's two main runways means that during westerly operations, which occur for about 70 to 75 per cent of the time in an average year, they are overflown by landing aircraft on final approach.

Increasingly there are claims that the noise of landing aircraft is worse than the noise of aircraft taking off – a point made cogently by my hon Friend. Undoubtedly, greater strides have been made in reducing takeoff noise. Those who live in the south of my hon Friend's constituency would probably say that take-off noise remained the bigger problem. Aircraft taking off use considerably more power than those landing, but because modern aircraft generally climb more quickly than earlier generations of jet aircraft, their noise is now attenuated more quickly by altitude. Also, because there are more take-off routes, the number of aircraft flying each one is fewer. For people living under the arrival routes, by contrast, the steady succession of aircraft flying over them may contribute to their annoyance.

For technical and safety reasons, aircraft usually take-off and land into the wind. At Heathrow, because the prevailing winds are from the south west, the airport must operate in a westerly direction for most of the time. Furthermore, landing aircraft have to be aligned with the runway and are usually established on the instrument landing system by about nine miles from touchdown. They will usually have descended to an altitude of about 2,500 ft by this point.

The distance of nine miles from touchdown means that most landing aircraft using the southern runway have to overfly my hon Friend's constituents. When the airport is busy, which it is for much of the day, aircraft will often join the ILS further east over Battersea, Brixton or Lewisham. When the northern runway is in use, landing aircraft will join that ILS from anywhere between Barnes and Greenwich. What cannot be varied is the final approach track of landing aircraft, which must be aligned with the centre line of the landing runway. A curved final approach is not possible.

For a long time, Heathrow has operated a system of westerly preference. The system has been in place since 1962 and is primarily a noise mitigation measure. Its purpose is to reduce the number of aircraft taking off to the east over west London, and so the numbers of people affected by take-off noise are reduced.

Historically, take-off noise has been the greater concern, but because of the improving climb performance of modern aircraft, the system of westerly preference is kept under review. The Heathrow Airport Consultative Committee and Heathrow Airport Ltd carried out their own evaluation of westerly preference last year and their findings indicated that it continues to have the overall beneficial effect of reducing the numbers of people living within the 57 dB(A) L_{eq} noise contour. This noise contour is the one widely accepted as being closely correlated with the onset of community annoyance from aircraft noise during the day. Aircraft taking off from Heathrow are required to follow noise preferential routes. They were designed as far as possible to avoid the most populated areas. Pilots are required to follow NPRs until they reach an altitude of 4,000 ft. The one NPR routed over my hon Friend's constituency passes to the south and is used during easterly operations only. That is for about 25 per cent of the time during an average year. Track-keeping by pilots using that route is of a high standard.

Comparable fixed routes for landing aircraft are not possible before aircraft join the ILS and align themselves with the runway. That is because air-traffic controllers require operational flexibility in order to maintain safe separation between landing aircraft. As a result, landing aircraft follow a wide swathe of tracks which are determined tactically by air-traffic controllers until each aircraft joins the ILS for the runway in use. They must then follow the international standard rate of descent of 3 deg to touchdown. The resulting concentration of landing traffic on final approach over the last eight to 13 miles to touchdown is unavoidable. My hon Friend referred to MLS the microwave landing system. Even if that is intro-

