



Institute of Acoustics

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Volume 22 No 2
March – April 1997

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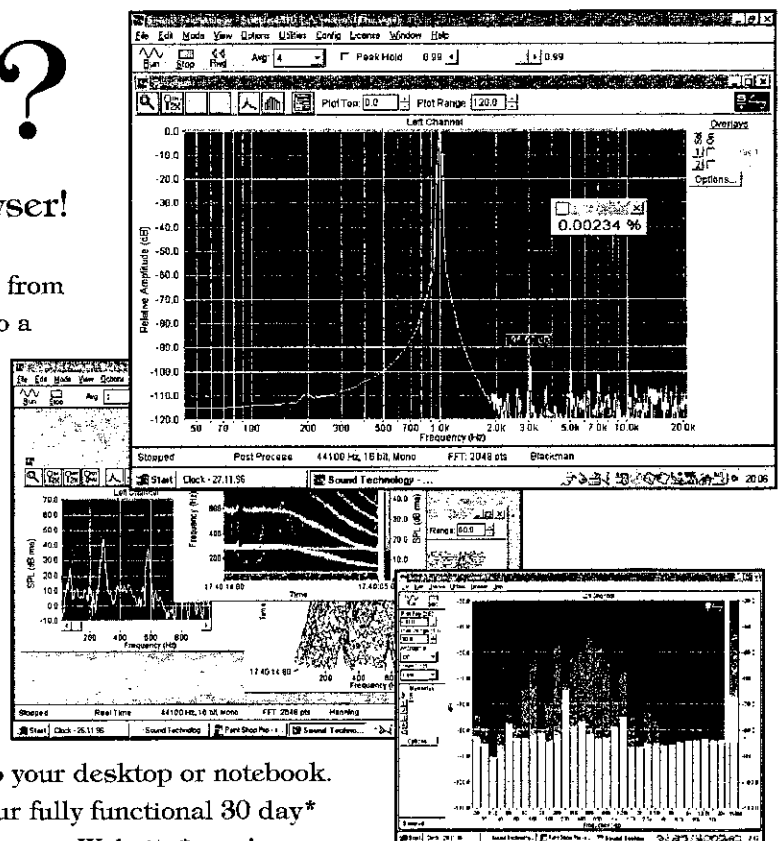
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Editor:

R Lawrence FIOA

Associate Editors:

J W Sargent MIOA

A J Pretlove FIOA

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Bulletin Management Board:

J W Sargent MIOA

I J Campbell MIOA

M A A Tatham FIOA

B M Shield MIOA

M K Ling MIOA

Contributions and letters to:

The Institute of Acoustics, 5 Holywell
Hill, St Albans, Herts. AL1 1EU
Tel 01727 848195 Fax 01727 850553

Books for review to:

A J Pretlove FIOA, Engineering
Department, University of Reading,
Whiteknights, Reading RG6 2AY

Information on new products to:

J W Sargent MIOA

Oak Tree House,

26 Stratford Way,

Watford,

Herts WD1 3DJ

Advertising:

Keith Rose FIOA

Brook Cottage, Royston Lane,

Comberton, Cambs. CB3 7EE

Tel 01223 263800 Fax 01223 264827

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

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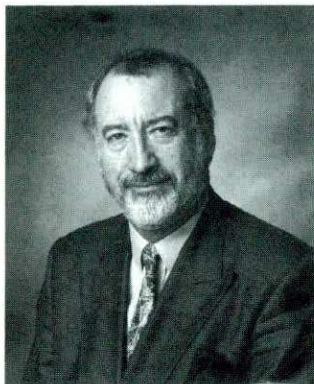
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Dear Fellow Member

Within a few hours of the arrival of the last issue of the Bulletin, I received an email from someone who had read my letter about our discussions with the EAA and who was concerned that we might be about to make changes to the Bulletin. Having recovered from the initial surprise that someone actually reads this letter, I quickly replied that we have no plans to alter the Bulletin from its current form, and I am pleased to have the chance to make that clear to all. In fact we have recently set up a new Management Board who will monitor and control publication of the Bulletin. The current members of this are John Sargent, Ian Campbell, Mark Tatham, Bridget Shield and Matthew Ling. I am confident that the Bulletin, which is the envy of other societies, will go from strength to strength.

The incident did suggest to me that it might be interesting to modify the Institute's Web page on the Internet to enable direct feedback to me by email. Visit the site at <http://www.Ioa.essex.ac.uk/iao/> and see how.

Those without email facilities are always welcome to contact me via Agriculture House. Particular issues on which I would value your views are, ways of increasing our interactions with related professional societies and ways in which we could raise the general profile and awareness of the Institute.

Finally a reminder that the Institute's AGM is to be held on Tuesday May 20 at Church House, Westminster, after the one-day meeting on The Management of Sound from Public Houses, Clubs and Other Indoor Venues. I look forward to seeing you there and at the Reception and Annual Dinner following.

Sincerely yours

A handwritten signature in cursive script that reads "Bernard Berry".

Bernard Berry

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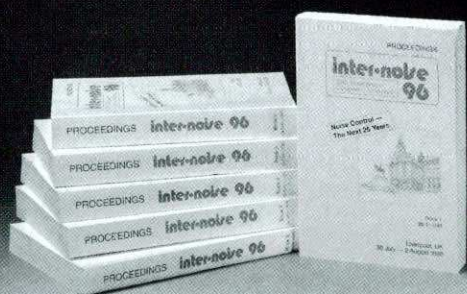
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THE NOISE ACT 1996

James Clappison MP

This is a transcript of the statement made by Mr James Clappison MP, Under Secretary of State for the Environment, at the Institute one-day meeting on the topic held on 12 February 1997 at the Commonwealth Conference Centre in London. A report of the meeting appears on page 31.

I am delighted to be here today to talk about neighbour noise policy and in particular about the Noise Act 1996 and its practical implementation. I am, of course, aware that the help and support of those who are attending this meeting today will be essential if the potential of the new legislation is to be fully realised.

The background to the new legislation will be familiar to many of you, and will be examined in some detail in the presentations later this morning.

I would, however, like to add my own personal thoughts. One of the features that most struck me during the debates on the Noise Act was that this was in its truest sense a piece of legislation with all-party support. Almost without exception, everyone who spoke during debate agreed with the aims of the Noise Act. Indeed the only source of contention was whether the Act went far enough in seeking to deal with the increasing problem of neighbour noise.

It has fallen to my Department to see that this consensus for action should be translated into workable remedies. The Noise Act carries forward only part of our policy on neighbour noise – but it is a very important part.

We were aware of the strong feeling amongst environmental health officers of the need for clarified powers of seizure and forfeiture of noise-making equipment. We therefore implemented these provisions in the Noise Act as quickly as practicable. The new powers have been available for statutory noise nuisance cases since September of last year. I have no doubt that seizure and forfeiture are effective and appropriate sanctions against the thoughtless noise-maker.

The second element of the Noise Act – the night noise offence – has, I am sure you are all aware, led to a great deal of debate. I make no apology for this. The issue of neighbour noise is one which deserves full and widespread discussion.

No-one is suggesting for one moment that a single piece of legislation will provide the answer. As I have said on many occasions, it is vitally important that the provisions of the Noise Act are seen as part of a package of measures and approaches. Management guidance for local authority noise services and the code of practice on liaison with the police represent additional parts of this package. Both of these documents are in the process of publication. However one should also not understate the importance of less formal methods of resolving such cases, such as mediation.

The role of mediation has become increasingly important in cases of neighbour noise disputes. As I am sure we are all aware, in an appreciable number of cases a complaint of unreasonable noise is just a symptom of a wider problem between neighbours. Mediation has proved increasingly successful in tackling the underlying causes of such disputes. My Department has shown its support for mediation by its continued funding of the umbrella organisation Mediation UK. We have recently also supported research which has for the first time compared the cost of mediating neighbour noise disputes with that of other more formal approaches. This research established that where appropriate, mediation offers genuine scope for savings in terms of staff resources and time spent dealing with such problems. It can also often provide a less adversarial solution to neighbour disputes.

Nevertheless, it remains the case that for many complaints, use of the available legislative controls is the most appropriate action. The night noise offence seeks to add another element to these controls.

In October of last year I was asked to give a speech on the development of the Government's neighbour noise policy to Chief Environmental Health Officers and Councillors in Surrey. The text of this was subsequently issued to Chief Environmental Health Officers throughout England. In the speech, I issued a challenge to those present to review the way their authorities currently dealt with neighbour noise; to question established practices; and to ask whether their service was meeting the needs of their residents.

Of course, for those who are responsible for the technical aspects and the practical implementation of the new offence, the challenge is no less great. For the first time a noise offence will be established based on an objective standard. The technical aspects of this have proved difficult. Nevertheless we are now satisfied that the new offence offers a practical and effective new weapon in the armoury of environmental health officers.

As in so many aspects of environmental health, there will be those who see only the problems in the new legislation, whereas others see the opportunity. I envisage that the guidance on the management of noise services will make authorities and individuals see these opportunities and find ways to overcome what may initially appear to be problems.

An appreciable number of local authorities are actively considering adoption of the new offence as soon as it becomes available. I can only commend them for their willingness to explore new ways of improving the service they provide. In reaching a decision as to whether to adopt the new offence, I am aware that a number of authorities have undertaken a root and branch review. They have not only looked at their current service. They have also widened this to look at the very

nature of the complaints they receive. A valid viewpoint on whether the offence is appropriate for an area can only, in my view, be achieved if a clear local picture is known of the level and nature of noise complaints.

The adoptive nature of the new offence is one which was the subject of much debate during the passage of the Act. There was a strong body of opinion that the offence should automatically apply in all local authority areas. Those who took that viewpoint did so with the best of intentions. Nevertheless, the Government argued that a local authority should be best placed to assess the local need for the new offence.

There will, of course, be areas where the level of night-time noise complaints does not justify adoption of the new offence and where provision of an out-of-hours noise service would not be a cost-effective use of public funds.

Of course, there may be cases where there is good reason for the new offence to be adopted, yet the local authority refuse to do so. As many of you will know, the Act gives the Secretary of State the power to direct that the offence should apply to a local authority area.

During the passage of the Bill, I announced that the Government would review the workings and take-up of the new noise offence after it has been operating for two years. We currently envisage that this will involve consideration of a variety of issues. This will include: the number of authorities that have adopted the offence; the types of area they cover; and the outcomes of complaints dealt with under the offence.

To inform the review, a clearer picture is needed of current practice in dealing with noise complaints, particularly those received out-of-hours. My Department has

therefore recently commissioned a research project to establish just what kind of services local authorities provided in October 1996. This will act as a base position from which we can measure change.

Further research will look in detail at how the noise services provided by local authorities improve over the two year period and beyond.

More generally, my Department has also commissioned research by the Building Research Establishment to consider the whole issue of domestic noise. This work aims to increase our understanding of neighbour noise complaints. It will investigate the reasons for these complaints as well as the main types of noise sources involved, how the noise is measured and the most effective methods employed to resolve disputes. This is important work, as it looks at the issues not just from an official viewpoint, but also seeks to find out what the protagonists think. The findings of this research are expected in the summer.

The findings of the review will assist in establishing how far a common approach from local authorities across England is developing in relation to the handling of noise complaints.

At the beginning of my remarks I said that the Noise Act provisions should be seen as part of a package and that noise is so often a symptom of wider problems between neighbours. So, you will be interested to hear that my colleague, David Curry, is this morning launching the provisions of the Housing Act 1996 designed to deal specifically with the problems of anti-social behaviour in the social and private rented sectors.

These measures include introductory tenancies to enable local authorities and housing action trusts to tackle problems amongst new tenants quickly and effectively and strengthened grounds for possession of existing secure tenancies. Behaviour by visitors to a tenant's home and conviction or arrestable offences in the locality can both now form grounds for possession. The way has also been paved for the use of professional witnesses, something which will be particularly useful where victims are too frightened to give evidence against their neighbours.

I have talked today of consensus and of challenges. A shared desire to address the very real problem of neighbour noise and the challenge of achieving this cost-effectively. Today's meeting reinforces that view.

Only by co-operation between all of those involved in developing and implementing effective neighbour noise policies can we begin to bring relief to all of those who suffer unwanted noise. I am sure today's meeting will help in carrying this forward. ❖



James Clappison MP speaking at the meeting

PARTIALLY AUTOMATED FIELD MEASUREMENT OF REVERBERATION TIME

Robert C Chanaud

Introduction

Measurement of reverberation time in the field as part of a room design, or as part of a sound transmission loss test, is subject to a number of problems which are generally discovered during analysis in the office. Among them are: (i) undiscovered bad data; (ii) an inadequate level range to determine the decay slope properly; (iii) poor locations for the microphones; (iv) statistically invalid numbers of measurements; and (v) a double decay curve skewing results. When discovered, it is often necessary to repeat the measurements adding additional expense.

A method has been developed that addresses these problems by partially automating the measurement process through the use of either a steady-state random or an impulsive sound source and software that runs a real time analyzer.

There were several goals of this development. They were: to improve the reverberation time calculation, to avoid collection of erroneous or useless data, to permit immediate on-site review of the results, to provide a data file for independent analysis and to allow measurements by less-trained individuals.

In cases where a computer cannot be carried into the field, a real time analyzer has an internal program that permits reverberation time to be measured with the analyzer only. One advantage of this method is that the MLS technique can be utilized for cases where high noise levels exist.

Equipment Needed

The method requires that the user have a notebook computer which is connected to a Larson-Davis real time analyzer (Model 2800, 2900, or 3200) through a null-modem cable. With the advent of small, lightweight computers, the additional equipment to be carried should not be a burden. The real time analyzer is connected to tripod mounted microphones (1 or 2 at present) for sound signal collection. The signal output of the analyzer can be connected to a power amplifier, and thence to a loudspeaker, for broad band noise generation. The program controls the signal.

Program Features

1. Either Metric or English units may be used.
2. Pretests are made to insure there is an adequate range of level at each frequency.
3. Either steady state or impulsive noise sources may be used.
4. An arbitrary number of repetitive tests can be made and averaged at each microphone.

5. The time and level of the initiation of the decay for both the steady and impulsive source is determined.
6. The time history is processed after the decay to determine the background level immediately after the event, and so determines the time and level of the end of the decay.
7. Double decay rates are detected. This occurs when early decay rates are significantly higher than later decay rates.
8. The Schroeder reverse integration method is invoked for impulsive noise sources.
9. Any combination of microphones can be used to create a microphone-averaged reverberation time spectrum.
10. Estimates of the total sound absorption in Sabines and the sound absorption coefficients for each frequency are tabulated.
11. The collected data can be independently analyzed.
12. The uncertainties of the spectral reverberation times are estimated.
13. The entire process is controlled from the computer screen.

Data Collection and Analysis

In entering descriptive information about the test to be performed, the user can either enter new data, or call up settings from a previous measurement. Figure 1 shows the initial screen. The user is required to enter approximate geometrical and acoustical information about the room. This can be in either English or Metric units. The Sabine equation is used to estimate the reverberation time, which is displayed. The user must choose the number of spectrum samples desired during the measurement period. The program calculates the amount of time needed to properly collect the data, especially at low frequencies. Then the time is divided by the number of samples to get the time interval between samples. The interval is displayed so the user can evaluate whether the spacing is close enough to adequately define the indicators, particularly the 50 ms Clarity indicator. It is tempting to arbitrarily increase the number of samples so the minor sample interval of 2.5 ms is achieved. Unfortunately, the data are placed in the instrument memory which is finite and small sample intervals may increase file size beyond memory limits (see the discussion below).

The user can select the source type and the lower limiting frequency for the tests. All data are collected in $1/3$ octave bands. The user can choose whether or not to correct the time history data for the background levels. In certain standards, background correction is not allowed.

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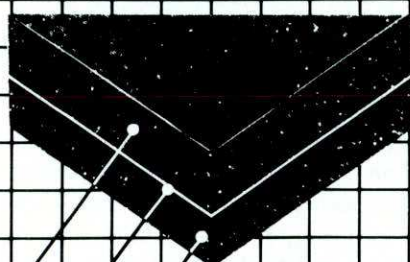
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☒ Metric
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 Width: m
 Height: m
 Characteristics
☐ Reverberant
☒ Average
☐ Absorptive
 Environment
 Temperature: C
 Humidity: %

Measurement Data
 Source Type
☐ Impulse Source
☒ Steady Source
 Frequency Bandwidth
☐ 50 Hz to 10 KHz
☒ 100 Hz to 10 KHz
☒ Correct for Background

Quantities
 Num. of Microphones:
 Num. of Samples:
 Num. of Tests:
 Estimated RT: 0.74 (in seconds)
 Sample Interval: 14 (in milliseconds)

Fig. 1. The initial screen

test (1 or 2 at present) and the number of tests to be made at each microphone. If the number of tests is more than four, the uncertainty of each test will be calculated.

