Institute of Acoustics

acoustics BULLETIN

Volume 22 No 5
September – October 1997

acoustics
BULLETIN

Volume 22 No 5
September - October 1997

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

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

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

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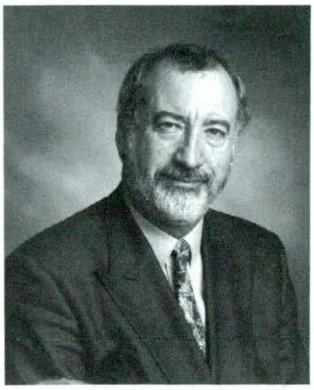


Dear Fellow Member

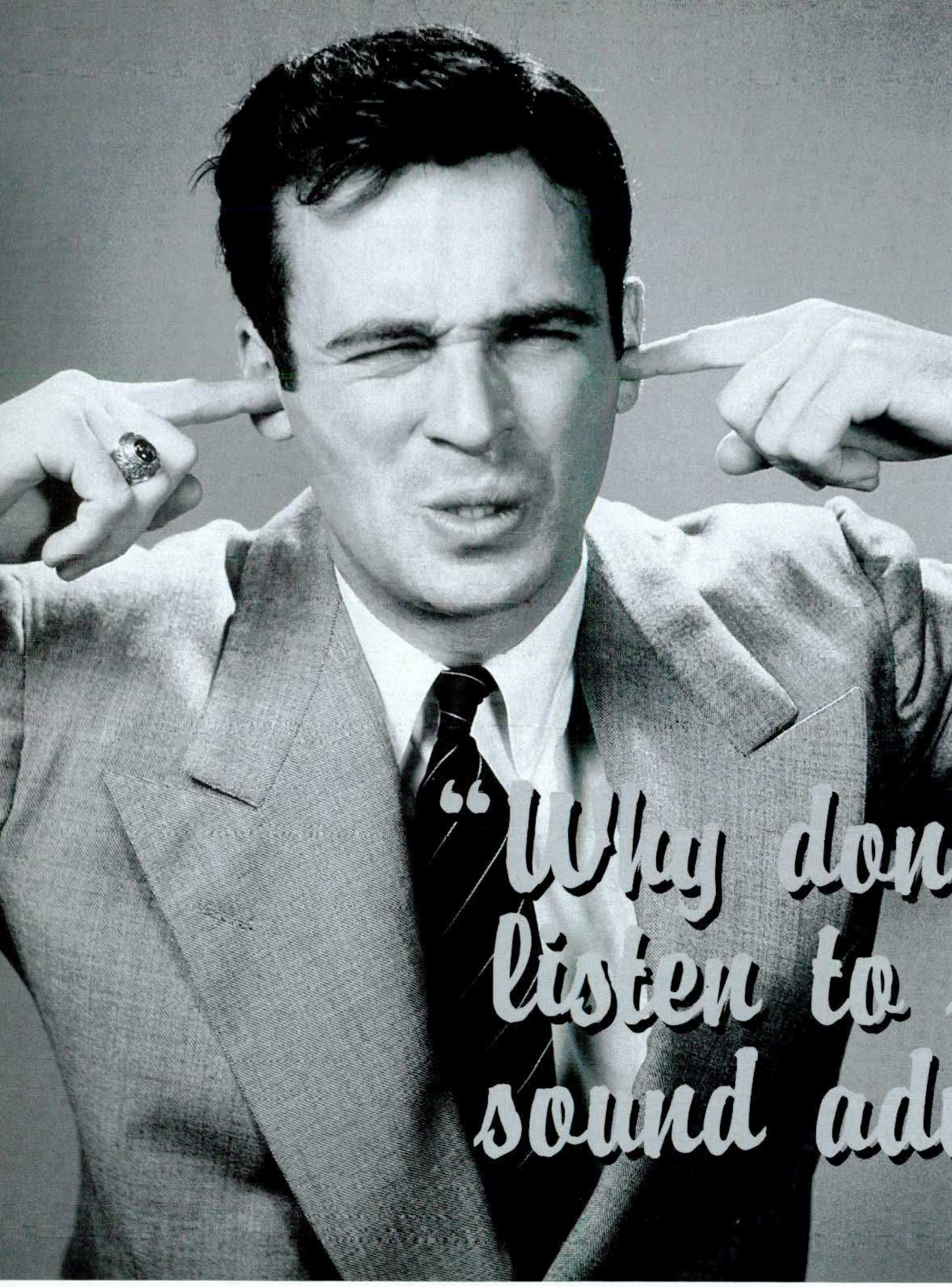
You will recall that, since January of this year, new arrangements have been in place for the Secretariat of the Institute, under which the Institute has become the direct employer of all the office staff. Separate contractual arrangements were made with Cathy Mackenzie as Chief Executive/ Secretary, and with Dr Roy Lawrence as Special Projects Coordinator. Recently Cathy and Roy advised the Executive Committee, through the Honorary Secretary, that they wished to be released from their contracts from October 31st. The Executive Committee have reluctantly accepted these retirements. For the moment, Cathy and Roy will be concentrating on their work on the Acoustics Bulletin and the Institute Register.

At the September meeting of the Executive Committee, Mr Roy Bratby, who was appointed Deputy Chief Executive in June, was confirmed as Chief Executive from November 1st. Cathy and Roy Lawrence have been vital forces in the Institute since its foundation. It is impossible to convey here the magnitude of their contribution. On page 5 in this Bulletin John Tyler FIOA has written an appreciation. We simply would not be the thriving Institute we are without them.

Together with the other members of Executive, and Council, and, with the continued enthusiasm and commitment of the Chief Executive and all of the staff, our key objective is to build on the foundations which Cathy and Roy have helped to establish, and to expand into the future with confidence.

Sincerely yours

Bernard Berry



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THE END OF AN ERA AT THE INSTITUTE

I have been asked to prepare a short note for the Bulletin to mark the retirement of Cathy Mackenzie and Roy Lawrence from the Institute. This I have been pleased to do as I have worked closely with them for many years and regard them as friends. However I have tried not to allow this fact to colour my summary of their activities and judgements of their performance; my efforts have been vetted by the management! Warts and all, they will be missed!

John W Tyler FIOA

October this year sees the end of one era of the Institute's existence and the blossoming of a new one. In brief, Cathy Mackenzie and Roy Lawrence are leaving the employ of the IOA after many years of faithful service although continuing to produce the Acoustics Bulletin and their involvement with the Institute's Diploma Distance Learning Programme and laboratory. Taking over the reins with the title of Chief Executive and hopefully leading the Institute to new heights of success is Roy (What!, another Roy!) Bratby.

This event must not be allowed to pass without, firstly, a well deserved tribute to the two people who dragged the Institute, kicking and screaming, into the twentieth century and equipped it to ensure its successful entry into the twenty first and, secondly a warm welcome to our new leader.

Cathy Mackenzie was appointed Institute Secretary in 1979 when the membership stood at only one quarter of its present 2400 and three years after the Institute became a fully professional body. She took on the task of providing a management service to the Institute, received an annual management fee and from this employed her own staff and supplied office services. This started in offices in the former Heriot Watt University buildings in Chambers Street in Edinburgh. Her skill with conferences was confirmed with the successful Internoise 83 Congress hosted by the Institute in Edinburgh. For the many Council and other meetings in London, Cathy travelled down regularly from Edinburgh reputedly with bulging, heavy briefcases full of Institute papers. All of her assistants worked part time and when the going was tough were prepared to work long hours with Cathy, such was the loyalty she engendered in her staff.

In 1989 the premises at Heriot Watt had to be vacated and since Roy Lawrence was now helping Cathy in the task of running the Institute's affairs, having taken early retirement from Liverpool Polytechnic (now Liverpool John Moores University) a move to St Albans, Roy's home ground, was initiated. The first manifestation of IOA in St Albans was in a tiny rented attic office. This was expanded to two small rented rooms in London Road, St Albans backed up by a small office in Roy's home.

This enabled Cathy to continue her good work in guiding the expansion of the activies of the IOA, running the various committees and conferences and continuing the, by now well known, long working hours far beyond the expected call of duty; one of the hall marks of Cathy's career with the Institute.

In all this time Roy was working for Oscar Faber Consulting Engineers in St Albans and devoting all his spare time to Institute activities.