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duced in the future and replaces ILS, it is not expected to change the requirement.
Wherever practicable, pilots are required to apply noise-reduction procedures known as continuous descent approach and low power, low drag. The aim is to keep the aircraft in a clean configuration for as long as possible to reduce the amount of noise reaching the ground. That means not lowering the undercarriage or using flaps until absolutely necessary and maintaining engine power at low levels consistent with safety.
During day-time operations, aircraft join the final approach glide slope at a minimum altitude of 2,500 ft about eight to nine miles from touchdown. As I said, that is a minimum joining point. During busy periods, aircraft will join further east at higher altitudes. There is a trial in progress, which was started approximately two years ago, whereby aircraft are required to join two to three miles further east at not less than 3,000 ft between 4 am and 6 am in the morning. The purpose is to reduce disturbance from early morning arrivals by having them join the ILS glidepath at a higher altitude. The procedure should benefit not only my hon Friend's constituents but those of the hon Members for Windsor and for Richmond Park. I however recognise that it has less support from other communities. An assessment of the trial is under way.
Runway alternation during westerly operations has been operated at Heathrow during the day between 7 am and 11 pm since 1972. One runway is used until 3 pm each day when landing traffic is switched to the other runway. The runway used also alternates on a weekly basis so that communities in west London benefit on alternate weeks from quiet periods in the evenings. It benefits most those who live under the last eight miles of the approach tracks.
Runway alternation was not extended into the night period in the 1970s in order primarily to provide opportunities for essential maintenance of the runways and associated equipment such as the ILS. A second trial of night-time runway alternation has however been running for some months and was provisionally brought to a close on Sunday 26 October. The results of the trial and the associated local opinion surveys are about to be evaluated – initially by the Heathrow Airport consultative committee and Heathrow Airport Ltd, who jointly initiated the first trial last winter. I hope to receive their report later this year. I will study it carefully before reaching a decision on any permanent arrangements. However, the initial feedback on night-time runway alternation indicates that it has generally been positively received.
Such initiatives and others are part of the continuing programme of research and studies which the Government undertake to develop measures for the mitigation of noise impacts around designated airports. HAL also undertakes studies through HACC and other groups. Safety must be an overriding consideration, but in a balanced approach, all important factors must be taken into consideration. We have a full programme. As well as consulting on the night restrictions, I hope shortly to consult on departure noise limits and to announce the results of the night-noise contours study.
Most night flights at Heathrow are early morning long-haul services arriving after 4 am. A ban on night flights at Heathrow was given serious consideration in 1976-77. It was decided after consultation to allow night operations to continue while taking steps to ensure that eventually all such operations were carried out by quieter types of aircraft. That has happened, and the noisiest types are no longer allowed to operate. Night movements at Heathrow have been regulated by successive Governments since 1962; their numbers are strictly limited.
It has been the practice for many years to review the night-flying restrictions at Heathrow from time to time – usually every five years. Just such a review is due to start early next year. It will consider the restrictions to be applied for the five years from October 1998 onwards. I hope to issue a consultation paper before the end of the year. I acknowledge that disturbance to sleep is a problem and the measures taken to alleviate it are important.

4 November 1997
Music (Sound Levels)
Mrs Brinton: To ask the Secretary of State for the Environment, Transport and the Regions (1) if he will list those regulations governing the level of sound played in clubs where music is played; (2) what assessment he has made of measures to encourage voluntary limitation of exposure to high decibel noise levels in clubs where music is played; (3) what research his Department has (a) commissioned and (b) evaluated on the long-term effects of unprotected exposure to high levels of sound in clubs where music is played; (4) what plans he has to extend existing legislation on noise safety at work to clubs where music is played.
Angela Eagle: Risks from noise exposure to people who work in clubs are covered by the Noise at Work Regulations 1989, while the health and safety of members of the public who attend clubs is governed by the general requirements of the Health and Safety at Work etc Act 1974. There are no plans to change this legislation in relation to clubs.
The licensing of clubs where music is played is the responsibility of the relevant licensing authority. It is for them to attach to licences such conditions as they consider necessary to protect the interests of both those attending the venue and those living nearby.
There has been substantial worldwide research on the effects of noise exposure on hearing, including work commissioned over many years by the Health and Safety Executive. In particular, the Health and Safety Executive published in 1985 a review by the Medical Research Council Institute of Hearing Research of the literature on damage to hearing arising from leisure noise, including noise in discotheques.
There has been no assessment of measures to encourage the voluntary limitation of exposure to high decibel noise levels in clubs where music is played.

Extracts provided Rupert Taylor FIOA. ❖

New Products

ALLAWAY ACOUSTICS

Acoustic Transfer Grilles

Noise control specialist Allaway Acoustics has introduced a new acoustic transfer grille, designed to deliver excellent suppression of cross-talk in buildings incorporating ventilation or conditioned air systems. The ATG-D44 is tested in accordance with three different British Standards (BS 2750, BS 4718 and BS 5821) and will be built to order in the company's UK based manufacturing facilities.

Unlike conventional grilles for air flow, the ATG-D44 is constructed with a channel section front and rear and incorporates a number of blades to create an acoustically treated labyrinth. Suitable for use in any area considered noise sensitive, transmission loss of up to 24 dB is achieved, alongside insertion loss of up to 18 dB.