The next step is a pretest. The program requires the user to measure the background level at each microphone and then activates the noise source (or allows time to activate an impulsive source). The screen for this is shown in Figure 2. The process is done through the pressing of keys on the screen. The difference in levels in each $1/3$ octave band from 50 Hz to 10 kHz is displayed for the user to review. If the range is inadequate [1] the user can change the level of the source, reposition it, adjust its spectrum shape, reposition the problem microphone, or adjust the background levels, if possible. The pretest results are conservative in that the source level chosen is the minimum during the sample period (for a steady source) and the background level chosen is the maximum during the sample period. This process does not in any way preclude performing the tests; but it can be repeated until the user is satisfied. The user can revert to the initial screen at any time to change initial data, eg change the source spectrum from pink to white noise.

The final step is to perform the reverberation test itself. If a broad band noise source is used, the reverberation test is repeated automatically the number of times requested in the initial form. When an impulse source is used, the user is prompted before each test. The program collects the data for each test and energy averages them to create test-averaged time histories for each microphone for each $1/3$ octave band. If there are more than

four tests, the uncertainty of the reverberation time is calculated. Upon conclusion, the program downloads the data from the analyzer to the computer, and does the analysis.

The program creates a test-averaged time history for each microphone and each $1/3$ octave band. Automatically defining the decay start and end times can be a challenge, particularly at low frequencies. For a steady sound source, the program calculates a short term moving average. When the average drops a certain amount, the initial level and time are flagged as the decay start. For the impulse source, the decay start commences at the maximum level. Since the data collection time is set to include the background levels, the program calculates a backward moving average from the end time, until it rises 3 dB where the decay end time is set. If the user makes the

choice, decay time history data up to the decay end are corrected for the background level with the reasonable assumption that the background and the decay are incoherent. This correction increases the usable level range and reduces the lengthening of the reverberation time caused by background contamination.

The data between the start and end times are used to calculate the reverberation time using linear regression. In addition, the program searches for an initial decay rate significantly greater than the later decay rate. If found, the program finds an initial crossover point and then iteratively corrects one set of data with the extrapolated linear regression line of the other set until a stable separation time between them is found. This results in an early reverberation time (or early decay time), a late reverberation time and an overall reverberation time (which includes all decay data).

If an impulsive source is used, the Schroeder reverse integration method [2] is used to generate a relatively smooth decay time history. The early, late and overall reverberation times are calculated from these data. Because of the nonlinear results of the summation, the double decay search procedure and the background correction procedure are altered. For impulsive sources, it is possible to have up to 6 values of reverberation time for each band of each microphone. Because the linear regression lines are presented for the user, there is little confusion caused by this.

The program also calculates microphone-averaged time histories for each $1/3$ octave band. The averaging

How will it sound?

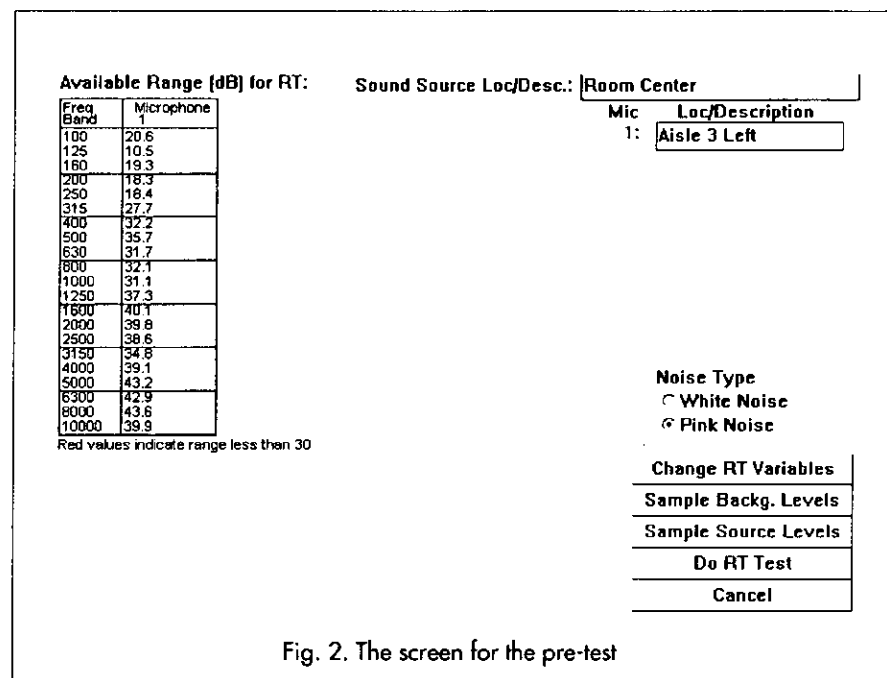


Fig. 2. The screen for the pre-test

history is used to calculate the 50 ms Definition; 50 and 80 ms Clarity and Center Time. These are also displayed and can be printed. Other indicators are being added.

With the press of a button, the user can switch to a table showing the spectrum and frequency-summed values of reverberation time, sound absorption coefficient and total sound absorption in Sabines. The program assumes the room is a rectangular parallelepiped for the purpose of surface area, so the total absorption values are subject to unknown variations if the room has another shape.

Data Files and Storage

Since a real time analyzer is used as the data collection instrument, permanent binary data files are created. The analyzer has a finite memory upper limit so the file size must be estimated. When too

process is done by energy averaging the raw time histories and recalculating the results independently rather than by averaging intermediate results such as reverberation time.

Examination and Modification of Results

After the data are transferred from the real time analyzer to the computer, the user can review the results immediately, and in some detail. The goal here was to afford the user an opportunity to ensure that the results look reasonable before quitting, and to allow him an opportunity to disagree with the automated steps, if necessary.

The spectral time histories for each microphone and for the microphone-average can be reviewed. Initially, the microphone-average is taken over all microphones, but the user can select any combination of microphones to include in the average. In this way he can discard any microphone that may have been wrongly positioned. Since there are only two microphones in the present version, this option is not useful yet.

The time history for any frequency can be shown with the associated linear regression lines; the reverberation time values are tabulated. In addition, a bar graph of the reverberation time spectrum for the chosen microphone is shown. The bar for the frequency of the currently displayed time history is highlighted. Thus the user can immediately peruse all the data. Any of the graphical data can be sent to a laser printer.

When there is a double decay for an impulsive source, up to 6 reverberation times can be tabulated and the linear regression lines shown. The linear regression line for the overall decay of the time history data can be adjusted in time at either end to suit the user. When this is done, the reverberation time is recalculated and the bar graph altered. The program remembers the original conditions, so the user can revert to the automated value with the press of a button.

The microphone-averaged frequency-summed time

large, either the memory is inadequate to collect the needed data, or other files on the analyzer must be removed to make room. The file size is determined by the number of microphones and the number of spectral samples (overall data collection time multiplied by the sample time interval). The overall data collection time is determined by taking into account the time to:

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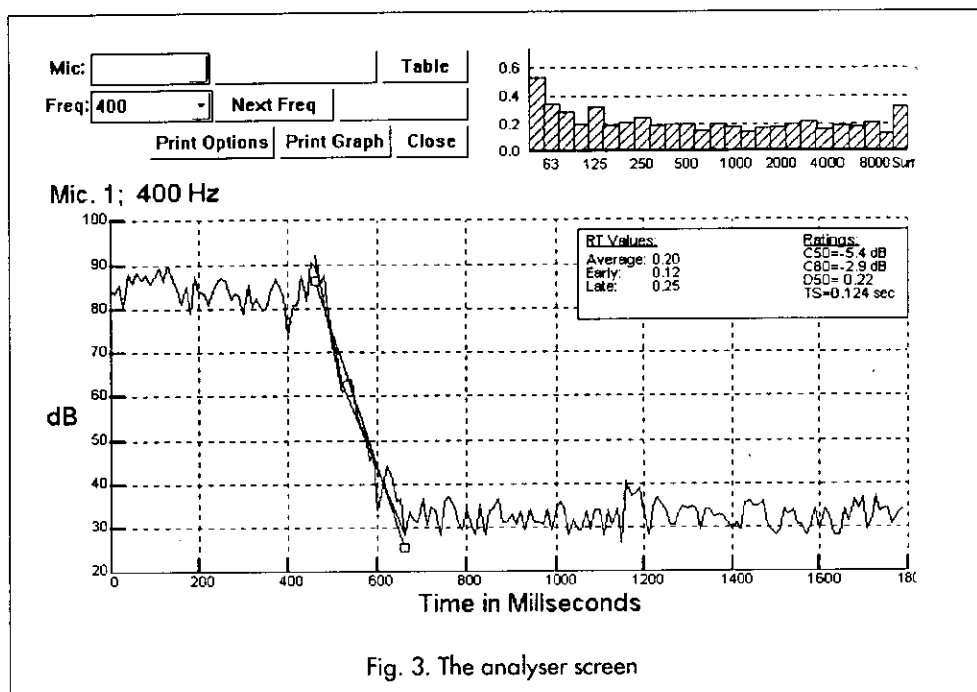


Fig. 3. The analyzer screen

- (1) energize the room
- (2) collect a useful source level sample (for steady sources)
- (3) to decay (using the Sabine equation); and
- (4) collect a useful background level.

This is done for the lowest frequency band. Then the time interval between samples, in milliseconds, is calculated and displayed, based on the number of spectrum samples desired by the user. The number of samples can be adjusted until the desired time resolution is achieved.

The collected data are stored in two sets of files. The first file, with an extension of .REV, is used by the software and contains descriptive information about the test. The second file, with an extension of .LDL, is a binary file that contains not only all the test-averaged time histories, but also all the factors relating to the operation of the instrument, such as averaging type and time. When independent analysis of the data is desired, this file can be translated into ASCII format and imported into a spreadsheet program, examined and further manipulated to give the user any results the software does not presently yield. The binary file actually contains time history data as low as 25 Hz and, if one microphone is chosen, as high as 20 kHz.

Direct Measurement of Reverberation Time

The real time analyzer can be used to obtain reverberation time measurements in situations where a computer cannot be used. The user can have the analyzer control a steady state noise or set the trigger on an impulsive noise

source. The results can be obtained very quickly and can be read on the analyzer screen. The data are saved in binary file that can be downloaded, translated to ASCII and used in a spreadsheet or placed in a data base. This method permits measurements to be made rapidly, but requires more care on the part of the user as less safeguards are available.

The advantage of direct measurement is that the maximal length sequence (MLS) technique [3] has been incorporated into the analyzer. This method should be used where the background noise level is too high to obtain an adequate level range for determining reverberation time. MLS takes advantage of the random

properties of the background versus the deterministic properties of the decaying sound to improve the signal-to-noise ratio. Unlike the traditional technique, which corrects for background interference, this technique reduces it.

Summary

Measurement of reverberation time and associated indicators can be a time consuming operation even for experienced persons and subject to several problems. By partially automating the process, errors are reduced, data collection time is reduced, and less trained personnel can be used with confidence that good measurements will be made. Other features such as addition of more indicators, use of two phase-matched microphones for Inter-aural Correlation Coefficient, and post-processing of digital audio tape (DAT) data are under development.

In cases where the background level is high, or where a computer is not available, the analyzer can be used alone to make valid measurements.

References

- [1] ISO3382/WG Measurement of the reverberation time of rooms with reference to other acoustical parameters
- [2] M R Schroeder, 'New method of measuring reverberation time', JASA, 37, 409, (1965)
- [3] M Vorlander and M Kob, 'Practical aspects of MLS measurements in building acoustics', Acustica - acta acustica 83, Supplement S103, (1996)

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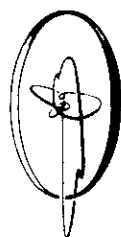
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HISTORY OF ACOUSTICS AT SALFORD

Peter Lord HonFIOA & Geoff Kerry FIOA

Acoustics in Salford started about 40 years ago with an interest in the damping characteristics of high polymer solids. The idea was to measure the mechanical damping over a wide range of vibration frequencies and temperatures. An instrument was developed for doing this, the offspring of which is still being manufactured and sold worldwide. All this took place in what was then the Royal Technical College, later to be split into the Royal College of Advanced Technology and the Salford Technical College.

Acoustics, as a discipline, was accommodated within the Department of Applied Physics, under the sympathetic eye of Miss Brenda Yates. The scientific activities in this field were, however, somewhat limited through lack of funding and space. Research was confined to interests which were small scale, ie impedance tube measurements, studies on the Helmholtz resonator using smoke particles and so on, alongside the damping work. The latter was by this time sponsored by the gramophone industry, notably Decca. The first building acoustics test facility, an insertion box, was built in an improvised semi-anechoic room constructed in the basement of 48 The Crescent, opposite the College on the A6, previously the home of James Prescott Joule. Did the ghosts look on in admiration at the way we coped with the traffic noise? Feel the energy!

Interest in noise control and all its ramifications was triggered off in a most peculiar way. It was decided that a meeting should be organised on noise and vibration control and that all the speakers should be invited, one of whom was Dr Per Brüel from Brüel and Kjær. He had been spotted Christmas shopping in Regent Street and persuaded to make a visit to Salford. The meeting was oversubscribed and realisation dawned that here was a subject that was about to take off. As a consequence, one week and two week courses were organised, generously supported by Brüel and Kjær and their staff, along with Vilhelm Jordan (consultant to the Sydney Opera House) and P A deLange of TNO and consultant to deDoelen in Rotterdam. These two stalwarts stayed in the UK for weeks at a time to help with the teaching.

So the direction in which acoustics was to go in the next few years was established. Further staff appointments were created and the small group of enthusiasts were offered the chance of moving into an old warehouse, actually an old print and dye works belonging to a local bookbinder. Nails in the rafters were the remains of fixings for hanging the drying cloth. Not exactly a prestigious building but there was room for expansion even if it had to be shared with rats from the nearby river who were perfectly at home with the leaking roof.

About this time other departments began to realise that the subject of acoustics might be a winner and

started to make overtures, promising that a good time would be had by all, but there was never any sign of real cash. Peter Lord then did some touting round industry, offering free consultancy over a number of years in exchange for a substantial cash injection. Eventually this was forthcoming from Pilkington's Glass, Turner and Newall and Ferranti. Much to everyone's surprise and delight the College equalled this sum and building work commenced to create a Transmission Suite and Anechoic Room, both of which would satisfy the standards of the day. Further staff appointments were made and research spread into areas such as hearing damage risk, physical modelling of concert halls, effect of noise and vibration on board ship, sound insulation of lightweight partitions and human response to vibration.

There was an increasing demand from industry for the use of the test facilities which resulted not only in a range of interesting projects but also some additional income. As the expertise grew, there were calls from many quarters for the services of the department. One such request resulted in us joining with a number of other institutions to monitor the effects of Concorde's sonic boom on buildings. Another major project looked at the propagation of noise in open plan offices. The industrial support continued as well and resulted in a major project near Manchester Airport to investigate sound insulation in houses especially dual glazing systems with staggered opening for ventilation.

A second group studying acoustics had started up in the college led by Bill Tempest FIOA and Mike Bryan FIOA. They concentrated on audiological problems, particularly associated with low frequency sound, and they built and operated their own set of test facilities. Initially there was friendly rivalry but a number of useful joint projects were undertaken.

Funding was generally so good that no applications were made to SERC until they paid us a visit and wanted to know why the department never asked for any money. As you might expect, after that hint, things soon changed. Unfortunately the group of acousticians was so successful with a *per capita* income which outstripped the rest of the University (which the CAT had now become) that there was envy in certain quarters and the department began to experience the dead hand of bureaucracy. Fortunately there was a change of Vice Chancellor who was unaware of the in-fighting (refer to C P Snow's 'The Masters' for further information) and suggested a separate department of Applied Acoustics should be formed.

The new department was given two years (something which would be unlikely to happen nowadays) to plan an undergraduate course in acoustics and to expand the research further. The undergraduate course was called a degree course in Electroacoustics, largely because it hap-

pened to be the title of a book by Hunt. It also had a nice ring to it and avoided, to a large extent, any clash with ISVR's course. Although some activities took a back seat for a while, the department came into being, the course was successful and rapidly expanded and the commercial testing continued apace; and not a business plan in sight!