Again the expansion of the Institute's activities outgrew the space available and the move to Agriculture House as a tenant of the National Farmers Union was made to solve this problem. The IOA is now well established in this home and it has been the scene of much development of the Institute's affairs. By this time Roy was working part time for Oscar Faber and part time with the Institute and finally full time with the IOA.

One of the most recent, and certainly the most demanding, activities was the organisation of the Internoise 96 Congress, held in Liverpool. Everybody in the Institute office worked immensely hard for this conference but Cathy and Roy outshone all by the sheer amount of time, day and night they devoted to this event (see footnote to the report in Acoustics Bulletin Sept/Oct 1996). It was generally accepted that this was the most successful Internoise Congress to that date.

Roy Lawrence's particular contribution to the functioning of the Institute, in addition, that is, to his work on conferences, has been concerned with the education programme of the IOA, the establishment of a computer based management and administration system and the development of the Acoustics Bulletin and Institute Register. Roy has contributed via the Education Committee to the development of the IOA Diploma, initiated in 1977, and, more recently, to the Distance Learning Programme.

The fact that the Institute is up to date with computer-based methods of running a modern office is due largely to Roy's efforts, but also, of course, to the Hon Treasurer's remarkably restrained response to Roy's maverick

tendencies regarding the purchase of computer and ancillary equipment!

At the end of 1990 Cathy and Roy restructured the way the Acoustics Bulletin was prepared and printed and modernised its appearance. Computer-based desk top publishing techniques were introduced and the number of issues per year increased from four to six. The Institute Register was Roy's brainchild and although requiring an immense amount of work to prepare and keep up to date it has proved to be a valuable addition to the range of IOA services to members.

No record of their contribution to IOA would be complete without a reference to the series of Reproduced Sound conferences in Windermere which they founded twelve years ago and have helped to organise ever since. These are the only conferences involving several other professional organisations in the broadcast and sound reproduction world and have been instrumental in spreading the Institute's reputation in this area. Together with the annual IOA Autumn Conferences, also at Windermere, Cathy and Roy have made these Lake District events very much their own.

Throughout their service with the IOA Cathy Mackenzie and Roy Lawrence have striven to maintain and improve the image of the Institute and in this the general view is that they have succeeded.

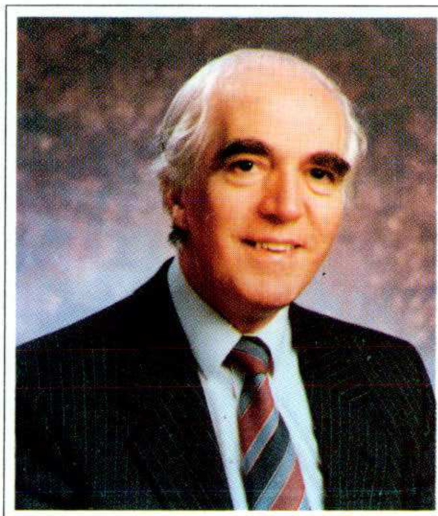
As personalities they are quite different as those who have worked with them will know. Cathy is invariably full of charm and good humour (although sometimes sorely tried by those she has to deal with) whereas Roy can sometimes present a gruff exterior. But those who grit their teeth and take the trouble to get to know him will realise that there is a soft and good humoured interior which can erupt and delight the company with stories and expert impersonations of people both inside and outside the Institute. He does not suffer fools gladly but in many people's books that is a talent not a fault.

The President, Honorary Officers, Institute Council, members of the standing committees, and the general membership will, it is certain, join me in thanking Cathy and Roy for all their loyal efforts for the IOA over so many years and in wishing them a happy and more relaxed future.

We now look forward to a new phase in the life of the Institute of Acoustics in which our new Chief Executive, Roy Bratby, will be able to demonstrate his mettle and will, we are sure, carry on the good work achieved by his predecessors. To introduce the new Roy to members a brief resume of his career follows.

We wish Roy Bratby success in his new venture and all will want to offer him every support to ensure a sound future for the IOA.

ROY D BRATBY ASCA MIMgt, The Institute's new Chief Executive



Educated at Dudley Grammar School, West Midlands, Roy Bratby began his career in 1953 as a Commercial Trainee with Rubery Owen & Co Ltd, one of the largest private engineering companies in the country. In 1958 he moved to C & L Hill Ltd, one of their subsidiaries, as Assistant Accountant prior to moving to Ductile Steels Ltd in 1960 as Assistant Accountant of one of their subsidiary companies before joining Bervie Engineering Co Ltd as Company Secretary and Accountant in 1962.

In 1965 he joined Baby Deer Ltd, the British subsidiary of the American Trimfoot Co, as Accountant. The company subsequently relocated to South West Scotland and following a visit to the parent company in the USA in 1968 he was appointed Financial Director and in 1970 he became Managing Director. Following the sale of Baby Deer Ltd to Phillips Patents Ltd in 1971 he was appointed to the Board of Phillips Patents Ltd and given sole responsibility for the Babywear Division of the Group.

In 1974 he moved into Estate Management as Assistant Factor of Stair Estates in South West Scotland before joining Country Houses Association as Chief Executive at their London Office in 1981. Country Houses Association, a charity, was founded in 1955 with the twofold purpose of saving, for the benefit of the nation, stately homes of historic importance and, in addition, to create within them apartments for retired and semi-retired people.

Mr Bratby joined the Institute of Acoustics as Deputy Chief Executive in June 1997. A member of the Institute of Company Accountants and of the Institute of Management, Mr Bratby is married with a son and daughter and lives in St Albans.

MEASURING LOUDNESS IN REAL TIME ON A HAND-HELD SOUND LEVEL METER

Richard Tyler FIOA

Introduction

There have been several attempts to define a standard method for measuring noise 'acceptable' to a person. It is probably true to say that none of these attempts are regarded as totally satisfactory in all circumstances, but the measure of LOUDNESS as defined by Professor Zwicker [1] and standardised in ISO-532:1975 [2] has achieved a reasonable degree of acceptance in the world of psychoacoustics. Because of the fairly significant computations needed to define a Loudness reading, measurements have often been made off-line, and very few instruments have succeeded in making real-time measurements, and then only with fairly large, heavy and expensive units.

Loudness was derived from many experiments on listeneners that showed non-linear relationships between the frequency and amplitude of a sound and its perception by the listener. A number is assigned and given the unit of SONE which increases as the perception of louder sounds (of any frequency) increases. These range from 1 or 2 Sones for the quietest sounds to 750 Sones for sounds around the threshold of pain. The curves in the ISO Standard give the scale of perception for a 'normal' listener and as a guide to a value, the interior noise experienced by a driver of a modern car travelling at 70 mph (110 kph) would probably be in the range 25 – 35 Sones.

The possibility of incorporating a real-time Loudness computation into a sound level meter with frequency analysis effected by Digital Signal Processing has been successfully investigated. This offers the possibility of a small, battery-operated portable unit that can directly measure Loudness at a moderate cost. This article describes the route taken to achieve this objective.

Why Use a Sound Level Meter?

The modern sound level meter is now equipped with far more capability than the ability to just measure an A-weighted sound pressure level. Thanks to the inclusion of low power microprocessors, very considerable computational power is easily available in small, battery-operated meters, and can be applied to fast signal processing in many different ways. Because they are widely used, the manufacturing costs are kept fairly low by volume production methods, whereas an instrument dedicated to measuring a parameter such as loudness is unlikely to achieve anywhere near the same sales volumes, which ultimately is reflected in its price. If the addition of a measure such as Loudness can be achieved by the addition of firmware to an existing hardware solution that is intended to fulfil the role of a 'conventional' sound level meter, then the cost of providing this additional measurement capability can be reduced.

In order to provide a measure of Loudness according to ISO 532, either octave or third octave band analysis must be available. It is necessary to have this spectral analysis performed on all bands simultaneously and, until fairly recently, this has not been possible in hand-held sound level meters. With the availability of low-power Digital Signal Processing (DSP) integrated circuits, frequency analysis over the entire audio spectrum has become a reality, and it is this aspect that allows other parameters such as Loudness to be considered in such an instrument. If the sound level meter is designed to perform octave band or third octave band analysis as a direct calculation function and not from the basis of an FFT, then a complete analysis of the audio spectrum can be produced in around 10 ms with existing hardware. These results could be used as the basis for calculating many other metrics such as reverberation time or Loudness.