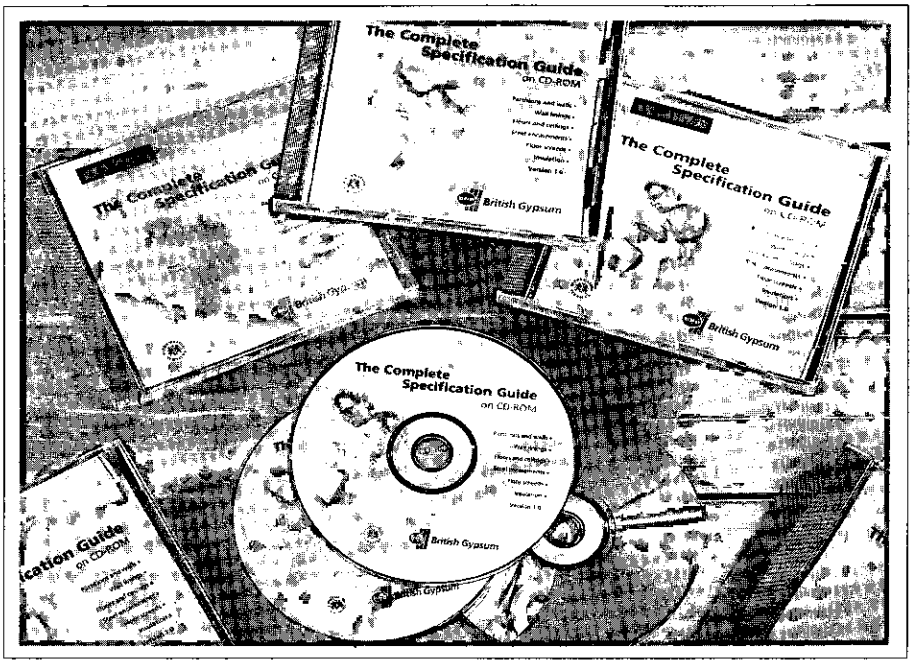
The ATG-D44 is available in a wide range of materials, including extruded or sheet aluminium, sheet zintec and stainless steel with optional polyester powder finish to any RAL or BS colour. Any width size can be accommodated and opening heights start at 136 mm, increasing in increments of 70 mm. The frames are supplied pre-drilled for fixing screws, complete with sealing gaskets.

Further information from Allaway Acoustics Ltd, Old Police Station, 1 Queens Road, Hertford, Herts SG14 1EN Tel: 01992 550825 Fax: 01992 554982

BRITISH GYPSUM

The White Book on CD

The 'Bible' of the construction industry, British Gypsum's White Book, is now at the heart of a brand new specification tool.



The Complete Specification Guide from British Gypsum is an innovative, interactive CD-ROM which it is claimed will radically change the way the company's products and systems are specified.

Developed in association with RIBA Services the CD-ROM gives specifiers a single reference to British Gypsum's dry-lining and plaster products and systems. In addition, it brings to the architect's desktop all the essential elements of British Gypsum's technical support services in one easy to use format.

The result is described as a comprehensive package of information and reference data from The White Book, NBS Model Specification Clauses, test data from the Building Test Centre and CDM regulations in one easy to access format. Added to this is a unique database which aids the selection and specification of British Gypsum's products and systems.

The Specification Selector Database is a core element of the new disk and provides a unique, interactive option for specifiers. By guiding the user through the specification process using responses to simple questions the architect can build up a detailed performance specification for a wall, partition, ceiling, floor or encasement option.

A copy of the CD may be inspected by appointment at the Institute office in St Albans.

For further information contact British Gypsum Ltd, East Leake, Loughborough, Leics LE12 6HX Tel: 0115 945 1000 Fax: 0115 945 1901.

illbruck

SQUARELINE acoustic ceiling

The new acoustic suspended ceiling tile from illbruck is said to combine the strength and reliability of one of the industry's tried and tested materials with one of today's ultra modern inorganic sound absorbing composites into an innovative acoustic panel. Optically futuristic, the completed ceiling projects a clean, fresh image designed to reflect the approaching millennium.

The expanded metal ceiling tile, available in white and galvanised steel, may be installed into any proprietary 600 x 600 lay-in grid system resulting in a tegular appearance.

BPB
The Building Test Centre
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NAMAS
TESTING
No. 0296, 0296S1

To achieve optimum sound absorption, SQUARELINE tiles have an innovative sound absorbing cassette factory-bonded to the reverse of the tiles, negating the double handling and facing of traditional mineral fibre quilted materials. The lightweight illtec FM cassettes are inorganic and completely mineral fibre free and unlike existing mineral fibre acoustical pads are available in a choice of finishes.
Further information is available from: Paul Durham, Technical Sales Manager, illbruck ltd, Croesfoel Ind Park, Rhostyllen, Wrexham LL14 4BJ Tel: 01978 294932 Fax: 01978 356629.