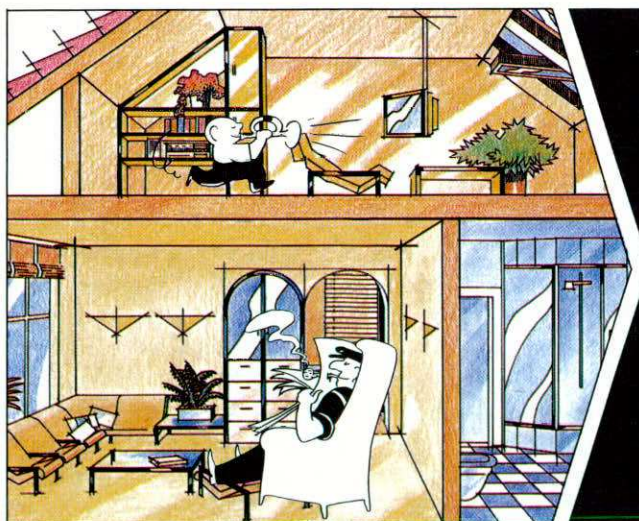
The research, more by good luck than good management, started to look at propagation from explosive sources and the influence of meteorological conditions. In its early days the work was sponsored by Nobel Explosives and ICI who were concerned about the environmental impact of their quarries in the Peak District National Park. This led to a study of noise from explosive mine shaft sinking in the, then new, Selby coalfield. A chance meeting between the Coal Board Environmental Officer, who knew of our work, and the senior Meteorological Officer from the Royal School of Artillery resulted in a long telephone call which set the seeds of co-operation on the impulse noise propagation work. With financial assistance from SERC and MoD,



Dr Brüel and Vice Chancellor John Ashworth at the opening of the test facilities in 1986

and practical help from the Meteorological Office and the Chemical and Biological Defence Establishment at Porton Down with a series of field trials, the first prediction model aimed at controlling impulse noise propagation was developed and put into use on firing ranges in the UK and Germany. The MoD fully appreciate the importance of being able to effectively control noise from firing

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Brüel kindly performed the opening ceremony. Bringing the culmination of a major building programme and a conference together at the same time was something of an achievement which required a little 'weekend work' resulting in a certain Professor of Acoustics being harangued by a university cleaner with the words 'geroff the floor, it's wet'.

The move to the Brindley Building meant that many of the department's staff had, for the first time, an office with a window and through that window came sunlight (even in Salford!) and a rejuvenation. The department was moving forward again. Additions to the staff were funded from various sources. There was a so-called 'New Blood' appointment which was financed by the SERC. Then Ferranti funded a lectureship to support someone who could help them with underwater transducer design. Similarly, CEL sponsored a research student so that they could have access to

ranges in the ever 'greening' world and have continued to support research into impulse noise and propagation model development.

Just as things seemed to be sailing along without any submerged rocks damaging the hull, 1982 was celebrated with massive cuts in higher education. Salford University was very badly savaged to the tune of 40%. This is not the time or place to discuss the reasons – it happened.

The department was asked to produce a report on where it would make cuts and how it saw its future. A document was presented to the then Vice Chancellor, Professor John Ashworth, showing that future and increasing income from external sources was assured and that there was no need for any reduction in staff or activity and a modest expansion in secretarial staff was in order. This proposal was accepted but because there had to be a reduction in overall space allocation within the University, Acoustics would have to move into space vacated by Civil Engineering in the Brindley Building, named after the local canal builder. Typical of so many upheavals, the department was allocated money to rebuild its facilities and, thanks to wide-awake staff, funds were also made available to keep the original facilities functioning and providing a service to industry until the new laboratories were up and running. After many years of refusing to even contemplate running the IOA Spring Conference at Salford, Peter Lord was finally persuaded that the opening of the new test facilities should be marked by something special and during the 1986 conference Dr Per

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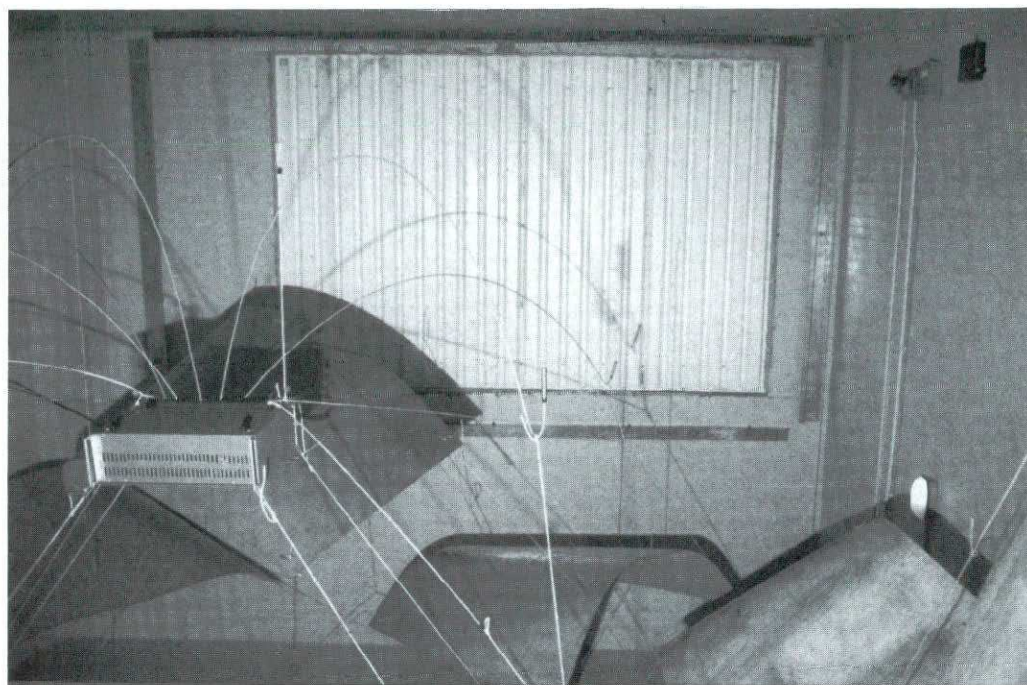
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technical expertise. Research students from far flung parts of the world started to arrive to join the first of our own home bred ones. New research areas were opened up in the field of concert hall acoustics. The many superb models built by a local technician used up much of the available bench space. By now the undergraduate course was attracting twenty or so students a year and staff, now part-time, from the audiology group, a victim of the 'cuts', came to help out with the teaching load and to support our activities in several areas.

The test facilities were now in constant use and it became a serious juggling act to ensure that all the activities, teaching, research and commercial work were accommodated without hindrance. We nearly introduced shift working! Pilkington Glass continued their long term support. The last series of SRI tests (all 500 or so) took place in the old Meadow Road transmission suite and within a few months of commissioning the new suite, Pilkington Glass were back testing their Planar glazing sys-



Inside the transmission suite

tem. The building boom in late 80s saw a succession of elements from prestigious buildings being erected in such places as Canary Wharf, Manchester and Gatwick airports and even the Channel Tunnel, being tested and refined in the laboratory. Research work into methods of measuring the absorption of theatre seats has resulted in a steady stream of such tests including one for the Royal Albert Hall refurbishment. In that instance the tests had to be carried out on a set of existing seats whilst the Hall was 'dark' for a couple of days. They were removed immediately after the last performance and shipped to Salford, tested the following day and returned overnight to London to be refitted for the next performance. They didn't have time to go cold!

The anechoic room was also in constant demand especially during term time in support of the electroacoustics course and also throughout the year for the hearing protector test rig. It was back in 1984 that we had received a phone call from a local personnel protective equipment test house asking about the hire of the anechoic room for the purpose of such testing. Since it was not our normal practice to hire out the facilities to other groups, at first we declined. However the Managing Director of the test house was nothing if not persistent and we eventually discovered that he wanted us to build a four-channel audiometer for the tests and become a NATLAS approved laboratory as well. Conscious of the small market for the tests and the fact



The new teaching post-production studio

that ISVR were also in the game, we still refused. However we discovered that the industry was demanding that there were at least two test facilities available and after discussing the situation with a representative from ISVR, a certain Peter Wheeler, we reluctantly agreed to go ahead with what was to become one of our major services which still operates in co-operation with Inspec. It was a few years before we finally applied for, what had become, NAMAS accreditation. However, following that successful application which resulted in our being the only accredited hearing protector test laboratory in the UK, we decided to expand the accreditation to our other regular testing and the resulting discipline has brought benefits to the laboratory and students alike.

Operating alongside the University's academic work, but as an entirely separate trading entity, is Salford University Business Services. Originally set up within the Mechanical Engineering Department, the company developed to provide a professional service to help market the University's expertise. For some considerable time a small team of professionals had been providing a consultancy service in acoustics, working closely with the department's staff, particularly in the areas of noise control and environmental acoustics.

Having seen us through the aftermath of the cuts and having firmly established acoustics as a major discipline at Salford, Peter Lord, somewhat reluctantly, confirmed his retirement and the search began for his successor. In his words 'it was time we had someone with a business head who would respond properly to the ever increasing questions about finance and efficiency and quality and! flowing from the Registrar's office rather than ignoring them or throwing the memoranda in the bin'. Peter Wheeler, who had successfully led the ISVR Consultancy Services in electroacoustics before becoming marketing director at Racal Acoustics, was offered the job. The combined attraction of moving north and becoming head of a NAMAS approved hearing protector test laboratory was sufficient to persuade him to leave the sunny south and, together with another new member of staff, they brought with them additional expertise in signal processing and electroacoustics which was to prove useful when our undergraduate activities expanded with the introduction of the audio technology course.

From 1990 on, research activities were concentrated into three areas, long range impulsive noise propagation, building acoustics, and active noise control/electroacoustics. In addition to expanding their activities into environmental noise management, the noise propagation team were asked through their NATO contacts to organise and lead an international team of experts on a series of trials in Norway to investigate the propagation of impulse sound through forests. The building acoustics team concentrated their efforts on profile cladding performance prediction and propagation from industrial buildings. The electroacoustics team were involved in active absorbers for aircraft cabin applications, active loudspeakers and the design of voice communications systems together with an EU-funded collaborative research study into test methods for hearing protectors in impulsive noise.

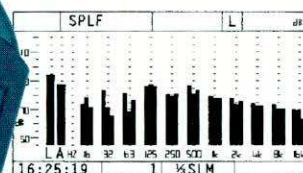
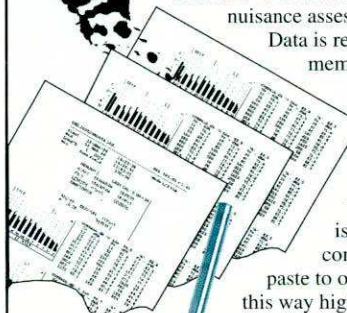
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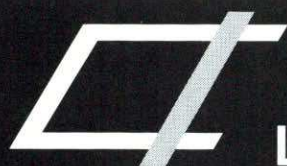
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The new listening room

In 1994 we opened our doors, once again, to the Institute and hosted another successful spring conference. The original plan to hold the annual dinner as a medieval banquet foundered when the service provider went bankrupt. Help was at hand in the form of the executive suite at the nearby Manchester United Association Football Ground and the annual dinner was held there, giving delegates a chance to walk on the hallowed turf during a pre-dinner tour.

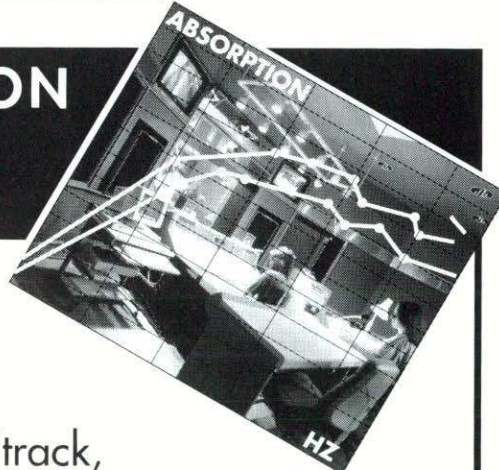
Following changes in higher education funding arrangements and the subsequent squeeze on available resources, Peter Wheeler realised that the department would not survive unless it expanded its undergraduate intake and finally drove us towards establishing a course in audio technology which came on-stream in 1993 trebling the first-year student intake. There followed,



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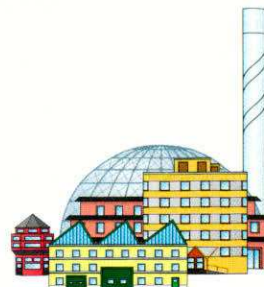
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in 1995, a collaborative venture with the Music Department when the music, acoustics and recording course was started. To support these activities new facilities were commissioned. In 1995 a purpose-made listening room was built to meet international standards and in 1996 the old thermal test rig was converted into two post production studios, one with a digital desk and one with an analogue one, both linked to the listening room and fully fitted out with state-of-the-art equipment. When coupled with the more traditional acoustic test rooms, the size of the investment in support facilities becomes apparent, being close on three quarters of a million pounds.

Further changes were in the offing. To support our rapid expansion two new lecturers were appointed; both were Salford alumni who had been 'blooded' in lectureships for a year or so elsewhere. In 1995 Peter Wheeler was appointed a Pro-Vice Chancellor and Dave Saunders took over as Head of Department, a subtle change in title for the department's leader, that heralded the much expanded 'new' University of Salford, a result of a merger in 1996 with the former PCFC-sector University College. The department changed its name to reflect more accurately its activities and became the Department of Acoustics and Audio Engineering and took responsibility for teaching whilst the research was separated, although still led by Peter Wheeler, to become part of the Telford Research Institute. A part-time postgraduate certificate course in reproduced sound was launched, appropriately, at the 12th IOA Reproduced Sound Conference in November 1996 and received its first students in January

1997. This will be developed into a masters degree in the near future. Links have recently been established with the Charles Keen College, Leicester. This college has experience of producing FE programmes for the audio industry and in 1996 received University of Salford affiliation to provide a foundation year entry route to the audio technology course.

In 1996, including the acoustics entrants on the foundation year in engineering, a total of over 100 first year undergraduates came to Salford to start their career in acoustics and audio engineering. 1997 will see our first audio technology graduates entering industry. Sadly it will also see the retirement of two of the department's stalwarts who have been at Salford since the early 60s. It is the department's intention to recruit two new members of staff in audio engineering, ensuring that there will be a firm foundation for further expansion in this area.

The University of Salford is now the largest provider of graduates in acoustics and audio engineering in the country. Its research group, although small, has a reputation throughout the world and its test facilities are amongst the best there are. Forty years on from the day Peter Lord entered the Royal Technical College, the discipline of acoustics is firmly established at Salford providing a strong base for the future development of the profession in the UK.

Peter Lord HonFIOA is a former President of the Institute of Acoustics and Geoff Kerry FIOA is currently Hon. Treasurer ❖

Urgent notice to members enrolled on the Institute's CPD scheme

Where are your CPD record sheets?

Over 200 IOA members have joined the Institute's Continuing Professional Development Scheme since it was started last year and, as far as is known, have been keeping records of their relevant activities. It is a requirement of the CPD Scheme that these records are submitted to the respective area representatives at the end of each year to be signed off and recorded by the Institute; so far very few records have been received in respect of 1996.

It is important that everyone who has joined the Scheme (irrespective of whether they are registered with the Engineering Council) send their record sheet (two copies if possible), together with a stamped, self addressed envelope, to their representative by 25th April 1997. This should be done even if it has not been possible to accumulate a total of 30 hours of acceptable activities for the year (in fact the aim is 90 hours rolled over 3 years).

This is a particularly important matter for those members who are registered with the Engineering Council, for whom adherence to the Scheme is a mandatory requirement to safeguard their status. For this purpose the Engineering Council has informed the Institute that they intend to visit St Albans in June to inspect the records of a sample of 10% of the IOA members registered with them.

Anyone having difficulties should contact Sue Bird via the Institute office.

ONE-DAY MEETING, 1997 AGM & ANNUAL DINNER

One-Day Meeting organised by the London Branch

The Management of Sound from Public Houses, Clubs and Other Indoor Venues

Church House Conference Centre, London

Tuesday 20 May 1997

Provisional Programme

- 09.15 Registration and coffee
10.00 Welcome by Jim Griffiths member of London Branch Committee and meeting organiser
10.15 Introduction to the topics and discussion of the major issues involved, led by John Hinton, Chairman of the IOA Working Party preparing the relevant Code of Practice
11.15 Coffee
11.45 AN OVERVIEW OF THE NUISANCE AND HEALTH IMPLICATIONS OF NOISE Antony White, Liverpool City Council
12.15 CONTROL OF MUSIC SOUND LEVELS FROM PUBLIC HOUSES Nigel Cogger, Arup Acoustics
12.45 Lunch
2.00 NOISE GUIDELINES AND CONTROL AT ALL NIGHT MUSIC PARTIES Jim Griffiths, David Leversedge & Robert Peirce, Symonds Travers Morgan
2.30 PRACTICAL MEASUREMENT AND CONTROL OF MUSIC NOISE BREAK-OUT FROM SMALL VENUES Andrew Bullmore, Hoare Lea Acoustics
3.00 THE MANAGEMENT OF CLUBS - THE OPERATOR'S VIEWPOINT Melvin Benn, Mean Fiddler Organisation
3.30 Tea
4.00 Discussion
5.00 IOA Annual General Meeting
7.00 Evening cruise and 1997 Institute Annual Dinner. All members and guests are invited irrespective of whether they are attending the technical meeting

Management of Sound from Pubs & Clubs & Other Indoor Venues: 20 May 1997

Name:

Organisation:

Address:

Tel:

Fax:

email:

- ☐ Please register me as a delegate to the one-day technical meeting
☐ Please send _____ tickets for the River Cruise and 1997 Annual Dinner
☐ I require vegetarian meals

Meeting fee which covers lunch and proceedings: ☐ Members £95.00 + £16.63 VAT = £111.63

☐ Others £125.00 + £21.88 VAT = £146.88

River Cruise and 1997 Annual Dinner: £30.00 each including VAT

- ☐ I cannot attend the meeting please send a copy of the proceedings and invoice me for
☐ £12.00 members ☐ £18.00 others

☐ I enclose a cheque ☐ Invoice me for the full amount, as shown above. Fees for bookings cancelled after 5 May will be payable in full.