Computation of Loudness

Time Interval The basis of the contours given in ISO 532 for producing a Loudness value were derived from sounds that were essentially constant in nature. It is therefore difficult to reconcile a spectrum calculated every 10 ms with the data used for the definition of Loudness. In trying to arrive at a reasonable time interval which may be regarded as constant, an integrated-averaged level (L_{eq}) of 0.5 s has been taken to approximate to a constant level for that time interval. This has been used as the basis of calculation for 'real-time' loudness. Data collected from noise sources such as vehicle interiors and machinery operation, where there were no sudden changes in the noise climate during the measurement interval, have confirmed that this interval, when compared to a longer interval of say 20 s, produces very similar results. The first requirement of processing is therefore to produce a 500 ms L_{eq}.

Bandwidth The Loudness contours are defined in both octave and third octave forms. Analysis of data by a number of different users has led many to conclude that the repeatability using third octave analysis is superior and so, in order to reduce the time taken to write the required programme for the meter, it was decided to use only third octave analysis for the first attempt. However, the computational load is larger and the constraints of producing a Loudness answer every 500 ms imposed a maximum time interval to perform all the calculations.

Using third octave data (Method B) in ISO 532, it is required to combine certain frequency bands together before making the assessment of Loudness. These are:

(1) all bands up to the 80 Hz third octave
(2) 100, 125 and 160 Hz third octaves
(3) 200 and 250 Hz third octaves.
All other one third octave bands up to 12.5 kHz are used individually.

There is no lower frequency specified for group (1) but as we are considering the audio band, the 25 Hz third octave was taken as the lowest complete third octave worth including. This means that at every 500 ms interval, groups of 5, 3 and 2 third octaves must first be combined before attempting to arrive at the Loudness value. This requires summing the L_{eq} values for each band using anti-logging, summing and logging routines which, whilst quite straightforward, is not the fastest calculation performed by a microprocessor.

Loudness Value Having achieved the correct number of data bands for a third octave Loudness calculation, a means has to be found of translating the series of curves drawn on the graphs in ISO 532B to a numerical value that the microprocessor can understand. This has been available in a BASIC programme for some years, written to run on a PC in non-real time. It required considerable translation effort to reduce the execution of these routines to be embedded within the operation of a sound level meter performing real-time frequency analysis and achieve a result every 500 ms. This has, however, proved possible.

Two sets of curves have to be included in the calculations as the standard defines these differently for a diffuse (GD) or free (GF) field. The programme as implemented calculates Loudness in Sones (GD) or Sones (GF) and can then produce the equivalent Loudness Level in Phons (GD) or Phons (GF) as required from the formula:

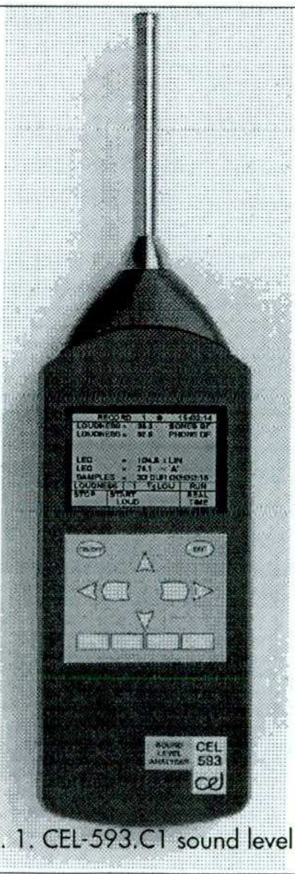


Fig. 1. CEL-593.C1 sound level meter

$$\text{Sones} = 2^{(\text{Phons} - 40)/10}$$

where S is the Loudness in Sones and P is the Loudness Level in Phons.

The microprocessor has insufficient processing time to produce both diffuse and free field measurements simultaneously and therefore the user must decide the most appropriate field type to use before starting measurements. The sound level meter can obviously measure both types equally well as they use omnidirectional microphones.

Operational Features

In deciding to incorporate these measurements within a sound level meter, other features may be included to assist the user. It is useful to compute the Loudness over longer periods than 500 ms if this is thought appropriate to the noise being measured, so facilities have been included that start and stop a measurement either manually or over a pre-set time ranging from 1 second to 1 hour. At the end of the measurement, the Loudness value and Loudness Level value for the entire measurement duration are computed as well as the individual answers that have been computed in real-time and displayed on the meter every 500 ms. All Loudness data is stored in the meter's memory and may be downloaded to a PC for display and archiving.

Additionally, graphical representation of the Loudness measurements for each measurement interval can be produced to show the time history over the measured duration, and statistical distribution of the Loudness values can be presented to show if the readings obtained are sufficiently similar to be considered as 'steady'.

Faster Loudness Measurements

When the complete execution of the programme was timed, it was found that the computational aspects of Loudness were occupying less than 200 ms. It was therefore feasible to present data faster than the selected 500 ms rate, but how valid is it? A measurement interval of only 100 ms, restricted to a 1 minute duration and with Loudness computation after the data has been collected, has been added in an attempt to determine the validity of measurements made with a shorter interval, but with the answer for the full duration also calculated.

Another approach that had been investigated during the development of the programme defined the Loudness computation as a neural network predicting the Loudness value on every 10 ms spectrum available from the sound level meter. Although not yet implemented within the programme of the sound level meter, trials using the same data have been made on a PC and success rates of over 95% have been recorded with each answer taking considerably less than 10 ms to process. It is believed that refining the existing process could lead to a Loudness calculation inside the sound level meter at the same rate as the spectra are created in real-time.

Elsewhere, methods of measuring 'real-time loudness' for non-steady sounds have been considered but are not yet commonplace. In the USA, an ANSI working group is meeting to attempt a new Standard in this area, and in the UK, Professor Brian Moore [3] and colleagues at

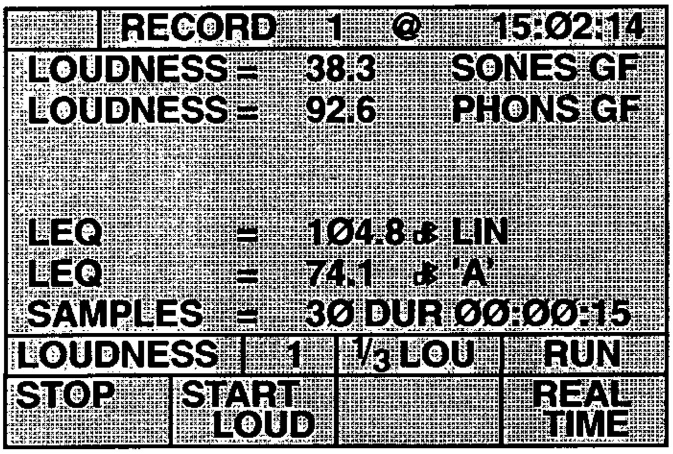


Fig. 2. Typical Loudness data screen display

Cambridge University have developed a system based on FFT analysis, that can compute a metric, named the ERB, which is claimed to represent both time-varying and steady sounds in a more accurate way than existing Loudness methods permit. This is available on a PC based measurement system [4] with updates around every 100 ms. This could also be implemented on the same sound level meter if worthwhile. The need for a faster method of determining the same perceptual response as was the intention of Zwicker seems to be gaining interest. What is lacking is an agreed method for achieving it as there now appears to be no major barriers to implementing many of the proposed ideas in instruments such as sound level meters.

Conclusion

By making certain assumptions and defining variables appropriately, it has been shown that the sound level meter is capable of measuring Loudness in real time. The CEL-593.C1 L and CEL-573.C1 L meters (see Figure 1) are available employing the methods described in this paper and have already been used significantly in the automotive industry, especially in the USA, as a means of defining the quality of sound in vehicle interiors. An example of the data displayed in real-time is shown in Figure 2. As new methods of sound perception gain wider acceptance, the sound level meter is well placed to offer a portable, cost-effective solution to the making of these measurements.

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[1] E Zwicker, Acustica, 10, 304 (1960)
[2] ISO 532: 1975 Acoustics – Method for calculating loudness level
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AN INTRODUCTION TO NOISE MAPPING

Matthew Ling MIOA

Introduction

In a previous article [1] the EC Green Paper on Future Noise Policy [2] was introduced and discussed. A product of the debate engendered by that document has been an increased interest in the technique of noise mapping. Whilst the principles of mapping are well established in some disciplines (eg land use and hydrology) its application to acoustics is relatively recent.