LARSON•DAVIS

New DSP80 Sound Level Meter for Motor Racing Circuit Owners

Larson•Davis are pleased to announce the supply of nine of their new DSP80 sound level meters to members of the Association of Motor Racing Circuit Owners (AMRCO).

The extremely versatile, yet easy to use DSP80 offers A, B, & C, weightings with Fast & Slow response, L_{eq} and L_{max} and an instant reset function which has proved useful for circuit members.

Circuits supplied include Castle Comb, Mallory Park, Silverstone and Thruxton as well as others in an effort by AMRCO to standardise the method of noise measuring at each circuit.
Further details of the DSP80 are available from Larson•Davis Ltd, Redcar Station Business Centre, Redcar, Cleveland TS10 2RD Tel: 01642 491565 Fax: 01642 490809.

AUTOMATED ANALYSIS

COMET/Acoustics Version 4.0

Automated Analysis announces the release of COMET/Acoustics Version 4.0. COMET is a numerical acoustic analysis package for the prediction of sound field in an acoustic medium. By giving users a better understanding of the noise their product will make, COMET helps them refine their design before investing in costly physical prototypes. It consists of a graphical user interface with intuitive menu structure, boundary element module and acoustic finite element.

The new version of COMET builds upon the COMET family of acoustic products. COMET consists of a basic Boundary Element Analysis module (BEA-I), an advanced Boundary Element Analysis module that includes structural acoustic coupling (BEA-II) and a Finite Element Analysis module (FEA). In addition to enhancements to these modules, Version 4.0 also offers two new modules. SAFE (Structural Acoustic Foam Engineering) and SAOpt (Structural Acoustic Optimisation).

The enhancement to the BEA modules are provided in terms of a fast approximate solver based on Rayleigh integrals for the estimation of the sound field, the modelling of viscous effects in acoustic domains, a mean flow analysis capability, a variable reverberant field analysis that allows the user to model multiple incoherent sources and a slowly varying reverberant field, a transient analysis capability, and finally the nearfield acoustic holography providing a facility for the computation of acoustic variables from pressure measurements.

The SAFE module that is introduced with Version 4.0 is a structural acoustic optimisation product. SAOpt is a robust tool that can be used during the design process for the minimisation of noise. The structural acoustic optimisation involves the use of a structural dynamic solver, an acoustic solver and an optimisation solver. The solution process in SAOpt utilising various software modules is automated using a script that controls the interaction between these programs.

COMET/Acoustics is available on Hardware platforms from the PC running Microsoft NT version 4.0 with minimum hardware configuration of a 100 MHz Pentium Processor, 64 Mb of memory, and 200 Mb of disk space, to UNIX workstations, including SGI, HP, IBM, DEC, Sun and Cray Super-computers.
For further details contact Automated Analysis Limited, Unit C, Enak House, Redkiln Way, Horsham, West Sussex, RH13 5QH Tel: 01403 218718 Fax: 01403 218728 or e-mail: automated@fastnet.co.uk.

NEWS ITEMS

THE NOISE CONTROL CENTRE

Huet Doors Distributor

Specialist door sets for acoustic, fire and security purposes are now being provided as part of the product portfolio of The Noise Control Centre's Architectural and Building Services Division in Wokingham, Berkshire.

One of the main system providers to NCC are Huet doors and windows, a French manufacturer with a reputation for quality and service. Huet doors are said to offer an opportunity to provide door sets of varying functions, including standard type doors, that are properly co-ordinated to be correctly matched in a multi-purpose environment, such as modern hotels and conference centres.
Further information from The Noise Control Centre, Architectural and Building Services Division, Charles House, Toutley Road, Wokingham, Berkshire RG41 5QN Tel: 0118 977 4212 Fax: 0118 977 2536.
The Noise Control Centre is a Sponsor Member of the Institute.

INDUSTRIAL ACOUSTICS COMPANY, USA

Taiwan Air Force orders additional JET AIRCRAFT Hush-Houses

The Republic of China Taiwan Air Force has contracted with Industrial Acoustics Company to supply two Engine/Aircraft Test Facilities with Noise Suppressors.