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CALLS FOR PAPERS

1997 Windermere Conferences
Hydro Hotel, Windermere

Reproduced Sound 13

23 – 26 October 1997

Topics • Digital Broadcasting & Internet Audio • Multi-Media Audio • Loudspeakers: Measurement and Developments • Auralisation and Speech Intelligibility • Recording and Listening Environments • Signal Processing • Control of Entertainment Noise • In-Car Audio •

1997 Autumn Conference

Codes of Practice

(their use and abuse in noise or vibration assessment)

27 – 30 November 1997

Topics include • Whether a particular code is used at all • How it is used • Does it need updating /re-writing? • The question of formal adoption under Section 71 of the Control of Pollution Act 1974 •

The sessions at both conferences will be a mixture of formal presentations and workshops. Offers of technical contributions should be sent in the form of a 100-word abstract to the Institute Office.

MEMBERSHIP

The following were elected to the grades shown
at the Council meeting on 27 February 1997

Fellow

Blauert, J P
Petyt, M

Member

Atkins, B R
Attwood, P E W
Cowling, G
Douglas, W G
Gilbert, C G

Hooper, I G
Howarth, M J
Mercy, S E
Patel, R
Rabouhi, K
Wood, A J

Associate Member

Cannon, A J
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Leino, M A
McNerney, P
Newman, S L
Owen, D G
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Williams, J A

Associate

Davies, K T

Student

Masterson, H R
Murphy, M J
Norris, H

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CONFERENCE NOTICE

Auditorium Design at the Millennium

Wellington Park Hotel and the Waterfront Hall, Belfast

22-24 May 1997

Provisional programme

Thursday 22 May at Wellington Park Hotel: Technical Sessions

• THE GIGO PRINCIPLE APPLIED TO ACOUSTIC MODELLING A James • PRACTICAL EXPERIENCE WITH CONCERT HALL DESIGNS WITH A COMPUTER, FEATURING THE GLASS-WALLED SIGYN HALL OF TURKU, T Lahti and H Möller • DIFFUSION PARAMETERS FOR AUDITORIUM SURFACES T J Hargreaves, T J Cox, Y W Lam & P d'Antonio • COMPARISON BETWEEN THE RESULTS OF OBJECTIVE AND SUBJECTIVE SURVEYS IN A DUAL-PURPOSE HALL C Semidor • THE ACOUSTIC DESIGN OF PALAS, A MULTI-PURPOSE ARENA IN PESARO A Cocchi, P Fausti & G Raffellini • ACOUSTIC DESIGN FOR THE REBUILT ST. AUGUSTINE'S CHAPEL, TONBRIDGE SCHOOL, KENT D Templeton & P Mapp • THE ACOUSTICS OF SHAKESPEARE'S GLOBE THEATRE P Mapp • THE ROYAL ALBERT HALL, PAST, PRESENT AND FUTURE R Metkemeijer • 21 YEARS OF ACOUSTIC SCALE MODEL TESTING M F Barron •

Thursday evening: Dinner at the Waterfront Hall followed by a performance by the Moscow State Symphony Orchestra,

Friday morning 23 May at Waterfront Hall (this will include a tour and musical demonstrations.)

• THE ARCHITECTURE OF THE WATERFRONT HALL V Robinson • WAR AND PEACE OVER 18 YEARS M Carr • THROUGH TIERS TO SMILES; BELFAST'S NEW WATERFRONT HALL L Haslam & A N Burd •

Friday afternoon 23 May at Wellington Park Hotel Technical Sessions

• THE INFLUENCE OF BASIC DESIGN VARIABLES ON THE ACOUSTICS OF CONCERT HALLS; NEW RESULTS DERIVED FROM ANALYSING A LARGE NUMBER OF EXISTING HALLS A-C Gade • SUBJECTIVE PARAMETERS OF MUSICAL ROOMS A Gimenez, A Marin, A Sanchis & J Romero • AN AUDIENCE SURVEY OF CONCERT HALL ACOUSTICS T J Cox & B M Shield • LIVE PERFORMANCE - CATERING FOR SPEECH, SOUND AND SOCIAL CHANGES A Minors • THE BEST REMAINING SEAT B Vaupel • THE ACOUSTIC DESIGN OF THE NEW MANCHESTER HALL: THE BRIDGEWATER HALL R Harris • EXTREMES AND FLEXIBILITY IN ORCHESTRA PIT ACOUSTICS A James • ACOUSTICAL EFFECTS OF USING ORCHESTRA SHELLS IN ITALIAN OPERA HOUSES A Farina, P Fausti & R Pompoli • DESIGNING STAGE CANOPIES FOR IMPROVED ACOUSTICS T J Cox & P d'Antonio •

Saturday morning 24 May at Wellington Park Hotel Technical Sessions

• DEVELOPING AWARENESS AND CONTROL OF SPATIAL SOUND R Essert • CHARACTERISTICS OF SOME MUSICAL INSTRUMENT SOURCES FOR ACOUSTICS SIMULATION AND AURALISATION L Couthon • AUDIBILITY OF ROOM RESPONSE SMOOTHING AS A FUNCTION OF REFLECTION ORDER R Torres, M Kleiner & P Svensson • DESIGN AND PERFORMANCE OF THE AUDITORIUM STRAVINSKY IN MONTREUX M Rossi • THE REVOLVING ACOUSTICS OF THE EDINBURGH INTERNATIONAL CONFERENCE CENTRE K Kyriakides & L Haslam • AN ASSESSMENT OF THE ACOUSTICS OF THE GUILDHALL PRESTON A Moorhouse • ACOUSTICS OF THE HERMITAGE THEATRE IN ST PETERSBURG M Lannie & C Shirzetsky • SUCCESSFUL ACOUSTIC DESIGN BY AN ARCHITECT: VICTOR HORTA AND THE PALAIS DES BEAUX ARTS CONCERT HALL, BRUSSELS D Commins •

Name
Company
Address

Tel: Fax: email:

☐ Please register me as a delegate

☐ Members or authors £330 + £57.75 VAT = £387.75 ☐ Others £380.00 + £66.50 VAT = £446.50

The Conference fee covers participation in all conference activities and includes a concert ticket for the Thursday evening performance, conference proceedings, refreshments, lunch and dinner on Thursday and Friday and lunch on Saturday.

Delegates should make their own hotel reservations; rooms have been reserved at the Conference hotel, please quote 'Institute of Acoustics' when making a reservation. Single room bed & breakfast rate £62.50 inc VAT

A list of alternative accommodation is available on request.

☐ I require vegetarian meals

This form should be returned by 12 May 1997 to the address below. Cancellations after that date will be payable in full.

☐ I am unable to attend the conference. Please send me a copy of the Conference Proceedings ☐ Members £25.00

☐ Non-members £35.00

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INSTITUTE DIARY 1997

- 24 APR**
IOA Publications,
Meetings Committee
St Albans
- 1 MAY**
North West Branch
Joint Mtg with UKELA
TBA
- 1 MAY**
IOA Membership,
Education Committee
St Albans
- 1 MAY**
Acoustics Bulletin
Copy Date (May/June)
- 12 MAY**
IOA Medals & Awards,
Executive Committee
& Council
St Albans
- 16 MAY**
IOA CofC in W'place
Noise Exam
Accredited Centres
- 20 MAY**
**One-day Meeting:
Sound from Pubs &
Clubs etc and
1997 Institute AGM
and Annual Dinner
London**
- 22-24 MAY**
**Conference:
Auditorium Design at
the Millenium
Belfast**
- 22 MAY**
Eastern Branch Evening
Mtg Natural Noise
Control
TBA
- 6 JUN**
IOA CofC in Env Noise
M'ment exam
Accredited Centres
- 13 JUN**
IOA CofC in W'place
Noise Ass't Advisory
Committee
St Albans
- 13 JUN**
IOA Bulletin
Management Boardl
St Albans
- 18 JUN**
Midlands Branch
Evening Mtg
TBA
- 18 JUN**
London Branch
Evening Mtg -
Acoustic Modelling
Methods
NESCOT
- 19/20 JUN**
IOA Diploma Exams
Accredited Centres
- 25 JUN**
I & M Group One-day
Mtg IEC 1672
London
- 1 JUL**
Acoustics Bulletin
Copy Date
(July/August)
- 10 JUL**
IOA CofC in
Environmental Noise
M'ment Advisory
Committee
St Albans
- 16 JUL**
RS13 Programme
Committee Mtg
Peterborough
- 19/22 AUG**
**ISMA '97
International
Symposium on
Musical Acoustics
Edinburgh**
- 2 SEP**
Acoustics Bulletin
Copy Date
(September/October)
- 9 SEP**
Midlands Branch
Evening Mtg
TBA
- 18 SEP**
IOA Publications,
Meetings Committee
St Albans
- 25 SEP**
IOA Membership,
Education Committee
St Albans
- 26 SEP**
CPD Committee &
Branch Represent-
atives Mtg
St Albans
- 2 OCT**
IOA Medals & Awards,
Council
St Albans
- 10 OCT**
IOA CofC in W'place
Noise Exam
Accredited Centres
- 23-26 OCT**
**Conference:
Reproduced Sound 13
Windermere**
- 31 OCT**
IOA CofC in Env Noise
M'ment exam
Accredited Centres
- 1 NOV**
Acoustics Bulletin
Copy Date
(Nov/December)
- 7 NOV**
IOA CofC in W'place
Noise Ass't Advisory
Committee
St Albans
- 12 NOV**
Midlands Branch
Evening Mtg
TBA
- 13 NOV**
IOA Publications,
Meetings Committee
St Albans
- 27-30 NOV**
**Autumn Conference:
Codes of Practice
Windermere**
- 4 DEC**
IOA Membership,
Education Committee
St Albans
- 5 DEC**
IOA CofC in
Environmental Noise
M'ment Advisory
Committee
St Albans
- 11 DEC**
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St Albans
- 16-17 DEC**
**Underwater Acoustics
Group Conference:
Loughborough**

EDUCATION

Certificate of Competence in Workplace Noise Assessment

The following were successful in the February 1997 examination

Amber
Tatchell, D J
Peat, S A

Colchester
Dosanjh, G
Mullins, M A

NESCOT
Alshahwan, A

Chalmers, G B C
Holmes, M
Reeves, G P
Woodgate, T E

Newcastle
Aubrey, R A
Costello, J W
Hagan, P E
Leech, D

Nix, W
Rollins, K E
Shepherd, R

Staffs
Klek, S R
Purcell, P A
Thompson, R B
Wallace, I

EEF Sheffield
Brookes, J E
Carter, D J
Gibbs, B M
North, M R

BELFAST'S WATERFRONT HALL

Alex Burd FIOA

A circular domed building on the banks of the tidal River Lagan (with mud flats exposed twice a day), floating on a bed of Belfast 'sleech' and with a nearby elevated railway and hovering helicopters may not at first sight appear the most desirable place for a new arts and conference centre. However, a major new public building such as this does not come along every day of the week, and so Sandy Brown Associates (SBA) had no hesitation in expressing interest in the project in 1989 and commencing discussion with Robinson and McIlwaine, a local firm of architects, leading up to a commission from Belfast City Council later that year. We joined the architects and theatre consultants (Carr and Angier) who had worked since 1978 to bring the project to life and were able during the next year to develop the general design to a point at which, the decision to go ahead having been taken, a full design team could be appointed. From that point to tenders took only one year. This completed a triad of SBA projects in the Celtic fringe with St David's Hall in Cardiff, the Royal Concert Hall in Glasgow and now the Waterfront Hall in Belfast.

Since that time the situation has improved all the time. The circular domed building comprised foyers, bars and other accommodation wrapped around an auditorium whose shape could be adjusted to our requirements. The River Lagan acquired a downstream weir which maintains a lagoon alongside the hall and, while the marina moorings shown in early artist's sketches never materialised, the environment became that of a 'waterfront hall'. The Belfast 'sleech' was a soft estuarine silty clay which demanded piling but had no more adverse effect than that; and the exclusion of train and helicopter noise and vibration is the normal day-to-day task of the acoustic consultant.

Measurements on a test pile, constructed down to the bedrock, indicated that although train passages were detectable the resulting noise levels in an auditorium would be acceptable. In view of the tight financial restraints the decision was taken not to vibration-isolate the building.

The brief for the project was to provide a prestigious civic building incorporating a concert hall and conference facility to seat 2250 and a minor hall with a capacity of 500. The usage spectrum had to be very wide, ranging from symphonic orchestral to theatrical performances, pop concerts, boxing and snooker matches, exhibitions and major conferences. This required a main auditorium with a world class acoustic, yet with the flexibility which would make it the most versatile in Europe incorporating different floor configurations including an orchestral pit, an arena format and a possible proscenium arch. Most of the requirements have been satisfied but, given the financial constraints, some com-

promises have been necessary.

The architects were impressed by the aesthetic and acoustic of St David's Hall so it is no surprise that the design is reminiscent of that hall. Given the recent accolade awarded to this Hall by Beranek whose book 'Concert and Opera Halls - How do they sound' placed it among the top 11 halls in the world which were included in this survey, this can be seen to have been a perceptive decision!

At 2250, the seating capacity of the Waterfront Hall is greater than the 2000 of St David's Hall, necessitating an increased volume. Because St David's Hall did not quite reach the design RT, the decision was taken to increase the volume even more than the enhanced audience numbers would require. Much of this enhanced volume would be placed above the stage to house the provision of flying facilities for stage use; the remainder was accommodated above the rest of the seating using a partially acoustically transparent ceiling to keep the visual ceiling at the optimum height.

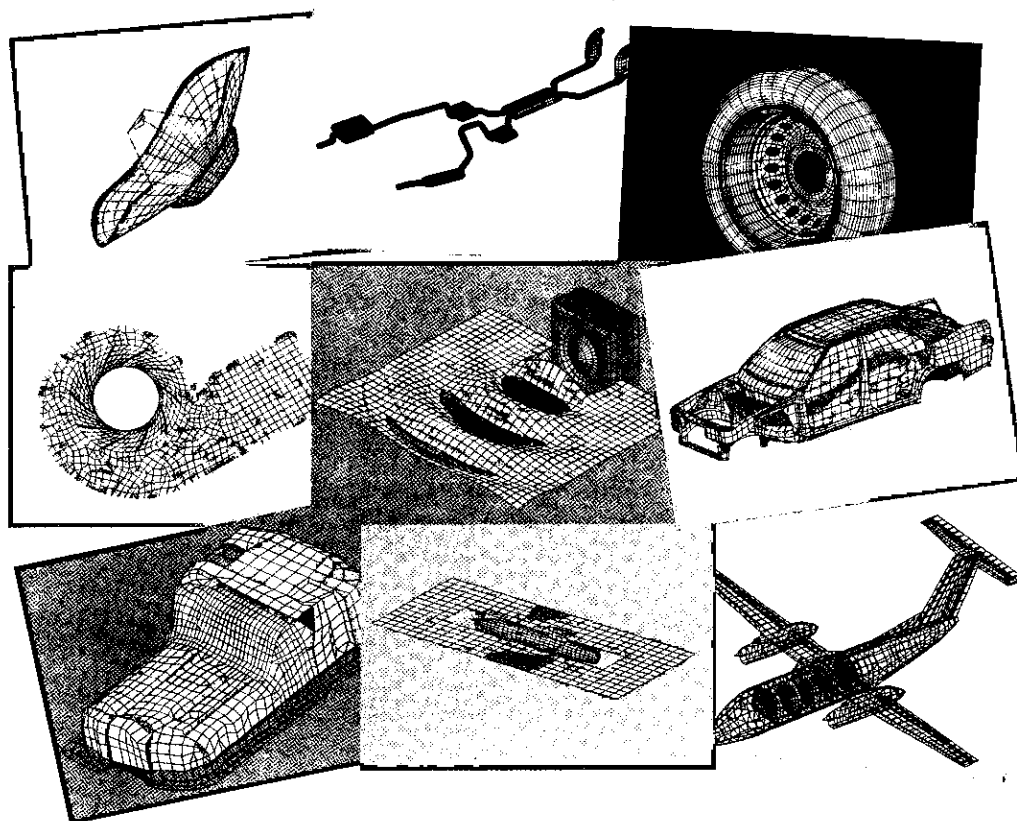
The overall shape of an elongated hexagon was retained with the audience seated in small blocks arranged to give good sight lines. The blocks are much less varied in height in the Waterfront Hall compared to St David's Hall but it is probable even so that the upstands between each seating block contribute to the lateral reflections for listeners.