This article aims to provide an overview of noise mapping, describing the technique, its potential benefits and some of the possible pitfalls. A comparison is also offered in respect of noise monitoring together with some observations on relevant noise indices.

The Nature of Noise Mapping

Noise mapping aims to provide a visual representation of the noise profile of a geographical area (town, city, region, country). Noise levels are charted in much the same way as topographical contours are used on a conventional map. By combining various information elements a map can be developed which displays not only land use but also highlights, for example, dominant noise sources and sensitive receivers (which may be taken as population areas). In addition such maps could display how the spatial distribution of noise levels varies over time.

Mapping or Monitoring?

An immediate question arises regarding the separate aims and purposes of noise mapping and noise monitoring. It is helpful to set down the commonly agreed aims of monitoring as below.

1. To give an accurate statement of noise levels in a specific location
2. To provide noise trend data
3. To establish exposure levels of a population for risk assessment purposes
4. To identify pollution hotspots or quiet areas
5. To yield information as to the effectiveness of noise pollution management schemes
6. To inform management/legislative/policy changes that may be required

This list demonstrates the close links between noise monitoring and noise mapping.

A common feature of the two approaches is the need for sufficient noise data to enable meaningful interpretation and discussion of the results. In broad terms noise data can be derived by measurement or prediction.

The following is an attempt to help identify the more appropriate choice.

Noise Measurement Surveys

An initial literature search has identified various procedures that have been used for large scale noise surveys.

Among the first reported comprehensive surveys was the London Noise Survey, carried out with BRE in 1961-2 [3] using a 500 yard spaced grid covering 36 square miles. This yielded 540 measurement points at the grid intersections. The noise levels were sampled for 2 minutes per hour for 24 hours. The data was then analysed to give L_{A10} and L_{A90}. An interesting aspect of this work was the finding that the average noise level of all data points correlated well with a single noise measurement taken at the top of the Post Office tower.

A survey of Greater Vancouver in 1972 [4] used 10,000 randomly selected grid points from a 56,000 node matrix. Ten 15 s samples were taken over a 3–5 minute period with L_{10} and L_{90} values calculated.

A study by BRE [5] in Watford used a 500 m sampling grid. Measurements were carried out for 24 hours for a range of descriptors (L_1, L_{10}, L_{50}, L_{90} and L_{eq}). These were measured over 1 hour periods and showed a standard deviation of 6 dB(A).

More recently the national noise incidence survey carried out in 1990 [6] chose 1,000 measurements based upon population density. Once again a wide range of descriptors were used ($L_{A01,1h}$, $L_{A10,1h}$, $L_{A50,1h}$, $L_{A95,1h}$, $L_{Aeq,1h}$) measured over 24 hours. Although this survey was arranged to cover the whole of mainland England and Wales, the numbers of sampling points in areas of low population were small.

Garcia and Faus [7] measured noise in 50 different locations in 7 Spanish cities. Indices used were L_1, L_{10}, L_{50}, L_{95}, L_{99} and L_{eq}. Measurements were carried out at ground floor, third floor and above. Little difference between noise levels was observed at the different heights, due to the noise fields present. The dominant noise source was reported to be road traffic. An expression was deduced relating noise levels to traffic density. The correlation between the various noise indices was also empirically derived and demonstrated that short measurement time periods could be used successfully if long term measurements were not possible.

Little work appears to have been carried out to profile noise in those areas regarded as 'quiet'. Bommer and Bruce [8] obtained a range of single figure and octave band data over one year for two national parks in the USA. Their work highlighted the difficulties with measurements in areas of extremely low background levels, the subjective acceptability of noises (eg waterfalls vs aircraft), the effect of weather and seasonal variations.

The literature demonstrates a number of points. Firstly, the dominant noise source in urban environments is normally associated with traffic. Secondly, there is a lack of a standardised approach to noise surveying. Thirdly, the sort of standard deviation of measurements encountered over a selected time period (eg daytime) may well be of the order of 6–8 dB.

It appears that the following three procedures have

been used for the selection of measurement locations:
1. Taking a random sample
2. Using the intersections on a grid
3. Using a stratified sample – according to
   (i) specific noise sources eg roads
   (ii) population density
   (iii) land use eg residential, industrial.

The grid technique is the most straightforward for providing data which can be correlated against prediction and for areas under proposed development. It lends itself well to contour mapping whilst stratified measurements may be more appropriate when relating levels to specific situations, eg population exposure. The selection of the grid size in the second approach is, however, complicated. In general, the larger the grid size the greater the variance of noise levels between grid points; the smaller the grid size the lower the variance, but with the complication of an increased number of measurement points. ISO 1996–2 [9] states that in general the difference between adjacent grid points should not be greater than 5 dB. However, resource implications will often preclude this level of measurement accuracy.

	Acquisition Method			
Criteria	**Measurement**	**Empirical**	**Computer**	**Scale Models**
Accuracy in normal use (dBA)	± 1.5	± 3	± 2	± 2
Form of results	For a particular point in time and space	For a particular point, optimisation possible	Multiple types: temporal and spatial, optimisation possible	Complete results but limited optimisation
Flexibility: study of variables, readjusting parameters	Poor: repeat measurements are required	Fairly good	Good	Fairly good

Table 1. Comparison of methods for acquiring noise levels

Prediction Methods

There are a number of options which can be considered, principally:
(i) Engineering methods – based upon the use of equations, graphs and empirical or measured data
(ii) Computer programmes – based on equations, models, standards and empirical data
(iii) Scale modelling – using reduced scale models in air, gas or water.

The prediction of noise levels is carried out in many countries for the different noise sources, eg Calculation of Road Traffic Noise (CRTN) [10] in the UK. Problems arise when comparison is to be made between countries or among software packages. The variety of noise calculation algorithms is extensive and little standardisation is apparent, despite the availability of some international standards.

Measurement or Prediction?

ISO 1996 suggests that a hybrid model utilising prediction and measurements can be employed with some success. In any case the divide between the first two methods is becoming more blurred with the tendency towards more portable and powerful computing power resulting in simpler engineering techniques being replaced by more comprehensive prediction systems which give greater flexibility and accuracy of predicted noise levels.

The selection of method must involve the resource implications and here there is little published work that includes any sort of cost benefit analysis. Utley [11] noted that no attempt had been made up to 1981 despite the widespread use of measurement surveys. Fisk [12] noted that to achieve consistent sampling accuracy it is possible to use shorter sample lengths at noisier sites than at quieter sites where the dominant source was road traffic.

The relatively recent development of computer prediction software means that more choices need to be examined before a definite decision can be made.

Lamure [13] compared the various methods available. His conclusions have been adapted in Table 1.

The two most practicable options would still seem to be measurement and prediction. The relative merits of these two techniques are explored further in Table 2. Ultimately, the choice of which method to use rests with a decision on the flexibility of the data required, eg will noise levels need to be known at a number of different times and what resolution of data is required?

Measurement		Prediction	
Pro	Con	Pro	Con
Measured values are known levels at a specific site Routine measurement procedure once personnel training completed	Site access difficult Only for one set of meteorological conditions Empirical corrections needed for other environmental conditions Large number of measurement positions could be required for accurate mapping	Flexible – changes readily made Minimal equipment needed (computer, digitiser, printer) Optimisation possible eg to examine changes in land use Some input data already available eg local government, OS air pollution modelling	Large amount of data required – time consuming for input unless already digitised What is used as source power data?

Table 2. Comparison of measurement and prediction

The Way Ahead

Whilst it is possible to manually use interpolation algorithms to obtain noise contour maps, this technique has been largely superseded by the use of geographical information systems (GIS). These are systems which enable the flexible input of data from a variety of sources, allowing different layers of information to be displayed simultaneously. Thus traffic infrastructure, population density and noise data could be displayed together and links made between the data. For example, the proportion of a population exposed to levels above a certain value could be estimated.

Little published work exists which reports using GIS with noise prediction for noise mapping. Gatreel and Naumann [14] reported simple urban noise mapping in Lancaster, UK, using the ARC/INFO GIS software. Noise data was obtained at 80 different sites and at two different times of day on two weekdays. Interpolation of the data demonstrated a correlation between data separated by up to 500 m. They concluded that useful information could be obtained but gave a note of caution that with any interpolated data the standard errors should also be presented in the graphical information. Pathak, Durucan and O'Reilly [15] used a bespoke prediction module with the ARC/INFO GIS to enable the spatial distribution of noise levels to be displayed, modelling noise from a surface mine taking into account the following factors; sound power output, operational period, topography and meteorological conditions. The model did not take into account wind velocity or ground effects. Some difficulty does exist in ensuring that all the relevant data is in the correct digital format, and in reality one of the largest costs involved is obtaining the data in the appropriate format.