The new installations will include adaptations of the IAC Standard Jet Aircraft Hush-Houses and IAC Power-Flow® Jet Engine Test Cells to test engines out of the airframe. In addition, an engine preparation shop will be provided. The Hush-Houses incorporate design modifications for increased noise reductions that were used successfully with IAC Noise Suppressors for the Korean Air Force.

The noise reduction capability of the Standard IAC Hush-Houses will be enhanced by means of a Secondary Power-Flow Exhaust Silencer 7.32 meters square in cross section and 8.53 meters long. Sound level measurements at existing installations, with and without a similar silencer, are said to confirm that such a silencer reduces noise by an additional 10 dB(A).

The following outlines some of the features of the completed Chiayi AFB IAC Hush-House, many of which will be included in the two new engine/aircraft test facilities.

Hush-Houses at Chiayi and Hualien Air Force Bases Under contract to the United States Air Force's (USAF) San Antonio Air Logistic Command's Directorate of Aerospace Management (SA-ALC/LD), Industrial Acoustics Company delivered the first of two IAC Jet Aircraft Hush-House Noise Suppressors to the ROC Taiwan Air Force (TAF) at their Chiayi Air Base. The second system is currently being installed at Hualien Air Base and is scheduled to be turned over to the TAF later this year.

These Hush-Houses are identical to the more than seventy standard systems IAC has supplied to USAF for their worldwide bases. Designed to support ground run-up operations for any fighter aircraft in the Air Force's inventory, standard hush-houses satisfy most local community noise ordinances. TAF's multi-purpose Hush-Houses will support overhaul and maintenance operations to keep their new fleet of F-16s airworthy.

Chiayi F-16 aircraft noise was reduced to 80 dB(A) or below, at a distance of 76 m from the Hush-House. At critical forward locations, the Hush-House suppresses the noise generated to below 75 dB(A) at the same distance.

Engine Operators are Isolated from Engine Noise The facility includes a Noishield® Control Room to observe engine test routines. This room is acoustically isolated to allow operational personnel to run engines up to full power in comfort and safety. While an F-16 at maximum after-burner power emits noise levels of over 140 dB(A) just a few meters away, inside the control room, levels are below 70 dB(A). The room also includes a thermostatically controlled air-conditioning and heating system.

Power Operated Doors Facilitate Test Area Access The aircraft/engine test area of the Hush-House is 25 meters long by 20 meters wide and 8.25 meters high. Walls and ceilings are faced with stainless steel Noishield Sound Absorbers for maximum noise reduction and corrosion resistance. Large bi-parting, electrically operated Noise-Lock® Doors provide ingress and egress for both aircraft and engines. Other Hush-House features include a storage area, rest room and toilets.

Power-Flow® Silencers for Aerodynamic/Acoustic Performance Eight Power-Flow Air Intake Silencers (4 in each of the opposite side walls) allow cooling and engine air to be drawn into the cell. The two forward intakes have electrically operated vanes to minimize flow vortices by directing air towards the intake of the engine under test.

In the rear wall of the cell, an

NEW

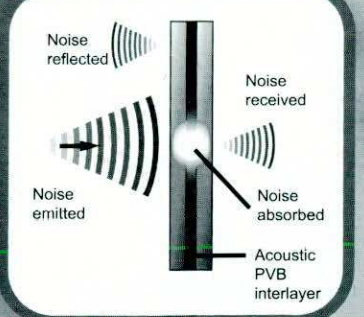
SG Stadip Silence

Sound insulating acoustic PVB laminated glass

SAINT-GOBAIN SOLAGLAS

The latest development in acoustic glazing technology and unique to Saint-Gobain and Solaglas, SG Stadip Silence is a laminated glass with a special acoustic PVB (polyvinylbutyral) interlayer. It provides exceptionally high levels of insulation against airborne sound and reduces impact noise caused by rain and hail.

*Solaglas is a major force in the UK glass industry with expertise stretching back more than 140 years. In 1990 it became part of the global **Saint-Gobain Group** the world's leading building materials manufacturer.*



It is a safety glass and is also available to meet security and explosion resistance specifications.

It can incorporate features such as solar control, thermal insulation and decoration.