The visual ceiling is of timber on steel frames. Those parts which are acoustically transparent are of 100 mm slats at 200 mm centres giving a 50% open area but enhanced by openings between each set of frames. Those parts which are to reflect sound to the seating areas are of 12 mm plywood. The preliminary acoustical design of this ceiling positioned specific reflecting areas to supply each of the seating blocks but, of course, looked extremely bitty! The final solution which is seen in the completed auditorium was an architectural solution based on our general ideas and will be seen to give a unified appearance to this element and to mirror the external shape of the building. Additional dish-shaped reflectors over the stage area are adjustable in height and designed to allow members of an orchestra to hear one another for balance and ensemble.

Ventilation is by a displacement system, air being introduced beneath each of the seats and rising by natural convection to extract ducts at ceiling level. The required degree of cooling is reduced by this technique and, given the large number of inlets, the air flow can be at an extremely low velocity. Measurements were made at the manufacturer's test facility in Finland. This type of ventilation system requires the structure to accommodate plenums below the seating tiers and for the seating wagons at stalls level also to be coupled to the ventilation sys-

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- Interior cabin noise modeling
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- 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



The hall at night

The results of these tests suggested that there were improvements necessary to achieve really excellent acoustics. The fitting of model tests into a design programme is always a tricky problem; the design has to be well enough advanced for the model to be realistic but the programme has to be flexible enough to accommodate changes which may be required by the study. I am pleased to say that, while not happy at the prospect, the architects undertook the necessary modifications which required seating tiers to be moved closer to the centre line, splaying of the side walls at rear of stalls and the redesign of the ceiling mentioned above together with a raising of the sections of ceiling above the rear tiers. On re-testing there was a significant improvement in the results which showed that the degree of diffusion had increased, echoes had been eliminated and listening conditions in the rear tiers had been substantially improved.

Sufficient roof weight to exclude external noise was defined at an early stage as a total weight per unit area and the structural engineers were allowed to allocate this weight between the two skins as they wished. Deep three-dimensional beams in a cruciform configuration were needed to span over the auditorium and to reach to the outer edge of the drum; this design allowed one quadrant to accommodate the fly grid without restricting access over the grid. Grouted concrete planks formed the lower surface while the outer roof was to be a dome, designed initially of pre-cast planks but finally built as an in-situ slab in lightweight concrete, with an external dec-

tem and to distribute the air. The system noise control has been extremely successful with design noise levels of NR20 being usefully bettered to NR15 with no additional modifications.

Model studies were carried out by Mike Barron at Bath University at completion of the design which came about the time that the project was going out for tender.

were needed to span over the auditorium and to reach to the outer edge of the drum; this design allowed one quadrant to accommodate the fly grid without restricting access over the grid. Grouted concrete planks formed the lower surface while the outer roof was to be a dome, designed initially of pre-cast planks but finally built as an in-situ slab in lightweight concrete, with an external dec-



Two views from the stage

orative finish of boarding and copper sheet over a ventilated air-space. Thermal movement of all the steel meant that the beams rested on sliding bearings and acoustic sealing of those points around the perimeter of the drum which penetrated the sound insulating skin proved to be a major challenge requiring large areas of plasterboard and the application of some ingenuity and care.

An additional performance space in the foyer necessitates good sound insulation between the foyers and the auditorium. Double doors with effective compression seals and acoustically treated lobbies were therefore incorporated in the design.

The Minor Hall (now known as The Studio) is a very simple but adaptable space intended for a wide range of performances. While music rehearsals and chamber groups may feature occasionally in the schedule, it is probable that drama and other speech related activities will be more common. Thus, while the space can be kept reasonably live with bleacher seating retracted, it will be much more dead when occupied by an audience of five hundred. In addition retractable panels surrounding the space at floor level can be rotated to show reflecting or absorbing faces and fabric drapes at high level can be manually extended to introduce a moderate amount of absorption.

Plant space is concentrated in two major (sensitive) areas; immediately above the minor hall and at upper level surrounding the auditorium. The minor hall, and particularly the plant space above, is constructed as a steel framed building with the upper (plant) areas having the steel frame isolated by resilient bearings. Additionally, to give added air-borne sound insulation, a jack-up floor was built over the concrete slab forming the ceiling of the Hall. Individual items of plant are, of course, seated on anti-vibration bearings on the major steel members. All pipe and ductwork is resiliently hung.

The block walls separating the main building plant rooms from the auditorium are double skin dense concrete blocks having no wall ties and with the outer skin tied to the adjacent columns with resilient wall ties. All walls are plastered on the auditorium side. The auditorium is well isolated from external noise, partly by the surrounding accommodation, but also protected from building noises by double skin walls and ceiling.

The wide range of activities in addition to concerts will benefit from deader acoustic conditions in the auditorium and to provide this a limited area of acoustic absorbing curtains at high level behind the two lighting bridges can be drawn out. These are in fact motor operated and form part of the smoke containment system in the event of a fire. In that case, they are supplemented by additional curtains hanging below the lighting bridges which prevent smoke spreading to the rear of the auditorium. The main technical provision to overcome the live acoustic is, however, a highly directional speech reinforcement system which, while normally retracted above the ceiling line, can be lowered to its design level from which point it directs sound to each of the seating areas with a minimised spill into the reverberant field. A second high-powered but non-directional sound system for pop use

has also now been installed.

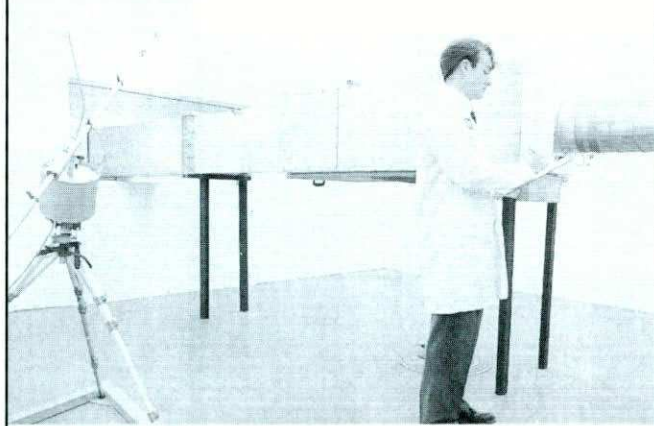
In order to open up the stalls area for promenade concerts and similar arena events the greater part (some 600 m²) of the stalls seating is mounted on wagons which can be removed from the auditorium on air castors to create a large open space. The entire stalls floor so exposed can be adjusted in height by screw jacks in addition to the front stage section which can be dropped to form a pit. A suspended, retractable proscenium of plywood and fabric is being constructed for theatrical performances. There is a platform provided for the later addition of an organ.

Acoustic measurements have been carried out and confirm that the reverberation time has been well maintained at some 2 seconds in the occupied auditorium; this value increases towards the low frequencies to give a warm sound quality. Much analysis remains to be done and it is intended that fuller information will be available at the Institute's conference on concert hall acoustics to be held in Belfast in May.

During the limited orchestral experience so far, the auditorium has received rave reviews. The liveness of the acoustic and the sense of surround sound have been commented on while a remarkable degree of intimacy is achieved in the rear tiers.

The acoustic consultants to the project were Sandy Brown Associates (Alex Burd FIOA, Laurence Haslam MIOA and Stephen Stringer MIOA). Sandy Brown Associates are members of the Association of Noise Consultants. ♦

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Tel: 0161 866 8800 Fax: 0161 866 9455

THE CONSTRUCTION (DESIGN & MANAGEMENT) REGULATIONS 1994 AND ACOUSTIC CONSULTANCY

Andrew J Asbury AMIOA

The Construction (Design and Management) Regulations, more commonly known as the CDM Regulations, have been in force for some time now, but there is still much debate as to their interpretation and the requirements of designers. It is likely that members of the acoustic consultancy profession may have heard some talk of these regulations, come across somebody calling themselves a 'Planning Supervisor', but otherwise have chosen to remain blissfully ignorant. This article will hopefully tell you everything you need to know about how the CDM Regulations affect your everyday business and how to avoid anything up to a twelve month prison sentence!

The wisdom behind the CDM Regulations is to shift some of the responsibility for health and safety from contractors to designers. In the past, health and safety was almost solely the domain of on-site contractors, which put workers at unnecessary risk when implementing bad designs. Health and safety should be in the mind of the designer along with issues such as performance, cost, appearance etc and should really hold equal importance.

Unfortunately, don't think that being an acoustic consultant or engineer doesn't make you a designer! The legal definition of a designer is somebody who 'carries out design work', 'prepares specifications', and 'prepares bills of quantities'. The second point may trap acousticians unawares and the last point has caused much displeasure in particular amongst the quantity surveyors of this world, who would never before have dreamed of calling themselves designers. It may even be possible to cite your client as being a designer if you are faced with such strict specifications that the scope of your design is limited, though brace yourself for some tough legal arguments.

So, if you cannot wrangle out of the Regulations through not calling yourself a designer (and I very much doubt you can) there are other recourses in that the Regulations only cover construction work on a 'structure' that involves more than 5 people, or lasts longer than thirty days. And if this has cheered you up, bare in the mind the HSE has a list of definitions of a structure currently two pages long, and that the regulations could be referred to in civil cases as a standard code of practice of which you should be aware, regardless of the size of the job.

If you're still convinced that the CDM Regulations do not apply to you, please do not feel the need to read further, though please feel free to share your reasoning with me! I am sure that by now you can think of jobs over the past few months where these regulations applied to you personally: the specification of acoustic hardware on a newbuild project, or maybe just the design of a large acoustic enclosure (which should be considered a structure).

So what needs to be done to ensure compliance with the Regulations? The first step for a designer is to be

appointed by a client (although the regulations are very sneaky by applying whenever a designer prepares a design to be used for construction work, regardless of the existence of a client). The client has a responsibility under the Regulations to ensure that the designer is 'competent' to complete that design and should be able to show that reasonable steps were undertaken to ensure the designer's competence on health and safety issues. Paragraph 35 of the Approved Code of Practice 'Managing Contractors for Health and Safety' identifies the following points to look for when assessing competence:

- Membership of a relevant professional body
- Familiarity with construction processes in the circumstances of the project and the impact on health and safety (within reason)
- Awareness of relevant health and safety legislation and appropriate risk assessment methods
- The health and safety policies of the designer as an employer, and for work carried out
- Identities of the people who will carry out the work including the review of the design, their skills and training
- The time allowed to fulfill the various elements of the designer's work (where appropriate)
- The technical facilities available to support the designer, particularly in the circumstances of the project. This is deemed as especially important in small companies
- The method of communicating design decisions to ensure that the resources to be allocated are clear. ('resources' are defined as time, plant, equipment, technical facilities and personnel)
- The way in which risks left in the design will be communicated.

Please make sure that you can show most of these things on demand for a client. If there is anybody out there who still does not have a Health and Safety policy for their employees written down it really is time to get one.

The duties for the designer are contained in Regulation 13 of the CDM Regulations. The first duty is for the designer to make sure the client is aware of his / her duties before undertaking any design in respect of any project. It is doubtful that many companies in the construction industry fulfill this requirement save the Planning Supervisor.

The second and most important duty is, when preparing a design, to avoid foreseeable risk for as many people involved in the construction process as possible, combat risks at source, provide information on any remaining risks and co-operate with the planning supervisor and any other designer involved in the project.

The third duty provides a standard 'reasonably practicable' caveat that defines the areas of knowledge that a

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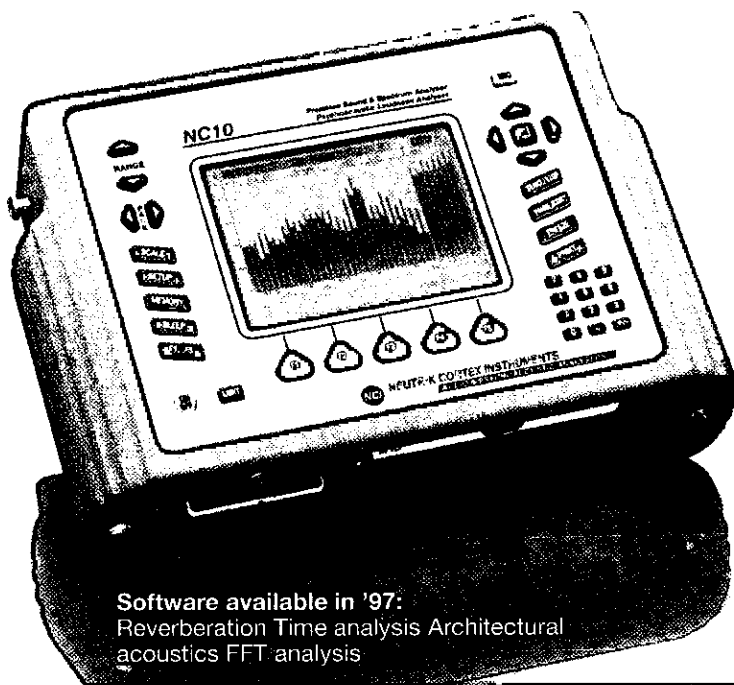
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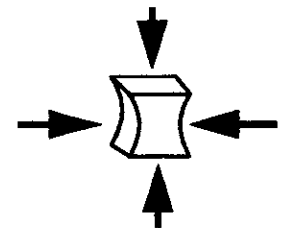
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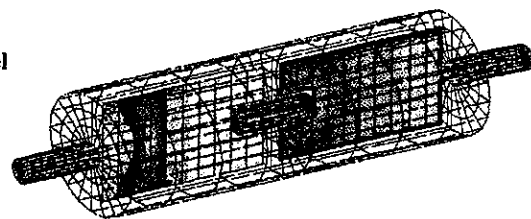
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RISK ASSESSMENT DETAILS							
Site: ABC Construction							
Hazard	Persons at Risk	Eliminate by Design?	Substitute?	Remaining Hazard	Solutions Considered not Reasonably Practicable	Inform?	File Note Number
Manual Handling of Blocks	Contractor	No	No	Manual Handling	Double Skinned Wall	Planning Supervisor	A1

Fig. 1. A typical risk assessment form

designer is expected to realise.

The first step when thinking about these issues is not to panic. The CDM Regulations are not supposed to invite writing two pages on the dangers of lifting bricks nor should they involve indicating a risk of finger injury during installation of a nail (both of these are true examples). It is perfectly safe to assume that contractors are competent and do not need obvious risks pointing out to them. Nor do we need to tell the contractor how to do his job. It is instead our new responsibility to design out as many risks as we can and, when we cannot, to make sure that we point out the risks that are not obvious. This is normally done by a risk assessment form. A typical assessment form is shown in Figure 1.

Now, let us assume we are on the design team for a new nightclub, with residential properties nearby. As such, we are responsible for some major design decisions. We require the nightclub to be constructed of a high density concrete block, to ensure acoustic performance of the wall structure. There are risks associated with this decision: Dense blocks can be difficult and dangerous to lift, are more likely to cause harm if dropped than standard building bricks, and entail more frequent rebuilding of scaffolding as they cannot be lifted as high by a builder.

These risks should be addressed in the following way: (i) can the risk be eliminated, (ii) can a substitution be effected? It may be possible to effect a substitution by replacing the dense block with a double skinned brick wall. However, our primary concern has to be acoustic performance, if the double skinned wall is not satisfactory the dense block wall remains, it is the residual risks that need to be identified to the Planning Supervisor in a manner not dissimilar to that shown in the risk assessment form. It is important to remember that safety is just one issue and is no more important than any other.

The Planning Supervisor's job is then to correlate all the remaining risks to form a Health and Safety plan for construction. Note that a scaffolding strategy has not been produced, nor have any suggestions for handling the dense block. These points are up to the contractor to work out, we have merely had to identify an important hazard that we cannot design out.

Perhaps now it can be seen more clearly the additional scope of responsibility the designer has. With a little thought about the use of materials, the scope of substitution, manual handling problems and the necessity of working at height it is perfectly reasonable to identify all

the risks that implementing our designs will involve. This process should be considered for construction, maintenance and demolition.

It is difficult to predict how long the CDM Regulations will be with us. They have had a major impact on construction work, creating a specific new role of 'Planning Supervisor', it is doubtful that these people would want to see the regulations vanish! The basic premise of putting safety in the mind of the designer is sound, though at first sight it may be seen as just another sheet of paperwork. Perhaps in the short term this extra time and paperwork may cost our industry money, though the longer term will produce safer products and sites. Notwithstanding this, the CDM Regulations are the law of the land and we all have new responsibilities that need facing.

Andrew Asbury AMIOA is with PDA Ltd, a member of the Association of Noise Consultants ♦

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Institute Code and Rules of Conduct

Revised Document agreed by Council on 27 February 1997

Preamble

In the Institute's Articles of Association there is a general requirement for members* to be bound to further the aims of the Institute to the best of their abilities. The standing of the Institute is enhanced if its members are not only well qualified, but also have a professional commitment to a standard of excellence in their work and in their dealings with other people.