Noise Indices

Throughout the previous discussion mention of noise levels has been without detailed discussion of what noise indices should be used in measurements or predictions. This diversity is illustrated by Gottlob [16], who reviews European standards and different guidance levels currently used. The discussions as to the most appropriate index is complex and as such is outside the scope of this article. However, a decision needs to be made based upon a consideration of the following factors:

(i) objective or subjective
(ii) weighted or unweighted
(iii) source specific.

Debate at the European level appears to be favouring the use of an L_{eq}, with some support for using a single rating figure which combines the different source levels and subjective responses along the idea of the indices of ISO 1996–2. Obviously, care needs to taken in the use of an index which provides insufficient resolution of the noise data, and as such a decision needs to be taken based upon the intended application of the mapping.

Concluding Comments

The debate on noise mapping has been stimulated by the EU Green Paper on Future Noise Policy and without doubt the debate is set to increase as the benefits are seen across Europe. Mapping provides the potential for assessing the impact of policy changes on noise exposure and the study of noise trends. Within the UK a number of local authorities* have begun feasibility studies into the cost-benefits of mapping.

This article has discussed some of the characteristics of noise mapping. It has identified the complexity of accurately predicting and combining effects from multiple sources. Much work is still required before we can be confident in the results in non-simplistic situations. However, once this has been achieved then the next step forward is to start mapping annoyance or noise related health effects rather than noise levels. Then the true impact of our noisy world can be assessed.

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* *This theme will be continued in a future issue*

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SELECTIVE AMPLITUDE COMPRESSION AND SPEECH INTELLIGIBILITY

Peter Barnett MIOA

Introduction

During early 1995 it was decided to investigate the hypothesis that the application of a form of selective amplitude compression to speech would lead to a quantifiable improvement in intelligibility. The developing requirements for providing adequate voice support systems in, inter alia, sports venues and other acoustically difficult spaces, provided an extra impetus for this work.

Apart from any effects traceable to distortion generated by the electronic components and transducers, the main cause of degradation of the speech signal arises from the effects of masking. That is to say the ability to correctly interpret a sound is limited by masking which arises from the time-coincident arrival at the listener of other sounds. These sounds could be in the form of noise arising from other sources and reverberation, that is to say the late arrival of an earlier sound that arrives after one or more reflections at the space boundaries. The relevance of background noise can be readily appreciated. The effect of reverberation is interesting in that, with speech, strongly voiced vowel sounds have the potential to overshadow weaker unvoiced consonant sounds, and it is the latter which carries the greater reponsibility as far as intelligibility is concerned.

This latter point suggests that if the vowel components can be selectively compressed by electronic means, a reduction in the influence of masking should result.* This article reports an investigation into this possibility that has been carried out piecemeal over the past 3 years.

Implementation and Methods

Lists of phonetically-balanced words were subjected to varying degrees of selected compression and recorded originally on a digital audio tape (DAT) and, more recently, on recordable CDs. Since the difference between compressed and uncompressed speech might be small, it was important to remove, as far as possible, variations caused by the nature of the source material. The target words were always delivered in a carrier sentence 'Please write ....' or 'Now write ....' . Each word list comprised 50 monosyllabic words and to minimise the effects of variations in rate of delivery or emphasis the talkers, who were trained actors, underwent a training programme as laid down in ISO TR 4870.

To ensure that the lists were not contaminated by either noise or reverberation, the initial recordings were carried out in the BRE anechoic chamber and in all 20 lists comprising 50 words each were recorded.

Each source tape (or CDR) was initially subject to a normalisation programme to ensure a precise repetition rate and word amplitude relative to the carrier sentence, in other words 'Please write BAG' or 'Please write bag' was adjusted to 'Please write bag'. The space between each sentence was that of digital silence. The editing programme was carried out on a digital system where each target word was assigned a file number and a simple macro shuffled the words and inserted the carrier sentence and the space between sentences.

In all, each word list was subject to 10 shuffles, giving a potential population of 200 lists. This process was extremely time-consuming and perhaps took in all some 6 to 9 months.

The word lists were then subject to varying degrees of amplitude compression and rerecorded. All signal transfers were carried out in the digital domain to minimise degradation and the recordings at this point were monaural. The recorded material was then presented in both compressed and uncompressed format to a Brüel & Kjær Head and Torso Binaural Recording System in the chosen acoustic environment. These recordings were subsequently contaminated with binaurally-recorded noise in various signal-to-noise ratios in the range −10 dB to +25 dB.

The final material was presented to a trained listening jury who had hearing judged to be 'normal'. In most cases at least 2 word lists per condition were used and each was scored by at least 10 persons.

It is then important to understand that each point on the graphs is in fact the consensus of 24.

The Studies

Force of circumstance dictated that some of the application testing exercises took place as an adjunct to other work involving word scores. The results reported in this article are therefore as follows:

1 .Initial research
2. The Mass Transit Railway Hong Kong
3. St. Albans Court House
4. Hazelwood School
5. The Flowerday Effect

Other data has been collected but permission of the client has not yet been obtained and hence has not been reported here but the results were consistent.

Initial Work

The initial work explored the potential benefits when speech is subject to contamination by noise. In this study, phonetically-balanced word lists were subject to varying degrees of compression and then contaminated with band-limited binaurally-recorded noise in varying degrees of signal-to-noise ratio.

Since the act of selectively compressing speech was introducing distortion, the effect of compression when applied to speech without added noise was tested and

Figure 1 shows the percentage correct scores for diagnostic rhyme tests carried out with varying degrees of compression.

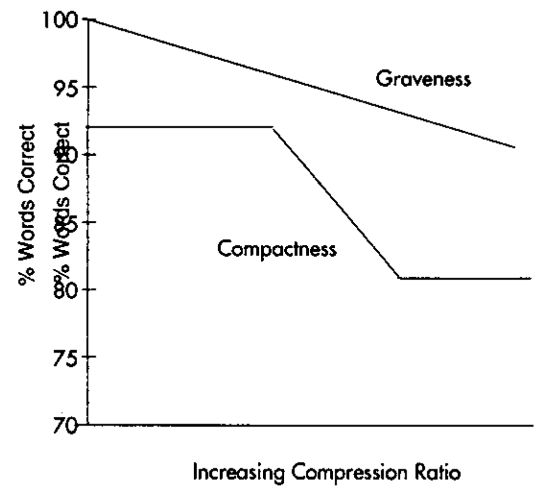

Fig. 1. Graph of Graveness and Compactness against Increasing Compression Ratio

It can be seen that with increasing compression ratio two speech attributes, namely graveness and compactness, suffered some degradation. Those speech attributes that were unaffected have not been considered further. It follows that when word score is plotted against increasing compression, as in Figure 2, a maximum is observed. It is logical to assume that the advantage of compression is eventually negated by the deleterious effect on the speech products.

From the foregoing, word scores are plotted in Figure 3 against signal-to-noise ratio for the chosen most advantageous compression statistics.

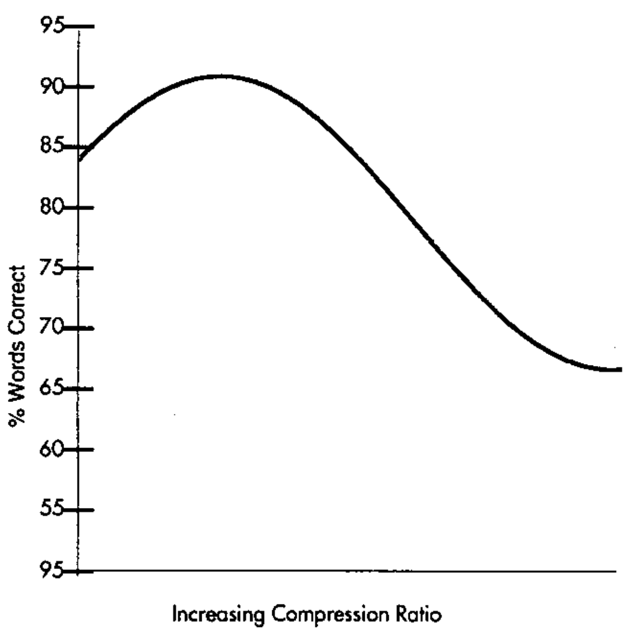

Fig. 2. Graph of Increasing Compression against %Words Correctly Scored for a Signal-to-Noise Ratio of 0dB

It can be seen from Figure 3 that there is a small but significant improvement in speech intelligibility with the application of compression in the presence of noise.