For further information contact our Glass Facts Service
Solaglas, Herald Way, Binley, Coventry, CV3 2ND
Tel: 01203 458844, fax: 01203 636473, e-mail: help@glassfacts.co.uk
Web: http://www.glassfacts.co.uk

Absorptive Resonator Power-Flow Augmentor Tube Silencer, 6.1 meters in diameter and over 24.4 meters long, collects and disperses engine exhaust gases. Built in 10 separate sections, the tube's interior is protected against the jet engine blast by perforated, corrugated stainless steel liners designed to expand and contract with temperature changes. While the temperature inside the exhaust silencer might reach 450 Celsius at maximum afterburner power, the exterior is cool to the touch.

Further information from Industrial Acoustics Company Inc, 1160 Commerce Avenue, NY 10462, USA Tel: (718) 931 8000 Fax: (718) 863 1138 email: info@ industrialacoustics.com.

CEL INSTRUMENTS

Friendly Model Aircraft

Fifty thousand people in the UK regularly fly model aircraft and over twenty six thousand members of the 600 UK clubs belonging to the British Model Flying Association(BMFA).

The association took early action to prevent noise nuisance with a self regulatory code of practice which ensures that all of the their member clubs make regular checks on all aircraft to ensure compliance.

The Royston Model Aircraft Club is a typical society. Established over 25 years ago they have over 50 members who meet twice a week to fly their aircraft from a site in Bassingbourn. The flying area is within an MoD Defence Establishment and, although it some distance to the nearest residential area, the club still closely monitors every model.

Each model aircraft has to meet the organisation's standards which set the noise emission at 82 dB(A) from 7 metres away. The test is carried out from four points around the model and, if the noise emission is below the specified level, the owner receives a certificate of compliance.

Measurements are taken with a sound level meter, like one of the 200 series from CEL Instruments that provide an easy and accurate way of obtaining readings. There are three models in the range, all complying with Type 2 specifications, and offering a range of features to provide a cost effective method of meeting the Association's regulations.

For further information on CEL noise monitoring equipment contact: CEL Instruments Ltd, 35-37 Bury Mead Road, Hitchin, Herts SG5 1RT Tel: 01462 422411 Fax: 01462 422511 email: sales@ cel.ltd.uk Website: http://www.cel.ltd.uk.

CEL Instruments is a Key Sponsor of the Institute

LARSON•DAVIS

Hire Service

After many years of quietly hiring noise monitoring equipment to existing customers, Larson•Davis Ltd is pleased to announce the expansion of this service to all interested parties.

Current stocks of the Larson•Davis range of Sound Level Meters and Analysers have now been increased and are available for hire on a half, or full weekly hire rate.

Environmental Noise Monitoring Systems are readily available using the Model 820 Type 1 Sound Level Meter together with the outdoor

microphone kit.

The Larson•Davis range includes miniature profiling dosimeters, short and long term environmental kits and real time analysers.'Windows' colour software for downloading and presenting results and full customer support is also available.

New Color Brochure

Larson•Davis Ltd announces the availability of a new six-page color brochure describing RTA Technologies' Environmental Noise Modeling (ENM' software, version 3.06).

ENM is the popular and reasonably priced Windows 3.1 and Windows 95 software used to predict noise levels at a distance from sources. The noise level attenuation is calculated for the effects of distance, barriers, ground effects, wind, and temperature gradients.

ENM, first sold as a DOS based program in 1986, is said to have provided hundreds of users with a fast and user friendly program.

The four modules of ENM: SOURCE helps characterize the sound producer, SECTION describes the two dimension elevation and height of the ground from the source to the receiver, MAP permits 3D topography to be defined using ground contours. The ENM SCENARIO Module does the work of calculating sound contours.

All modules can be open at once to assure fast and understandable data entry and immediate visualization of results. Traffic noise can be modeled from information available from the FHWA traffic noise model.

Further information from: Larson•Davis Ltd, Redcar Station Business Centre, Station Road, Redcar, Cleveland, TS10 2RD, Tel: 01642 491565 Fax: 01642 490809. E-mail: lardaveuro@ enterprise.net

EUROSCIENCE

A European version of the British Asssociation for the Advancement of Science, and other European level information/discussion initiatives.

Based on the article: *'New Eurosci-ence Group'* in *Research Europe* 20/11/97.

The concept of Euroscience is of a mass membership, non-profit organisation working to advance science at a European level. Its visionaries are its Director: Francoise Praederie, senior astronomer at the Paris Observatory, and Claude Kordon, a neurobiologist and director of research at CNRS.

They are undoubtedly correct that there is a niche for Euroscience. The increasing globalisation of science, and growing European integration, mean that there are greater opportunities for interaction and debate within European science. The recent announcement of a proposed new scientific journal, published by the European Commission, with the name *Euroscientia Forum* is further evidence of the belief.