A Code of Conduct designed to embody broad ethical principles is necessarily drawn up in general terms. The Rules of Conduct indicate the manner in which members are required to conduct themselves in most situations. For situations not specifically encompassed by the Rules, the principle to be followed is that, in any conflict between a member's personal interests and those of the wider community, the latter should take precedence.

Any person who wishes to bring a complaint or information relating to alleged improper conduct or breach of the Institute's Code and Rules of Conduct should contact the Chairman of the Membership Committee who will follow a defined procedure.

Code of Conduct

Every member of the Institute shall at all times so order his conduct as to uphold the dignity and reputation of his profession and of the Institute of Acoustics and to safeguard the public interest in matters of safety, health and the environment. He shall exercise his professional skill and judgement to the best of his ability and discharge his professional responsibilities with integrity.

Rules of Conduct

For clarity, these rules have been grouped into the principal duties which all members should endeavour to discharge in pursuing their professional lives.

Professional Competence and Integrity

1. A member has a responsibility to upgrade his professional knowledge and skill and shall maintain an adequate awareness of technological developments, procedures, standards, laws and statutory regulations which are relevant to his field and shall encourage his subordinates to do likewise by involvement in the Continuing Professional Development activities of the Institute of Acoustics or by other means.

2. A member shall not knowingly act for a client for whom another member is acting in the same matter until either the first contract has been determined by the client or the other member has consented to his acting. A member approached by a client and asked to give an opinion on the work of another shall seek an assurance that the first member is aware of the second member's involvement.

3. A member shall not maliciously or recklessly injure or attempt to injure, whether directly or indirectly, the professional reputation of another.

Public Interest

4. A member shall not do anything, or permit anything under his authority to be done, of which the probable and involuntary consequences would, in his professional judgment, endanger human life or safety, expose valuable property to the risk of destruction or serious damage, or needlessly pollute the environment, except when legally authorised to do so.

5. In his work, a member shall respect all relevant laws and statutory regulations.

Duty to Employers

6. When discharging his professional duties a member shall:

(a) satisfy himself as to their scope, obtaining in advance any necessary clarification or confirmation, and shall not accept professional obligations which he believes he has not sufficient competence or authority to perform;

(b) accept responsibility for all work carried out by him, or under his supervision or direction, and shall take all reasonable steps to ensure that persons working under his authority are competent to carry out the tasks assigned to them and that they accept responsibility for work done under the authority delegated to them;

(c) give advice that is objective and, as far as practicable, reliable and if this advice is not accepted, take all reasonable steps to ensure that the person who over-rules or disregards his advice is aware of the possible consequences;

(d) disclose to his client or employer any benefits or interests that he may have in any matter in which he is engaged on their behalf;

(e) neither communicate to any person, nor publish any information or matter not previously known by him or published in the public domain, which has been communicated to him in confidence by a client or employer without the express authority of that client or employer;

(f) not offer or give or receive any inducement (financial or otherwise) to or from a third party in return for the introduction of clients or professional assignments without making such action known to the client.

Procedures

In the event of a complaint or the bringing to his notice of information relating to alleged improper conduct or breach of the Institute's Code and Rules of Conduct, the Chairman of the Membership Committee shall appoint from the members of the Committee a member or members to carry out an investigation into the facts of the submission and report to the Chairman. If he deems it appropriate a meeting of a Disciplinary Panel will be convened which reports back to the Chairman. The Disciplinary Panel shall comprise all members of the Membership Committee excluding any with a direct interest in the case.

The Chairman of the Membership Committee reports the findings to Council which shall determine the appropriate course of action. Where dismissal is considered to be

appropriate, the member has a right of appeal to Council and subsequently to a General Meeting as defined in the Articles of Association.

Council shall arrange for all interested parties to be informed and may, at its discretion, publish the results.

* In these rules 'member' means a member of any class referred to in the Bylaws and 'employer' includes client. All references in the masculine gender shall apply equally to women. Chartered Engineers and Incorporated Engineers are also subject to the Code and Rules of Conduct of the Engineering Council.

Sponsor Membership

Revised Document agreed by Council on 27 February 1997

The Institute of Acoustics, established in 1974 as the professional institute for acousticians, can form a unique vehicle for communication between manufacturers and suppliers of acoustic equipment or materials and potential buyers or specifiers of their products. The whole field of acoustics depends on having a strong well informed commercial section to assist both the academic centres and the various consultancies carry out their research and projects; both of which are equally important and will enable future generations of acousticians to take the art forward.

In addition to producing the bi-monthly Acoustics Bulletin and the annual Register of Members in which manufacturers can publicise their wares either by advertising or editorial, the Institute has three grades of commercial sponsorship which offer significant advantages in return for a relatively modest fee.

Key Sponsor

This is the premier grade of sponsorship and is only available by invitation from the Institute's Council to those companies who are in the mainstream of acoustic activity and who are regularly engaged with Institute events to take up this grade of sponsorship. Key Sponsors pay a fixed fee every year and in return for this they get enhanced benefits related to their involvement with IOA activities.

Sponsoring Organisation

The grade of Sponsoring Organisation was first introduced in 1989 and is open to companies and organisations with a substantial involvement in the field of acoustics. Election to this grade allows companies and organisations to show their support for the work of the Institute and at the same time enjoy certain membership benefits.

An interested company or organisation submits a confidential application to the IOA Membership Committee which, having satisfied itself as to the suitability of the applicant, recommends to the IOA Council that the status of Sponsoring Organisation be conferred.

Sponsoring Organisations of the Institute pay an annual fee which is set by the Council and is related to the number of staff within the organisation who are actively involved in the field of acoustics.

The benefits available to Sponsoring Organisations are

as follows:

- A discount of 20% on the fees for exhibiting at a second and subsequent Institute meeting or conference attended during a calendar year.
- A discount of 20% on the delegate fee (members rate) otherwise payable for up to five staff attending any meeting or conference of the Institute.
- One free delegate at the Institute's Spring Conference (or whatever event may be deemed from year to year to replace it)
- Distribution of the Sponsoring Organisation's relevant literature at any Institute meeting or conference.
- One nominated staff member to receive all Institute all general mailings and one copy of each issue of the Bulletin and of the Register of Members.
- The use of the special IOA Sponsor logo or the words 'A Sponsoring Organisation of the Institute of Acoustics' on any literature etc.
- A listing in every issue of the Bulletin, at all venues where the Institute has a display and in the Institute's Register of Members.

Institutional Subscriber

This grade of Sponsor Membership is directed primarily towards Institutional Departments such as an Local Authority Environmental Health Department or an Educational Establishment which has an involvement in acoustics and wishes to be routinely informed of the Institute's activities.

Institutional Subscribers pay an annual fee which is set by Council and this attracts benefits as follows:

- A discount of 10% on the delegate fee (members or non-members rate as applicable) otherwise payable for up to two staff attending any meeting or conference of the Institute.
- One nominated member of staff to receive a copy of each issue of Acoustics Bulletin, all other mailings to members and the Institute's annual Register of Members.
- Inclusion in the listing as Subscribers in the Institute's annual Register of Members.

Fees

Fees for the various grades of Sponsorship are determined annually by the IOA Council. For 1997 these are:

Key Sponsor £2,750 plus VAT

Sponsoring Organisation

(a) Organisations with 15 or more staff involved in acoustics £800 plus VAT

(b) Organisations with less than 15 staff involved in acoustics £600 plus VAT

Institutional Subscriber £100 plus VAT

Conditions

The Institute's By-laws, Articles of Association and Code of Conduct are deemed to apply to Sponsor Members. The Institute of Acoustics reserves the right to refuse to exhibit, publish or distribute any material that is deemed to be inappropriate, offensive or defamatory. ♦

The Noise Act 1996

London, 12 February 1997

The Noise Act 1996 introduces a new night noise offence and a new procedure for the confiscation of noise-making equipment. The importance and topicality of these measures against the problems of neighbour noise were such that 104 delegates attended this one-day meeting at the Commonwealth Conference Centre in west London, a joint venture of the Institute's Measurement & Instrumentation and Environmental Noise Groups. Richard Tyler of CEL Instruments and Colin Grimwood of the Building Research Establishment were the meeting organisers.

Institute President Bernard Berry opened the meeting, and welcomed the Under Secretary of State for the Environment James Clappison, who described the background to the Act (*his address to the meeting is set out on page 5 of this issue*). The Minister pointed out the rapid increase in complaints about noise and the consensus wish for workable remedies. The new night noise offence, based on an objective standard, is one such remedy. Local Authorities may choose whether or not to adopt this criminal offence, and its effectiveness in dealing with complaints will be considered in a review in two years time.

The provisions of the Act were detailed by Stephen Benton (Department of the Environment), who set out the requirements for local authorities that adopt the night noise offence, stressing the discretion and flexibility available in the investigation of complaints and imposition of penalties. He addressed some concerns raised during the consultation process, including the resources required to implement the new offence, and the intention that the new offence will complement existing statutory nuisance measures.

The night noise offence is based on an objective standard based on noise measurements described in a measurement protocol. A document will shortly be issued by the Secretary of State setting out the procedural details and Colin Grimwood reviewed BRE's involvement in developing and refining the protocol.

As described, the investigating officer must measure both the noise emitted from the offending dwelling and also what is termed the underlying noise level which describes the noise level in the complainant's dwelling during pauses in the noise at issue. The permitted level of noise is 35 dB where the underlying noise level does not exceed 25 dB or 10 dB above it in all other cases. The DoE is currently revising the text to take account of comments concerning the noise levels, the measurement procedure and the requirements for the instruments and their calibration.

Two representatives of local authorities presented opinions and views on adoption of the Act. Keith Horton (North Somerset District Council) pointed out a perceived gap between the desire of the general public for action against noise problems and the reluctance of many local

authorities to adopt the Act. Keith recognised the likely costs for authorities of providing comprehensive night noise services (although the necessary provision would obviously depend on public demand), and potential difficulties in enforcement, although a previous field test had seemed satisfactory. Des Waters (London Borough of Southwark) considered the implications of the Act for the management of noise control services; issues of resources, staffing and safety were highlighted, along with the effectiveness of statutory nuisance action in response to complaints about noise. Despite their misgivings, both speakers welcomed the Act as a positive step, which would alert even sceptical authorities to the need to review their approaches to noise problems.

The afternoon session featured half-hour workshop sessions on the measurements required by the Act, led by three IOA Sponsor Members: Brüel & Kjær, CEL Instruments and Gracey & Associates (UK representatives for Norsonic). The delegates moved in groups between the three workshops to allow first-hand examination of the instrumentation and for questions to be put to the presenters. Topics covered included the likely calibration requirements for the equipment, the need to exclude 'unwanted' noise events from the measurement period and correct use of the measured data to verify the offence.

Both the morning and afternoon sessions concluded with open discussions led respectively by Stephen Turner FIOA of Stanger Science and Environment (Chairman, Environmental Noise Group) and Richard Tyler FIOA of

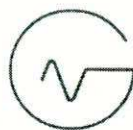
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Left to right, the President, Mr Clappison, Richard Tyler and Stephen Turner

the Institute's offices. Jo Edwards and Helen Goddard from AMS Acoustics assisted Peter Barnett put on a number of measurement exercises in that acoustically interesting space which had until recently seen service housing the local Crown Court.

The investigations covered direct-to-reverberant ratio (practically and theoretically), source directivity, reverberation time and speech intelligibility. Measurements were even made in the dock where the Rouse car murderer reputedly stood rather late on in his life; did the jury really hear, and if they heard did they understand, what the witnesses were saying from the witness box?

The course is visible evidence of the growing links between the Institute of Acoustics and the Institute of Sound and Communications Engineers; it is interesting that the latter has taken steps to accept attendance on this course as satisfying part of the tuition requirements for their new Certificate and Diploma

Programmes in Sound Reproduction Engineering. These qualifications will have a considerable part to play in qualification for various grades of membership of that Institute.

Roy Lawrence FIOA

CEL Instruments (Chairman, Measurement & Instrumentation Group). The presenters answered questions on subjects ranging from the Secretary of State's powers to require local authorities to enforce the Act, to precise details of the reporting of the measured noise levels. The combination of presentation, workshops and discussions was well received and the delegates enjoyed a day that was helpful and informative about the many issues that the Act has raised.

Peter Hanes MIOA

Acoustics for Sound System Engineers

St Albans, 1/2 March 1997

This week-end course, organised in collaboration with the Institute of Sound and Communications Engineers, took place at the Institute's offices in St Albans. Part of the Institute's meetings programme, it was a continuation of a series of similar courses put on in parallel with recent Reproduced Sound conferences in Windermere.

The course attracted the maximum enrolment of ten delegates and there is a waiting list for July when it will be offered again. The tutors were Peter Barnett of AMS Acoustics, Dr Paul Darlington of the University of Salford and Roy Lawrence of the Institute office staff.

Tutorial sessions were held at St Albans all day Saturday and Sunday and these were supported by audio and video demonstration material and practical exercises. The delegates were generally surprised to experience the {1,1,0} (or was it the {1,0,1}?) mode in the Institute's library.

There was a practical session on the Saturday evening at the St Albans Town Hall, conveniently 800 metres from

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Hansard

4 February 1997

Noise Act 1996

Mr Harry Greenway: To ask the Secretary of State for the Environment what (a) guidance and (b) resources he is giving to local authorities in respect of the implementation of the Noise Act 1996; and if he will make a statement.

Mr Clappison: My Department will be issuing a circular to local authorities to give guidance on the implementation of the Noise Act 1996.

We have estimated that the overall additional cost to local authorities in England to enforce the night noise offence would be in the region of £1 million in 1997-98, rising to £3 million in 1999-2000. This assumes a gradual rate of adoption and takes account of the extent of out of hours noise services currently being provided. This was taken into account in the 1997-98 local government finance settlement and in the baselines for future settlements.

19 February 1997

Road Noise Reduction

Lord Moran asked Her Majesty's Government:

What progress is being made with the use of whisper concrete, porous asphalt or other materials to reduce road noise.

The Parliamentary Under-Secretary of State Department of Transport (Viscount Goschen): This is an operational matter for the Highways Agency. I have asked the Chief Executive, Mr Lawrie Haynes, to write to the noble Lord.

Letter to Lord Moran from the Chief Executive of the Highways Agency, Mr Lawrie Haynes, dated 19 February 1997. *The Parliamentary Under-Secretary of State has asked me to reply to your recent question about progress being made with the use of whisper concrete, porous asphalt and other materials to reduce road noise.*

Whisper concrete was included within the agency's specification in 1996 and porous asphalt in 1993. They are now available as options for the construction of trunk roads and are specified where they are technically suitable and where it is cost effective to do so. Whisper concrete has been used on a section of M18 and of the A50. Porous asphalt has been used on sections of M1, M6, M25 and M40, as well as on several all-purpose trunk roads.

Usage has been limited, particularly of porous asphalt because of drawbacks, including higher cost and lower durability. These are being addressed as part of the agency's research programme. Improvements have already been made in durability of porous asphalt, allowing it to be used on more heavily trafficked roads, although the cost is still significantly higher than for conventional materials.

Further research has been carried out into alternative road surfaces which offer reduced noise compared with conventional asphalt and concrete, while providing better value for money than porous surfaces. Work is still progressing, although two materials are already permitted as alternatives to conventional surfaces. It is expected that further materials will emerge from this programme of research.

20 February 1997

Low-Flying Military Aircraft: Noise Study

Lord Wise asked Her Majesty's Government:

What is the conclusion of the study commissioned in co-operation with the US and Canadian governments into the feasibility of epidemiological research to examine a possible linkage between noise from low-flying military aircraft and adverse health effects.

Earl Howe: The study, commissioned with the Institute of Sound and Vibration Research of the University of Southampton, as prime contractor, supported by the National Physical Laboratory and the Medical Research Council, was completed in December 1996. Because of the wide dispersion of military low flying, and the infrequency of exposure to noise from this source by the average person, the study concluded that it would not be practicable to carry out a meaningful epidemiological study of the effects of noise from low flying military aircraft on the health of overflown populations. Statistical calculations suggested that an initial sample of at least 20,000 people would need to be included in any study population; however, in order to allow for confounding factors and uncertainties in the pattern of exposure, the size of the study population would have to be increased by a factor of between five and 10.

A comprehensive field validation study carried out in the Vale of Evesham found that the daily noise exposure in the most heavily over flown areas did not exceed that experienced by over a quarter of the population of England and Wales from general ambient noise. No indi-

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vidual aircraft event exceeded 120 dB(A) L_{Amax} , and the majority of events were below 100 dB(A). This reaffirms our belief that, although the restrictions placed on the heights, speeds and operating procedures of military aircraft are designed to ensure that noise levels on the ground do not exceed 125 dB(A), a level which research suggests provides a margin of safety to human hearing, in practice any exposure to noise from military low flying is likely to be significantly lower.

Copies of a composite document comprising reports of ISVR and the MRC, and an executive summary by the tri-national steering committee have been placed in the Library of the House.