With the hindsight of further experimentation, modifications have been made to the application of compression and additional improvements as shown in Figure 4 which represents the present state of the technology.

Further Studies and Reverberation

The results of this initial study indicated there was value in pursuing this idea further. Also since some practical applications of this approach were likely to involve the degradation of speech by reverberation, it was clear that this aspect should be investigated too. For this reason tests were carried out in three spaces and the results are set out below.

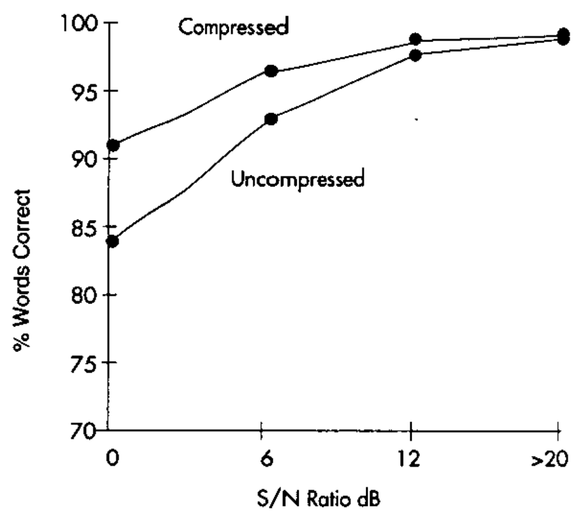

Fig. 3. Results of Word Scores vis Signal-to-Noise Ratio from Initial Study

Mass Transit Railway (Hong Kong) Measurements were carried out in the ticket hall of Lai Chi Kok station to seek evidence of improvement in speech intelligibility in this type of environment.

Lai Chi Kok Ticket Hall has Reverberation Times of 1.7 s at 500 Hz and 1.5 s at 2 kHz, a relatively low ceiling and hard tiled walls.

Binaural recordings were made in the space with both compressed and uncompressed source material. The recordings were made during night time engineering hours when the ambient noise level was low. The addition of noise presented a small problem. Firstly, earlier work suggested that mixing monaural noise without the addition of the space's reverberant components gave variable results and the jurors observed that it did not sound natural. Yet to make binaural recordings of the noise of occupancy in this type of space is extremely difficult on account of client hesitancy.

Monaural recordings present little problem since a paying customer is able to wear a tie-clip microphone. A computer model of this station had earlier been developed for other purposes and it was possible to convolve

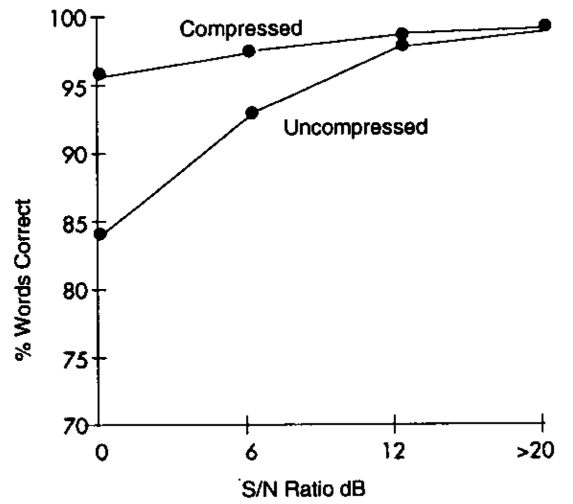

Fig. 4. Results from Initial Study Modified to Account for Current Methodology

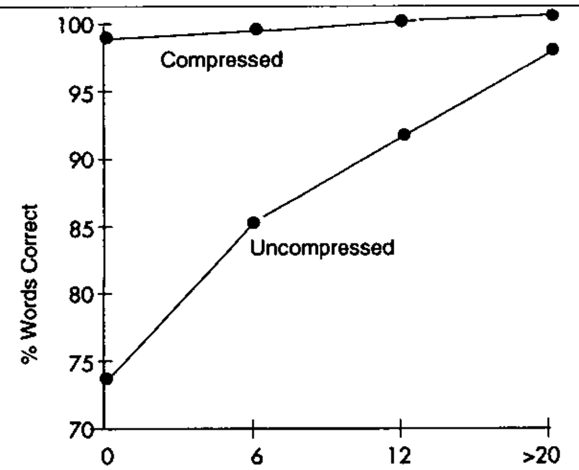

Fig. 5. Lai Chi Kok Results

the monaural noise within the space and obtain a binaural output and it was this recording which was subsequently used to contaminate the recorded word lists. The results of this exercise are shown in Figure 5.

Again it can be seen that the application of compression produces a significant improvement even when the noise level is extremely low.

St. Albans Old Court House This has been used by the Institute in conjunction with the 'Acoustics for Sound System Engineers' courses. A practical is held in the venue where the students carry out various acoustic measurement exercises. The Court House is basically octagonal with Reverberation Times of 3.5 s at 500 Hz and 2.8 s at 2 kHz.

A simple speech intelligibility exercise is carried out to acquaint the students with word score testing methods; students sit in various locations acting as a listening crew to recorded word lists played through a single loudspeaker. No hearing test was carried out on the students but all felt that their hearing was 'normal'.

The students were unaware that some of the word lists had been compressed. The results are shown in Table 1.

Student	Condition	
	Uncompressed	Compressed
1	84	96
4	78	90
2	76	92
3	76	92
8	72	84
7	71	88
9	70	82
5	68	84
6	68	80
AV	73.7	87.6

Table 1. Percentage Word Score Results

It can be seen that a useful improvement is indicated. The noise level from external traffic was low and the signal-to-noise ratio was probably in excess of 25 dB(A) and thus not a significant factor. It is thus reasonable to conclude that compression provides a potential benefit under reverberant conditions.

It has not been possible to associate each student's results sheet with a position in the space but it is estimated by calculation that the direct-to-reverberant ratio was in the region of −5 to −10 dB.

Hazelwood School The exercise carried out here (unlike St. Albans Court House) was a controlled experimen.t Hazelwood School Hall has a hard floor and walls and doubles as a gymnasium. The reverberation times of the space are as shown in Figure 6.

It can be seen that the space is quite reverberant and as a teaching space with an unaided voice it provides poor intelligibility.

The main purpose of this experiment was to determine if there was a significant difference between word lists that were scored directly by a listening crew and those recorded and presented to a listening jury. For this experiment two listening panels alternated between act-