Further initiatives include a European science press release service, and the extension of Science's web magazine *The Next Wave* to cover issues of importance to young European Scientists.

Items for inclusion in this section should be sent to John Sargent MIOA, Oak Tree House, 26 Stratford Way, Watford WD1 3DJ ❖

Certificate of Competence in Measurement of Sound Transmission in Buildings

Following the success of the Institute of Acoustics' certificates in Workplace Noise Assessment and Environmental Noise Measurement, the IOA is launching a new certificate in Measurement of Sound Transmission in Buildings. As with the existing certificates this is envisaged as being a one week course and will be assessed by written examination and by a practical test.

The aim of the course is to train appropriately qualified people to a standard where they are competent to carry out measurements of sound transmission in buildings. Courses will include an introduction to basic theory as well as giving students practical experience in measurement. At the end of the course students should be able to carry out the measurement of sound transmission in a variety of situations with different types of equipment, carry out all the calculations and write an appropriate report.

Due to pressures on time, only a limited time will be devoted to wide issues such as interpreting Building Regulations, measurements in industrial or commercial buildings and in noise control measures.

Institutions interested in holding such courses should contact Roy Bratby, Chief Executive, at the IOA for further information.

Non-Institute Meetings

February 2–6, 1998: Ultrasonic Technological Progresses-98, Moscow, Russia
Contact: Secretariat UsTP-98, 64 Leningradski prosp, MADI-TU, Moscow, Russia; Fax: +7 095 151 7911; e-mail: utp@madi.msk.su

March 4–5, 1998: 4th Annual Conference of the Society of Acoustics (Singapore), Singapore
Contact: Dr W S Gan, Acoustical Services (1989) Pte Ltd, 209–212 Innovation Centre, NTU, Manyang Avenue, Singapore 639798, Republic of Singapore; Tel: +65 7913242, Fax: +65 7913665 email: wsgan@singnet.com.sg

March 23–26, 1998: DAGA 98, Meeting of the German Acoustical Society, Zurich, Switzerland
Contact: German Acoustical Society DEGA; Univ Oldenburg, Dept Physics/Acoustics; D-26111 Oldenburg; Tel: +49 441 798 3572; Fax: +49 441 798 3698; e-mail: DEGA@aku.physik.unioldenburg.de

April 5–8, 1998: Noise-Con 98, Ypsilanti, MI, USA
Contact: INCE, PO Box 3206, Arlington Branch, Poughkeepsie, NY 12603, USA; Fax: +1 914 462 4006; e-mail: inceusa@aol.com

May 12–15, 1998: IEEE International Conference on Acoustics, Speech and Signal Processing, Seattle, WA, USA
Contact: L Atlas, Dept EE (FT 10), Univ of Washington, Seattle, WA, USA; Fax: +1 206 543 3842; e-mail: atlas@ee.washington.edu

May 18–22, 1998: 7th Spring School on Acoustooptics and Applications, Gdansk, Poland
Contact: B Linde, Institute of Experimental Physics, University of Gdansk, Poland; Fax: +48 58 41 31 75; e-mail: school@univ.gda.pl

May 25–27, 1998: Noise and Planning 98, Naples, Italy
Contact: Noise and Planning, via Bragadino 2, I-20144 Milano, Italy; Fax: +39 2 48 01 88 39; e-mail: md1467@mclink.it

June 8–10, 1998: Joint EAA/EEAA Symposium Transport Noise and Vibration, Tallinn, Estonia
Contact: East-European Acoustical Association, 196158, Moskovskoe shosse 44, St Petersburg, Russia; Fax: +7 812 12 79 323; e-mail: krylspb@sovam.com

June 9–12, 1998: 8th International Conference on Hand-Arm Vibration, Umea, Sweden.
Contact: National Institute for Work Life, Conference Secretariat HAV98, PO Box 7654, S-90713 Umea, Sweden; Fax: +46 90 16 50 27; email: hav98@niwl.se

June 20–26,1998: Joint Meeting of the 16th International Congress on Acoustics (ICA) and the 135th Meeting of the Acoustical Society of America (ASA), Seattle, Washington, USA
Contact: ICA/ASA '98 Secretariat, Applied Physics Laboratory, Univ of Washington, 1013 NE 40th Street, Seattle, WA 98105-6698, USA; Tel: +1 206 543-1275, Fax: +1 206 543 6785, E-mail: ICA/ASA98@apl.washington.edu