My department will continue to be involved in scientific research on noise and health. Should new research suggest a linkage between military low flying and adverse health effects, we will consider what changes to our aircraft operating procedures should be made. In the meantime, we firmly believe that they reflect the best available scientific and medical advice.

26 February 1997

Noise Pollution

Mrs Helen Jackson: To ask the Secretary of State for the Environment (1) what is the nature and terms of reference of the work commissioned by his Department to study the impact of noise pollution in the countryside; who has the contract for this work; when it commenced; and when he expects a report to be (a) completed and (b) made public; (2) at which locations and for which activities testing for noise has taken place in South Yorkshire as part of his Department's investigations into the impact of noise pollution in the countryside; (3) what plans his Department has to consult local environmental groups in areas where his Department is testing for noise pollution.

Mr Clappison [holding answer 24 Feb 1997]: In March 1996, the Building Research Establishment was contracted by my Department to recommend a suitable technique for the measurement and assessment of noise from clay target shooting, taking into account its impact on local communities. The recommended technique will be incorporated into a new code of practice on minimising noise from clay target shooting being prepared by the Chartered Institute of Environmental Health, the Clay Pigeon Shooting Association and the British Shooting Sports Council.

The research involves the measurement of noise from 16 shooting sites in England, together with surveys of the reaction to the noise of residents living close to the sites. In South Yorkshire, measurements and surveys have been undertaken in Grenoside, Sheffield. The research does not involve consultation with local environmental groups.

The work is expected to be completed by the end of March 1997. My Department's policy is that, unless there are overriding reasons to the contrary, research findings are published as soon as possible after completion of the project.

4 March 1997

Noise Pollution

Mr Harry Greenway: To ask the Secretary of State for the Environment what research his Department is currently

undertaking into noise pollution; and if he will make a statement.

Mr Clappison: My Department is currently funding the following noise research work:

Domestic noise complaints as seen by local authorities and those complained of: Noise climate assessment: a review of national and European practices: Clay target shooting: establishment of noise measurement methodology: Review of the take-up of the new night noise offence in the Noise Act 1996 – phase 1: survey of local authority practice in dealing with domestic night noise complaints as at October 1996 to provide a baseline for studying the take up and workings of new offence: Technical advice to the Department on acoustic issues.

6 March 1997

Noise Maps

Mr Meacher: To ask the Secretary of State for the Environment what plans he has to fund the development of noise maps.

Mr Gummer: The Government remain to be convinced that national noise mapping would be a cost effective use of resources. My Department has, however, recently commissioned research to study local authority practice in noise assessment and mapping, and the costs involved.

20 March 1997

Transport Council

Mr Patrick Thompson: To ask the Secretary of State for Transport if he will make a statement on the Transport Council held in Brussels on 11 March.

Sir George Young: The Transport Council met in Brussels on 11 March. My noble Friend the Minister for Aviation and Shipping represented the United Kingdom.

The Council also reached political agreement on an amendment to directive 92/14 on aircraft noise. Its main effect is to update the list of aircraft from developing nations exempted until 2002 from the phase-out of some noisier aircraft.

Extracts provided by Rupert Taylor FIOA.

BSI News

New and revised British Standards

Handbook of audio and video symbols

BS 7946: 1997. Details graphical symbols to be used on equipment and systems in the field of audio, video and audiovisual engineering. No current standard is superseded.

Connectors used in the field of audio, video and audiovisual engineering

BS 7947: 1997. Gives guidance on identification and application of connectors to be used in conjunction with BS 6840: Part 11 and definitive electrical and mechanical standards, such as IEC 130, where these exist. No current standard is superseded.

Specification for the verification of sound level meters

BS 7580: Part 2: 1997 Shortened procedure for type 2 sound level meters. Specifies a shortened verification test procedure for type 2 sound level meters which are used for gen-

eral field applications. No current standard is superseded.

Amendments to British Standards (replacement pages)

BS 6402: 1994 Electroacoustics – Specifications for personal sound exposure meters [IEC 1252: 1993] Amendment No. 1. Gr 2 AMD 9323. Note: This amendment implements EN 61252: 1995 as a British Standard and rennumbers BS 6402: 1994 as BS EN 61252: 1997.

BS 7580: 1992 Specification for the verification of sound level meters. Amendment No. 1. This amendment rennumbers BS 7580: 1992 as BS 7580: Part 1: 1996 'Comprehensive procedure'.

BS EN 60094 Magnetic tape sound recording and reproducing systems BS EN 60094 -7: 1994 [BS 6288: Part 7:1994] Specification for cassettes for commercial tape records and domestic use [IEC 94 -7: 1986] Amendment No: 1 Gr 2 AMD 9287.

BS 6288: Magnetic tape sound recording and reproducing systems. BS 6288: Part 3: 1990 Methods of measuring the characteristics of recording and reproducing equipment for sound on magnetic tape [IEC 94 -3:1979] Amendment No. 1 Gr 7 AMD 9286. This amendment implements EN 60094 - 3: 1996 as a British Standard and dual-numbers BS 6288: Part 3: 1990 with BS EN 60094 - 3:1997.

BS EN Publications

The following are British Standard implementations of the English language versions of European Standards (EN's)

BS EN 50147: Anechoic chambers. BS EN 50147 - 1: 1997 Shield attenuation measurement. Establishes a common measurement procedure for validating the shielding effectiveness of a shielded enclosure. No current standard superseded.

BS EN's implemented by amendment

The following BS EN is implemented by amendment to existing documents.

BS EN 61252: 1997 Electroacoustics – Specifications for personal sound exposure meters. Implementation of European Standard EN 61252: 1995 by amendment to BS 6402:1994.

Drafts for Public Comment

(for information only)

96/564096 DC Amendment to ISO 1996 – 2 Acoustics – Description and measurement of environmental noise – Part 2: Acquisition of data pertinent to land use – Amendment 1 (Possible amendment to BS 7445: Part 2: 1991) (ISO/DIS 1996 - 2/DAM 1).

EN ISO's & ISP's

The following International standards have been adopted as EN's. These documents have been approved by CEN/CENELEC.

EN ISO 717: Acoustics – Rating of sound insulation in buildings and of building elements.

EN ISO 717-1: 1996 Airborne sound insulation

EN ISO 717-2: 1996 Impact sound insulation

EN ISO 4871:1996 Acoustics – Declaration and verification of noise transmission values of machinery and equipment.

EN ISO 11689: 1996 Acoustics – Procedure for the comparison of noise emission data for machinery and equipment.

EN ISO 11820: 1996 Acoustics – Measurements on silencers in situ.

EN ISO 12001: 1996 Acoustics – Noise emitted by machinery and equipment – Rules for the drafting and presentation of a noise test code.

EN ISO 8662: Hand-held portable power tools – Measurement of vibrations at the handle. EN ISO 8662-9: 1996 Rammers, EN ISO 8662-14: 1996 Stone-working tools and needle scalars.

EN ISO 11957: 1996 Acoustics – Determination of sound insulation performance of cabins – Laboratory and in situ measurements.

ISO Standards

ISO 389-7: 1996 Acoustics – Reference zero for the calibration of audiometric equipment – Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions. Will be implemented as BS ISO 389-7:1996.

ISO 717: Acoustics – Rating of sound insulation in buildings and of building elements. ISO 717-1:1996 (Edition 2) Airborne sound insulation. Following ratification by CEN will be published as BS EN ISO 717-1 to supersede BS 5821: Part 1:1984. ISO 717-2: 1996 (Edition 2) Impact sound insulation. Following ratification by CEN

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will be published as BS EN ISO 717-2 to supersede BS 5821: Part 2: 1984.

ISO 2923: 1996 (Edition 2) Acoustics – Measurement of noise on board vessels. Will be implemented as BS ISO 2923: 1996.

ISO 4866: Mechanical vibration and shock – Vibration of buildings – Guidelines for the measurement of vibrations and evaluation of their effects on buildings Amendment 2: 1996 to ISO 4866: 1990.

ISO 4871: 1996 (Edition 2) Acoustics – Declaration and noise emission values of machinery and equipment. Will be implemented as BS EN ISO 4871 following ratification by CEN.

ISO 6395: Acoustics – Measurement of exterior noise emitted by earth moving machinery – Dynamic test conditions. Amendment 1: 1996 to ISO 6395: 1988. Will be implemented as an amendment to BS 6812: Part 2: 1991.

ISO 8253-3: 1996 Acoustics – Audiometric test methods – Part 3: Speech audiometry. Will be implemented as BS ISO 8253-3: 1996.

ISO 10815: 1996 Mechanical vibration – Measurement of vibration generated internally in railway tunnels by the passage of trains. Will be implemented as BS ISO 10815: 1996.

CEN European Standards

The document listed below is now available as an advance warning copy of the BS EN implementation.

EN 352-3: 1996 Hearing protectors – Safety requirements and testing – Part 3: Ear-muffs attached to an industrial safety helmet.

This information, provided by John W Tyler FIOA, was announced in the Jan & Feb 1997 issues of BSI News.

Book Review

BRE: Reports on CD, Number 2
Building Research Establishment and
Construction Research Communications Ltd
Annual subscription for 4 quarterly CD's: £75 + VAT
ISSN 1364-9817

Now, here is a novelty: not a book for review but a CD, and it may be the first of many. However, the essential features are similar and the reviewer's questions are the same: What does it contain which is useful, and is it worth the price asked?

This CD is the second of the four to be published by BRE in 1996 and contains the special theme on research in sound insulation, noise and acoustics (at BRE). It contains two main sections which are unrelated. The first lists a number of recent BRE Research Reports and, for many of these, both a summary and text are available. Interesting though some of them are they have little to do with Acoustics or Vibration. However, the second section is the 'special theme' mentioned above. Broadly there are two areas of interest in this second section of the CD: (i) A history of acoustics at BRE together with a compilation of key documents published from 1974 onwards, and (ii) some details of current research.

In the historical section are listed the text of various

digests and reports published over a period of twenty years or more, covering important BRE work in noise insulation, room acoustics, environmental noise and so on. Unfortunately this is the only relevant acoustical detail included on the CD. In the section on current research in acoustics there is only a short list of one-line descriptions of projects in progress, with no details at all. It is a strange logic which does not permit more details of current research in acoustics (particularly when this is the special theme of the CD) whilst at the same time publishing full current papers in other areas of research.

However to balance my acoustic viewpoint I must record the view of one of my colleagues working in Construction. He tells me that this single CD contains a staggering £400 worth of work, if purchased in paper form, of which £75 worth is directly useful to him. He feels that for companies and Universities with an interest in Construction the series is certainly a good reference purchase. Hence in the right circumstances this is worth purchasing for your library.

The presentation of work in this fashion (on CD) is still novel and has great potential. However, this particular offering, like so many others of a like kind, is full of frustration, particularly in the special theme, and does not take full advantage of the medium. On top of this it is a fairly obvious plug for BRE complete with maps of how to get to any one of its three sites. Not, I venture to suggest, information that our members will pay £88 for, though others might.

From an acoustics and vibration viewpoint it therefore boils down to asking whether you would wish to pay for the CD in order to acquire details only of older work at BRE. I feel that this is unlikely. As my headmaster wrote: 'Good try, but must do better'.

A J Pretlove FIOA

Diploma Examinations 1996 Erratum to the Report by the Chief Examiner printed in the January/February 1997 issue.

There was an error in the fifth paragraph of my report: owing to a double misunderstanding, the trawl through the list of candidates to identify those achieving the minimum criterion of three merits (at one sitting) in the written papers plus either a merit or a pass in the project was terminated prematurely after identifying those with four merits as it was assumed that a sufficient number of candidates had been identified; but I assumed that the list sent to me was complete.

In addition to the two candidates mentioned in my report, who both achieved four merits, two further candidates fulfilled the minimum criterion. However, I feel that if I am to maintain the high standard I have established over the years in order to make being awarded the Prize and being Specially Commended really worthwhile, neither of the two additional candidates should be Specially Commended.

I apologise to all concerned over this unfortunate error which arose in the most curious and special circumstances. Members may be assured that I have instituted further checks to ensure that a similar error cannot occur again.

J M Bowsher HonFIOA

New Products

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proACTIVE Earmuffs

ProActive™ product line from Noise Cancellation Technologies Inc offers a range of earmuffs with a high performance at low frequencies using active noise reduction (ANR) technology.

proACTIVE 3000

Designed for maximum protection, the proACTIVE 3000 combines a comfortable, high-performance industrial earmuff with the added benefit of active low frequency noise reduction. The patent pending design of the proACTIVE 3000 is completely cordless – the rechargeable nickel cadmium (Ni-Cd) battery module and electronics are integrated into the earmuff providing mobility, comfort and safety. The proACTIVE 3000 is appropriate for use in general industrial settings.

proACTIVE 3500

Designed for communications in high-noise settings, the proACTIVE 3500 combines a comfortable, high-performance industrial earmuff with the added benefit of active low frequency noise reduction. The proACTIVE 3500 improves communications on both ends; audibility of received speech is enhanced as a result of superior background noise reduction, and speech is transmitted more clearly through the noise cancelling electret boom microphone. The proACTIVE 3500 is designed to work with the latest radio models.

Boom microphone options

The proACTIVE line of communications headsets have been updated to accommodate optional boom microphones for specific working environments.

Hard Hat Styles

The proACTIVE 3100 earmuff and the proACTIVE 3600 headset are intended for use with hard hats. The

earcups are properly fitted to the head with a behind-the-neck wire band.

proACTIVE 1000 Series

The proACTIVE 1000 and the proACTIVE 1500 are fully active headphone and headset designed specifically to reduce low frequency noise from engines, motors and fans in commercial and industrial environments. These products reduce the background din and improve intelligibility of speech, music, warning signals and other critical sounds. Plus, the manufacturers claim, they will greatly improve communication and concentration, and reduce the stress and fatigue associated with overexposure to low frequency noise.

The power source for the proACTIVE Line is a rechargeable NiCd battery module. The proACTIVE personal charger provides an overnight charge which will last at least 12 hours. Each battery module will function for at least 500 recharging cycles. The proACTIVE headset will emit an audible tone when the battery needs recharging.

Further information can be obtained from Illbruck Ltd, Croesfoel Industrial Park, Rhostyllen Wrexham, Clwyd LL14 4BJ. Tel: 01978 313385 Fax: 01978 313386.

DIAGNOSTIC INSTRUMENTS

Multi-Channel PC-based Signal

Analysers

Diagnostic Instruments have announced their launch of a full range of multi-channel, real-time, signal analysers. The DI 6-25 range of PC-based signal analysers is modular in design allowing users to configure both hardware and software to their particular application. Inputs are available between 2 and 14 channels. A signal generator is available for internal calibration and test purposes. All of the potential 14

inputs are sampled simultaneously at a frequency of up to 51.2 kHz using multiple high-precision 16 bit converters. Using Digital Signal Processing (DSP) provides true real-time FFT bandwidths of up to 20 kHz. Data may be streamed directly to the host computer disk or RAM.

Applications software for multi-channel acquisition and FFT analysis operates in both Windows 95 and Windows 3.1. Particular care has been taken with the user-interface to ensure that the system is simple to install and use, providing 'virtual instrument' control over all aspects one would expect in a fully-functional bench-top, multi-channel signal analyser. A comprehensive range of time and frequency domain functions are available as standard. Data transfer from the DI 6-25 is not limited to simple cut and paste of graphics; standard file formats allows data export to other Windows applications including spreadsheets and wordprocessors as well as the majority of third party post-processing applications.

The open architecture approach to the design of the DI 6-25 enables users have full control over the key elements of the system, including modification of the user interface, measurement set-up and file transfer format, whilst the self calibration facility maintains measurement integrity.

The DI 6-25 range fully complements DI's range of hand-portable signal analysers whilst DI Quickstart™ program allows users to be productive from day one.

Structural Analyser DI-2203

The new DI-2203 portable analyser from Diagnostic Instruments combines performance and unparalleled ease of use at a highly competitive price. By designing a dedicated Structural Analyser, Diagnostic Instruments have been able to optimise both the user interface and functionality of the unit specifically for its intended role.

Designed to perform tests on



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mechanical and civil structures typical applications of the DI-2203 will include: In-situ structural and vibration level measurement and frequency analysis; Phased response measurements for Operational Deformation Shape (ODS) analysis; acquisition of FRF's and coherence for modal tests; and structural integrity surveys of civil structures.

A new addition to the series, the DI-2203 retains many of the attributes of its more expensive stable mate, the multi-purpose and highly successful DI-2200.

Based on the proven DI-2200 hardware platform, the DI-2203 is robust, hand portable, and battery powered. The analyser is equally suitable for use in the lab, on the factory floor, or in the field.

The DI-2203 supports single and dual channel measurements in both the time and frequency domains, as well as cross channel functions such as frequency response and coherence.

A comprehensive windowing facility is also provided. This versatile device makes an ideal field portable front-end for a variety of leading 3rd party structural and modal analysis software packages for the PC. These include SMS Star Modal, ICATS Modent/Modesh, VEC PCModal, and others.