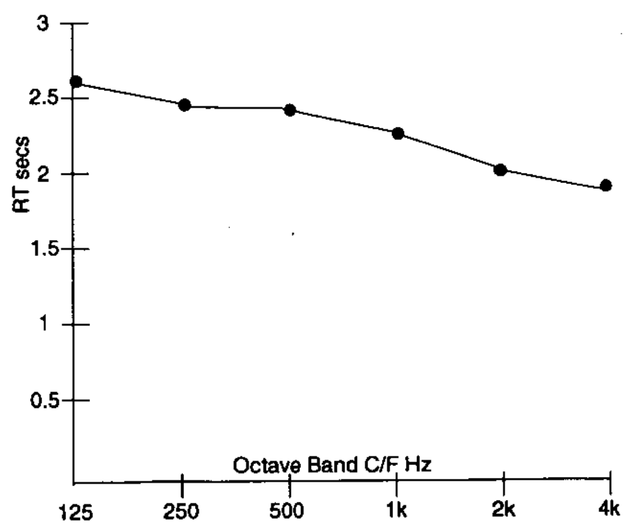

Fig. 6. Measured Reverberation Time of Hazelwood School Hall

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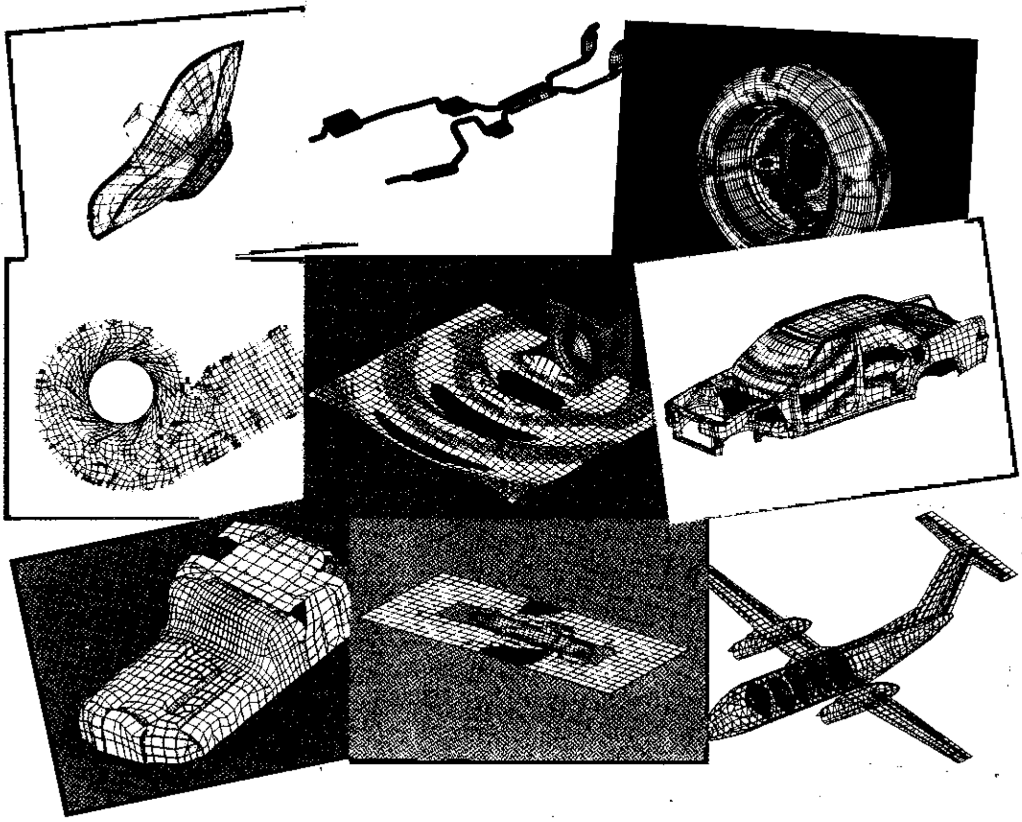

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Case radiation analysis
Positioning of sound absorption material

ing as jury members and crew members. Two positions in the hall were used with a Brüel & Kjær Head and Torso Binaural Recording System positioned between them as shown in the configuration indicated in Figure 7.

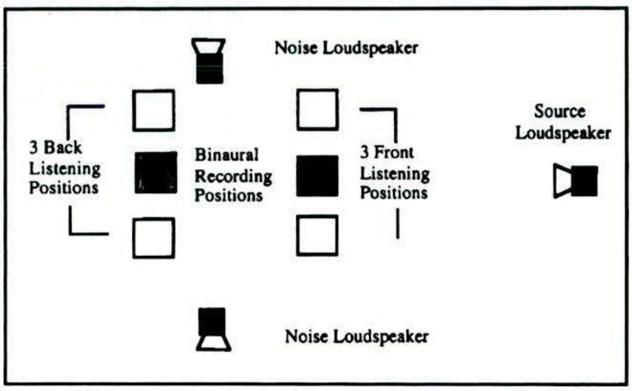

Fig. 7. Plan of Hall Layout

Noise was introduced to the space via two loudspeakers. Due to the very reverberant nature of the space the noise field was fairly uniform in level.

Based on statistical room acoustics the direct-to-reverberant ratio at the front and back seats, with the source as described was calculated as displayed in Table 2.

Seating Position	Octave Band Hz 125	250	500	1k	2k	4k
Front	−14.0	−13.5	−11.0	−8.0	−6.0	−5.0
Back	−17.0	−16.0	−13.0	−11.0	−8.0	−7.0

Table 2. Direct-to-Reverberant Ratio

The listening crew and jury were experienced and had undergone training. As for St Albans Court House, some of the compression experimentation was carried out alongside other exercises. Word lists at the preferred compression ratio were introduced in the test procedure.

The results presented in Figures 8 and 9 are averages derived from both listening crew and jury scores. They are presented as front and back listening positions with the nominal S/N ratio.

The results obtained show a considerable improvement in word scores especially at the back listening position.

The Flowerday case An interesting side issue arises fortuitously from the fact that in the Hazelwood exercise one of the jurors, a Mr F Flowerday, was known to have age-related high frequency hearing loss and this fact was supported by a simple test.

Under normal circumstances his hearing loss would have rendered him ineligible for the tests but it was considered prudent not to exclude him. He was used as an extra man and occupied the vacant seat when the Brüel & Kjær HATS was in the other position. He also served on the listening jury scoring the recordings.

Instead of discounting Mr Flowerday's results a chance decision was taken to mark them and Figure 10