June 21–26, 1998: 13th US National Congress of Theoretical and Applied Mechanics, Gainesville, FL, USA
Contact: M Eisenberg, AeMES Department, University of Florida, PO Box 116250, Gainesville, FL 32611-6250, USA; Fax: +1 352 392 7303; e-mail: meise@eng.ufl.edu

June 26–July 1, 1998: International Symposium on Musical Acoustics – ISMA 98, Leavenworth, Washington State, USA
Contact: ISMA 98 Secretariat; The Catgut Acoustical Society; 112 Essex Av, Montclair, NJ 07042, USA; Tel: +1 201 744 4029 (Thursday only); Fax: +1 201 744 9197 e-mail: catgutas@msn.com; http://www.boystown.org/isma98

June 27–30 International Phonetic Sciences-98 (IPS-98) Bellingham, WA, USA
Contact: R Weiss, Linguistics Program, Western Washington University, Bellingham, WA 98225, USA Fax: +1 360 650 4837; e-mail: weiss@henson.cc.wwu.edu

September 7–9, 1998: Nordic Acoustical Meeting 98, Stockholm, Sweden
Contact: Swedish Acoustical Society, c/o Ingemansson AB, Box 47321; S-10074 Stockholm, Sweden; Fax: +46 818 2678; e-mail: nam98@ingemansson.se

September 14–16 Iberian Congress of Acoustics, Lisbon, Portugal
Contact: CAPS-Instituto Superior Tecnico, Av Rovisco Pais, 1096 Lisboa Codex, Portugal; Fax: +351 1 352 3014; email: capsist@alfa.ist.utl.pt

September 16–18, 1998: International Conference on Noise and Vibration Engineering, Leuven, Belgium
Contact: Ms L Notre, KU Leuven, Division PMA Celestijnenlaan 300B, B-3001 Leuven, Belgium; Fax: +32 16 32 29 87; e-mail: lieve.notre@mech.kuleuven.ac.be; Web: http://www.mech.kuleuven.ac.be/pma/events/isma/isma.html

October 12–16, 1998: 136th Meeting of the Acoustical Society of America, Norfolk, VA, USA
Contact: Elaine Moran, ASA, 500 Sunnyside Blvd, Woodbury, NY 11797 USA; Fax: +1 516 576 2377; e-mail: asa@aip.org

November 16–18, 1998: Inter-Noise 98, Christchurch, New Zealand
Contact: New Zealand Acoustical Society Inc, PO Box 1181, Auckland, New Zealand

November 20, 1998: Recreational Noise, Queenstown, New Zealand (In association with the above)
Contact: P Dickenson, Ministry of Health, PO Box 5013, Wellington, New Zealand, Fax: +64 4 496 2340; e-mail: philip.dickenson@mohwn.synet.net.nz

November 22–26, 1998: Biological Effects of Noise, ICBEN 98, Sydney, Australia
Contact: N Carter, National Acoustics Centre, Chatswood, Sydney, Australia; Fax: +61 2 411 8273

November 30–December 4, 1998: 5th International Conference on Spoken Language Processing, Sydney, Australia
Contact: Tour Hosts, GPO Box 128, Sydney, NSW 2001, Australia; Fax: +61 2 9262, 3135 ❖

Acoustics Recruitment Associates

150 Craddocks Avenue Ashtead Surrey KT21 1NL
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e-mail:ara@dial.pipex.com

Technical Adviser: Dr Geoff Leventhall

Loudspeakers. A 'household name' manufacturer of loudspeakers is looking for the right person to join their team of product developers.
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Instrument Sales. A big name is looking for a good person in the Southern Area.
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Send in your CV if any of these vacancies interest you.

If you are a company, contact us to discuss your recruitment needs.

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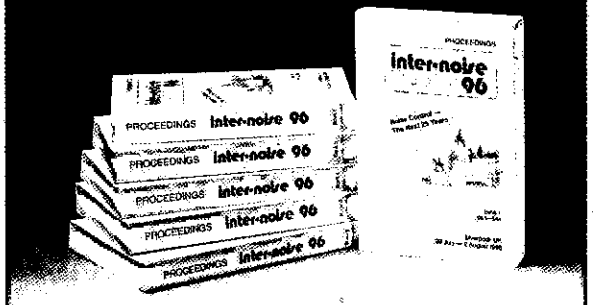

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