An integral PCMCIA interface provides access to virtually unlimited external/setup storage capacity using SRAM memory cards.

For further information on these (or any) Diagnostic Instruments product, please contact: Anne McSherry, Sales Administrator, Diagnostic Instruments, 2 Michaelson Square, Kirkton Campus, Livingston EH54 7DP, Scotland. Tel: 01506 470011 Fax: 01506 470012 EMail: anne@diaginst.co.uk

THE NOISE CONTROL CENTRE

Coustiboard 63

Coustiboard 63 is the latest acoustic product from The Noise Control Centre. It is a laminated plywood board with a high integrity cork elastomer core and is designed to be used for floor and bulkhead constructions, where high levels of noise

reduction are required.

It is self supporting with high flexural stiffness and low surface weight. No special fixings or installation methods are needed as the material can be cut and fabricated in the same way as conventional plywood.

The laminated construction together with the core material provides resonance and coincidence control at low and high frequencies respectively; this results in a higher level of noise reduction than standard or heavy layer laminate boards.

The superior performance of the Coustiboard often negates the need for further acoustic treatment such as acoustic foams or fibres therefore reducing material costs and labour in these areas.

The Coustiboard 63 can be supplied with a variety of surface finishes depending on the application and service conditions likely to be experienced. Virtually any wood veneer finish is available, or alternatively metal or melamine and phenolic facings can be incorporated to increase durability and fire performance.

Pre-formed shapes are available subject to practical limitations as panels can be provided as a kit to suit a particular vehicle build or project.

Recent applications include outside broadcast vehicles, bus and coach seatboxes and floor constructions and offshore living quarters on an exploration platform.

Coustiboard 63 is one of the latest editions to the extensive range of noise control materials available from The Noise Control Centre.

For further details contact the sales office on Tel: 01664 82180. The Noise Control Centre, Crown Business Park, Old Dalby, Melton Mowbray, Leics LE14 3NQ.

The Noise Control Centre is a Sponsor Member of the Institute.

AMPLICON LIVELINE

Data Acquisition Board for DSP

The DAP3000/212 is an intelligent data acquisition board for DSP applications, it can handle large numbers of analog inputs and pro-

cess the data in real-time using an on-board 48 MHz 486 processor.

The DAP3200 has an on-board real-time multitasking operating system which has pre-written functions such as FFT that can calculate a block size as large as 16,384 points while data is being acquired.

Applications such as vibration analysis can be configured by the novice.

Further information is available from Amplicon Liveline Ltd, Centenary Estate, Brighton BN2 4AW. Tel: 0800 525335.

KEMO

Quick reference guide on filters and signal-conditioning products

Kemo Ltd has produced a 16-page quick reference guide giving details of the company's ranges of active filters and signal conditioning products.

Products covered in the guide include benchtop filters, manually adjustable multichannel filters, computer controlled multichannel filters and amplifiers, filter modules, filtering systems, board-level products and PC-based chassis mounted systems. Also included is an applications guide to assist users in selecting the right filter for their requirements and a glossary of filter terms.

Further information from Kemo Ltd, 3 Brook Court, Blakeney Road, Beckenham, Kent BR3 1HG. Tel: 0181 658 3838 Fax: 0181 658 4084.

GRACEY & ASSOCIATES

Sound Level Meter Calibration

System

Gracey & Associates have signed a contract to supply the Singapore Productivity and Standards Board (PSB) with a complete test and measurement system for checking all sound level meters to be used for legal metrology in Singapore. The Norsonic system, NOR-1504A, had its field trials in Gracey & Associates calibration laboratories in Chelveston and forms the heart of their ISO-9000 calibration laboratory.

The NOR-1504A sound level meter calibration system is a PC-

based system controlling a signal generator, voltmeter and test unit. It provides fast and accurate calibration of sound level meters to the requirements of IEC 651 and IEC 804 using three different interface modes; manual, semi-automated and fully automated. It will also calibrate sound calibrators and pistonphones in accordance with IEC942 and test octave and fractional octave filters in accordance with IEC1260. The system produces a full test report generated on printer including a complete calibration certificate.

Further information from Gracey & Associates, High Street, Chelveston, Northants NN9 6AS. Tel: 01933 624212 Fax: 01933 624608.

Gracey & Associates is a Sponsor Member of the Institute.

ANTHONY BEST DYNAMICS

PLATO for Borg Warner

At the Margam plant of Borg Warner Automotive near Port Talbot in South Wales, the PLATO noise and vibration analysis system from Anthony Best Dynamics (ABD) provides repeatable end-of-line quality testing on four wheel drive transfer cases destined for use in the new Land Rover. Incorporated in a fully automatic dynamometer, the production line PLATO system measures noise levels from each transfer case as it is run over a speed range and under load.

The PLATO system is a multi-

channel, order-locked analysis system for testing transmissions gearboxes, transfer cases and axles) and other types of rotating machinery. ABD has a range of analysis systems which can be purchased either as turnkey packages comprising both the software and the accompanying hardware, or as stand alone products so that clients can run the systems on their own personal computers.

For further information contact Andy Rumble, Anthony Best Dynamics, Holt Road, Bradford-on-Avon, Wilts BA15 1AJ. Tel: 01225 867575.

News Items

Institute Member wins European Award

Last year, a team led by a member of the Institute, Dr Richard Bacon of the University of Surrey, won the prestigious European Academic Software Award in Science for their work on the Software Teaching of Modular Physics (STOMP). The project was originally funded by the HEFC under the Learning Technology Programme. The team, led by Dr Bacon, has involved over 50 academic and programming staff in nine UK and three overseas institutions.

STOMP aims to provide a complete and open learning environment which takes full advantage of current computer technology and

can be used in class situations or for self learning. The teaching strategy of each unit is centred around a script in which the theory is introduced. The scripts have an informal style and hyperlinks lead to other scripts, pictures, video and audio resources, interactive models, presentations and simulated labor-

atory experiments. A set of data handling tools such as a spreadsheet and a graphing tool are included to allow the results of virtual experiments and other data to be analysed. Background information such as textbook chapters, physicists' biographies databooks and a glossary add up to the main instructional materials.

STOMP modules are based upon distance learning principles, in which all the information and support a student is likely to require are provided within the package. However, the package is intended to be open and flexible so that teaching staff can make changes to the structure or organisation of the material if necessary, or even add new hyperlinks, new documents or new activities. An independent evaluation of STOMP was carried out in 1994, 1995 involving the Physics Departments of ten UK Universities, indicating that it can be used successfully for teaching, provided adequate instruction is given for effective use of the package.

Appropriately enough the first module completed was on waves and vibration! Another on 'Measurement and Uncertainty' is now available, and one on optics is under development. STOMP is available on CD-ROM.

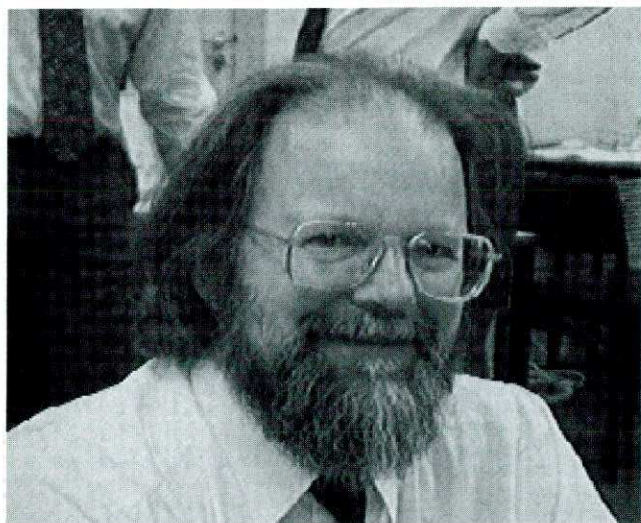
The European Award recognises what is clearly an impressive achievement and it is good to see Institute members at the forefront of such pioneering educational endeavours.

Industrial Acoustics Company Ltd

George Dawson and Geoff Crowhurst have been appointed Managing Director and Deputy Managing Director (Standard Products) of IAC. The management changes coincide with the retirement of joint MD, George Sotos, who has been with the company for 44 years.

IAC is a Sponsor Member of the Institute.

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



Dr Richard Bacon

Non-Institute Meetings

April 14-18, 1997: 4th French Congress on Acoustics, Marseilles

Contact: Secretariat CFA, 4; 31 chemin Joseph Aiguier, F-13402 Marseilles Cédex 20, France. Tel: +33 91 16 40 68; Fax: +33 91 22 82 48; e-mail: cfa4@lma.cnrs-mrs.fr; http://alphalma.cnrs-mrs.fr/cfa4.html

April 21-24, 1997: International Conference on Acoustics, Speech, and Signal Processing - ICASSP 97, Munich

Contact: H Fastl, Lehrstuhl für Mensch-Maschine-Kommunikation, Technical University of Munich, 80290 München, Germany. Tel: +49 89 2892 -8540; Fax: +49 89 2892 -8535; e-mail: fas@mmk.e-technik.tu.muenchen.de

April 21-25, 1997: International Conference on Shallow Water Acoustics, Beijing

Contact: SWAC '97 Secretariat; c/o Institute of Acoustics, PO Box 71, Beijing, 100080; China. Fax: +(86-10) 6256 -9079 (Beijing); + (1-404) 894 -7790 (Atlanta); e-mail: xwf@canna.ioa.ac.cn (Beijing); swac97@gatech.edu (Atlanta)

May 12-16, 1997: 13th FASE Symposium on Hydroacoustics and Ultrasonics, Gdynia, Jurata

Contact: Prof. Eugeniusz Kozaczka, Akademia Marynarki Wojennej, ul. Smidowicza 71, P1-81-919 Gdynia, Poland; Fax: +48 58 25 48 46; e-mail: amw@beta.nask.gda.pl

May 21-23, 1997: 25th Congress of the Italian Acoustic Association, Perugia

Contact: F Asdrubali, Scientific Secretariat 25th AIA Congress, Istituto di Energetica, Facoltà di Ingegneria, Via G. Duranti 1-A/4, 06125 Perugia, Italy. Tel: +39 75 58 52 695; Fax: +39 75 58 52 696

June 3-5, 1997: 8th International Meeting on Low Frequency Noise and Vibration, Gothenburg

Contact: Multi-Science Publishing Co Ltd, 107 High Street, Brentwood, Essex CM14 4RX, UK. Tel: +44 1277 224 632; Fax: +44 1277 223 453

June 3-6, 1997: 7ème Colloque de Visualisation et de traitement d'images en mécanique des fluides, Saint-Louis

Contact: I.S.L.; Service AOR; Madame Hengy; B.P. 34; 68301 Saint Louis CEDEX; Tel.: 03 89 69 51 36 Fax: 03 89 69 53 35

June 5-7, 1997: Conference on ICP and Inner Ear Pressure, Bath

Contact: British Society of Audiology, 80 Brighton Road, Reading RG6 1PS, UK; Fax: +44 1734 351 915; e-mail: mpsar@bath.ac.uk

June 15-17, 1997: NOISE-CON 97, State College, PA

Contact: INCE, PO Box 320, Arlington Branch, Poughkeepsie, NY 12603, USA; Fax: +1 914 463 0201

June 15-20, 1997: 8th International Symposium on Nondestructive Characterization of Materials, Boulder, CO

Contact: Debbie Harris, The Johns Hopkins University, Center for NDE, 102 Maryland Hall, 3400 N. Charles Street, Baltimore, MD 21218, USA; Fax: +1 410 516 7249; e-mail: cnde@jhvu.ms.hcfjhv.edu

June 15-22, 1997: 133rd Meeting of the Acoustical Society of America, State College, PA

Contact: S. Hayek, Active Vibration Control Laboratory, Pennsylvania State University, 227 Hammond Building, University Park, PA 16802-1401, USA; Fax: +1 814 863 7967; e-mail: sihesm@engr.psu.edu

June 18-20, 1997: Larynx 97 Marseille

Contact: Laboratoire Parole et Langage Université de Provence; 29, Avenue Robert Schuman; 13261- AIX EN PROVENCE; Fax: (33) 04 42 59 50 986; E-mail: larynx97@pl.univ-aix.fr

June 17-21, 1997: 14th International Symposium on Nonlinear Acoustics, Nanjing

Contact: Professor Ronjue Wei, Nanjing University, Institute of Acoustics, Nanjing, 210008 China; Fax: +86 25 330 2728

June 18-21, 1997: 3rd European Conference on Audiology, Prague

Contact: Paediatric Otolaryngologic Clinic, Faculty Hospital Motol, V. Uvalu 84, 15018 Prague 5, Czech Republic; Fax: +42 2 2443 2620

June 24-27, 1997: 1st European Conference on Signal Analysis and Prediction, Prague

Contact: ESCAP Secretariat, Institute of Chemical Technology, Technická 5, 166 28 Praha 6, Czech Republic; e-mail: escap@vscht.cz; WWW: http://www.vscht.cz/escap97/

June 25-27, 1997: 12th Symposium on Echocardiography and 9th Meeting of the International Cardiac Doppler Society, Rotterdam

Contact: L.M.C. Congress and Business Services, P.O.Box 593, NL-3700 AN Zeist, The Netherlands; Fax: +31 343 533 357

June 25-27, 1997: 5th International Congress of the International Society of Applied Psycholinguistics, Porto

Contact: Maria da Graca Pinto, Universidade do Porto, Faculdade de Letras, Via Panoramica, s/n, PT-4150 Porto, Portugal; Fax: +351 2 610 1990

July 2-4, 1997: Ultrasonics International 97, Delft

Contact: W. Sachse, Dept. of Theoretical and Applied Mechanics, Cornell University, Ithaca, NY 14853, USA; Fax: +1 607 255 9179; e-mail: sachse@msc.cornell.edu

July 14-17, 1997: 6th International Conference on Recent Advances in Structural Dynamics, Southampton

Contact: N. Ferguson, ISVR, University of Southampton, Southampton SO17 1BJ, UK; Fax: +44 1703 593 033; e-mail: mzs@isvr.soton.ac.uk

July 14-18, 1997: Third International Conference on Theoretical & Computational Acoustics, Newark, NJ

Contact: Yu-Chiung Teng, Columbia Univ, Henry Krumb School of Mines; Aldridge Lab. of Appl. Geophysics, New York, New York, 10027, USA; Tel.: (212) 854 -2910, Fax: (212) 854 -6504

July 21-25, 1997: Fourth International Conference on Natural Physical Processes Related to Sea Surface Sound, Chilworth Manor, Hampshire

Contact: Maureen Strickland, ISVR Conference Secretary, University of Southampton, Southampton SO17 1BJ, UK; Tel.: +44 1703 592294; Fax: +44 1703 593033; e-mail: mzs@isvr.soton.ac.uk

August 21-23, 1997: ACTIVE97, Budapest

Contact: Internoise Congress Secretariat, OPAKFI, H-1027 Budapest, Fö u. 68, Hungary. Tel:/Fax: +36 1 201 88 43; email: a97.opa@mtesz.hu

August 25-27, 1997: Internoise 97, Budapest

Contact: as above

September 15-17, 1997: 1st International Conference on Whole-body Vibration Injuries, Southampton

Contact: Mrs H E Smith, Human Factors Research Unit, ISVR, University of Southampton, Southampton SO17 1BJ, UK Tel: +44 1703 592277, Fax: +44 1703 592927, email hfru97@isvr.soton.ac.uk

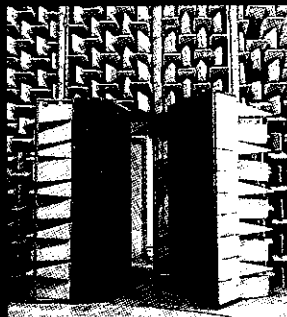
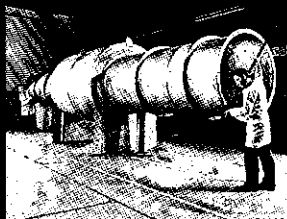
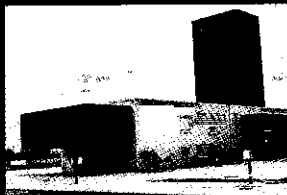
September 17-19, 1997: 32nd UK Group Meeting on the Human Response to Vibration, Southampton

Contact: as above



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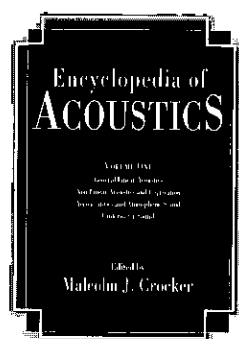
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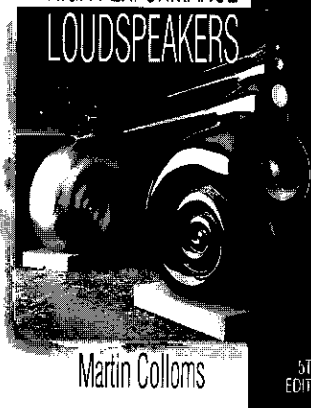
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