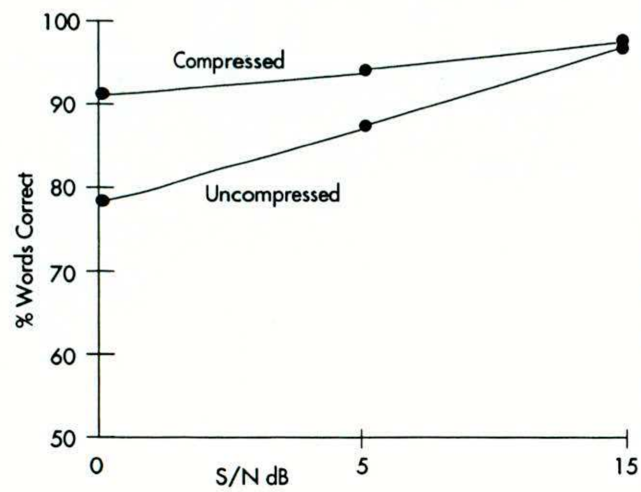

Fig. 8. Graph of Word Scores – Front Listening Position

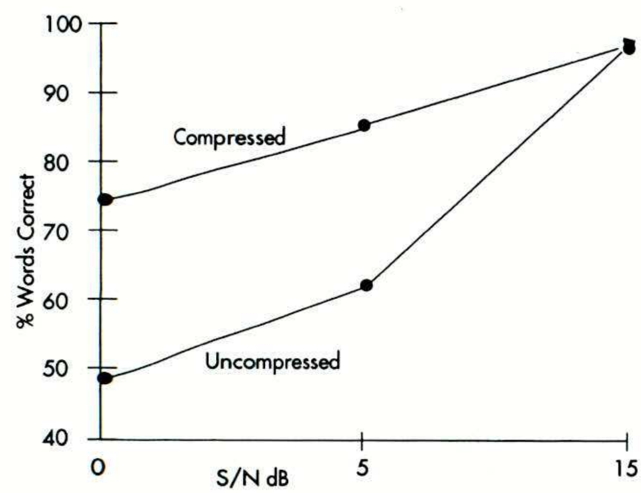

Fig. 9. Graph of Word Scores – Rear Listening Position

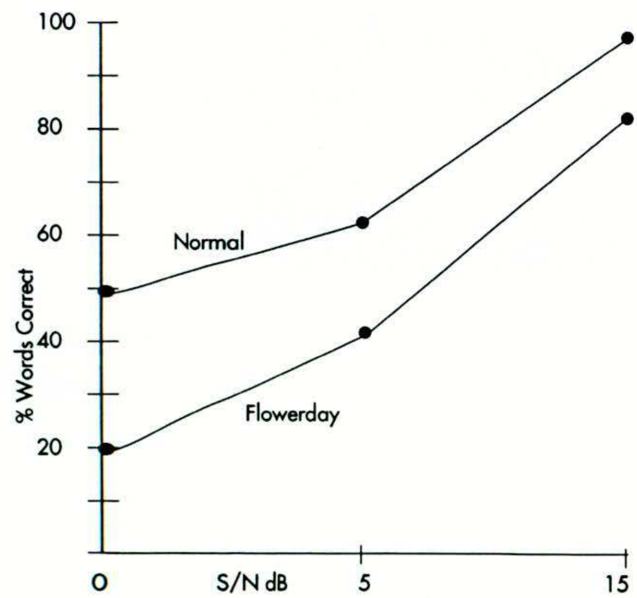

Fig. 10. Word Scores – Back Listening Position

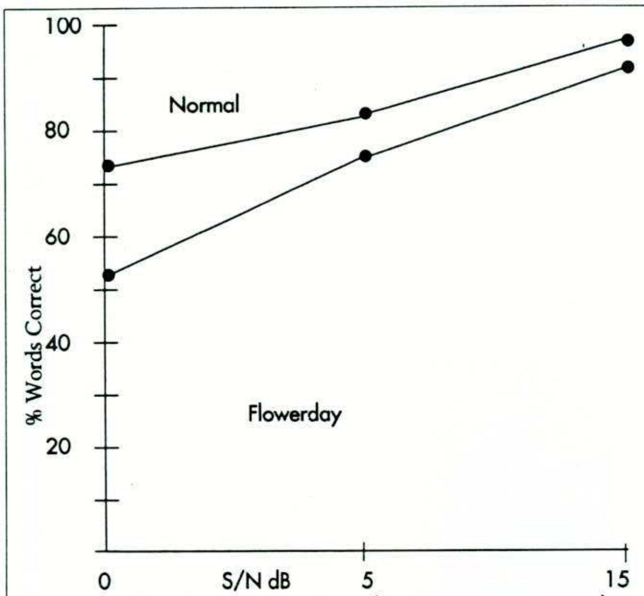

Fig. 11. Word Scores – Back Listening Position with amplitude compression

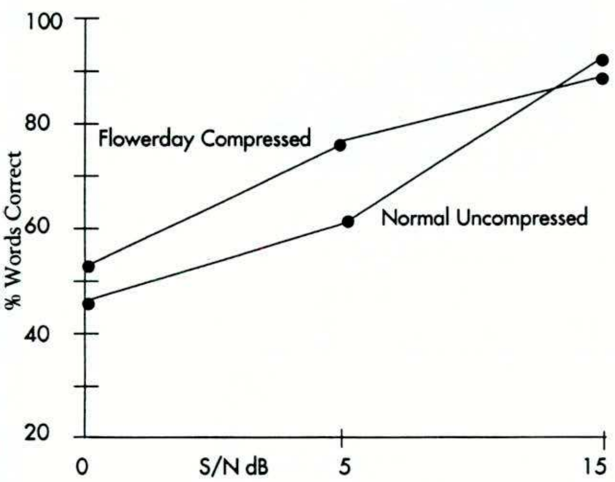

Fig. 12. Comparison of Normal (uncompressed) and Flowerday (compressed) results

shows a comparison of Mr Flowerday's scores with those of a normal population.

With compression applied the following tentative conclusions may be drawn:

Both the normal and Flowerday results were improved. Figure 11 shows a comparison between normal hearing with uncompressed speech and Mr Flowerday with compressed speech. It can be seen that the application of compression returns, under these conditions, Mr Flowerday's results to normal.

The results, of course, are for one person only but each data point was for two word scores, two in the hall and two as a jury, making eight results in all. The standard deviation of the results was within those expected for this type of test. It should also be emphasised that Mr Flowerday was not cognisant of the extent of his hearing problem or the reasons for the test.

Concluding Comments

The foregoing demonstrates that correct application of selective amplitude compression can produce a significant improvement in speech intelligibility derived from a voice support system. Although some of the data was obtained by chance, with the exception of St Albans Old Court House, good experimental procedure was observed at all times; for brevity much of the details has been omitted from this article.

Under certain circumstances it is possible to quantify the improvement expected and this prediction method is presently being validated. It clearly has considerable potential in respect of PA systems and other applications including, for example, car radios – hence the need for patent application. A programme of experimentation with car radios is in place for the near future. Work is also planned to quantify the potential improvements for various Reverberation Times, direct-to-reverberant ratios and signal-to-noise ratios. Such a matrix of data would allow the potential improvement to be determined for any space and may prove to be a cost-effective alternative to acoustic treatment.

* *Both the means and the method are subject to a pending patent and the actual degree of compression and its manner of application may not be disclosed at this time. This article has been submitted in order that a discussion of the principles involved may take place at an early date.*

Peter Barnett MIOA is Director of AMS Acoustics, Chase Side, London.

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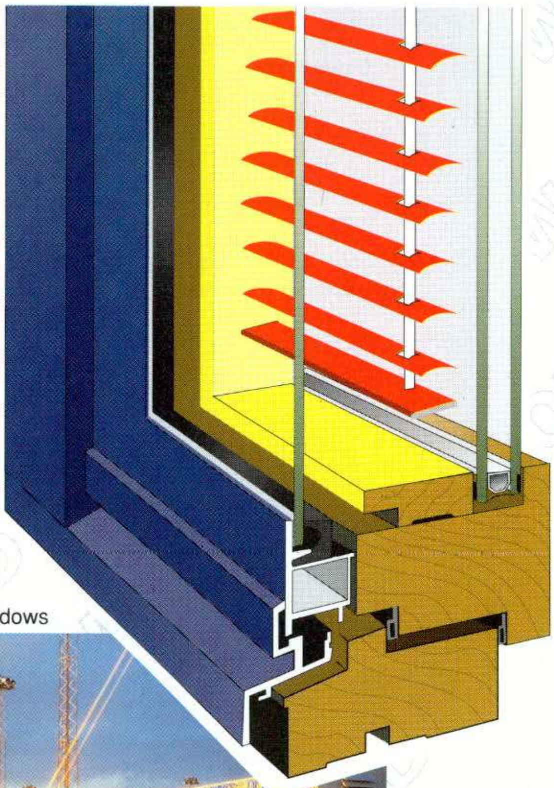

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MULTI-SINE EXCITATION AND THE MEASUREMENT OF FREE-FIELD RESPONSE OF LOUDSPEAKERS

Bjorn Winsvold & Ole-Herman Bjor

In order to successfully determine the frequency response of loudspeakers it is necessary to ensure that the test environment does not introduce errors into the measurement. Typical sources of error are background noise and reflected components of the test signal itself.

The effect of background noise can be minimised by increasing the level of the test signal to effectively swamp the interfering signal, this would however have no effect on the reflected components as they would stay at the same level relative to the test signal. Even well within the reverberation radius the errors associated with reflected components can result in a high degree of uncertainty in the determination of the loudspeaker's performance.

To avoid these problems measurements are often made outdoors or in an anechoic chamber where nearly free field conditions can be assumed. In both cases expense and inconvenient test procedures are involved. The use of gated multi-sine test methods would overcome these problems and allow loudspeakers to be tested in 'normal' acoustic conditions saving both time and the expense of special test facilities.

The basic determination that has to be made is that of the transfer function between the electrical drive signal and the resulting sound pressure level. In these cases gating techniques may be used to remove the reflected components on the basis that the unwanted reflections normally arrive later than the wanted direct sound. In order to obtain effective gating, however, the test signal and its response must have a duration that is short compared to the time difference between the direct sound and the first reflection.

This tends to suggest a pulse testing method but as the peak of the test signal has to be limited these tests are not very effective and lead to very low signal to noise ratio in the measurement.

An implementation* that overcomes the problem of limited pulse handling capability and achieving a good signal to noise ratio uses a multi-sine test signal combined with a Fast Fourier Transform (FFT) technique. It has the added advantage of being quick and uses standard instrumentation.

The multi-sine excitation signal comprises a number of equal amplitude sinusoidal signals. There is one sine wave at the frequency of each active line used in the FFT analysis. They have their relative phase shifted, without affecting the frequency content of the test signal, to limit its crest factor. A typical crest factor for a multi-sine test signal may be as low as 1.3 compared with the 1.4 for a pure sine wave.

The multi-sine signal is fed to the loudspeaker under test and to channel 1 of the analyser, the resulting sound pressure level is measured with a precision microphone in channel 2. In the example below, the frequency response function H1 is measured based on 100 averages in frequency steps of 31.5 Hz up to 25 kHz (800 lines). Averaging is used to enhance the signal-to-noise ratio. This procedure even attenuates impulsive extraneous signals as they are effectively attenuated due to the cross correlation method applied. It is not necessary to use a window in the measurement as the excitation signal has the same period as the analysis time period used in the FFT-analysis and as a result there can be no discontinuities in the sample frames. The complex transfer function that results includes the direct and reflected components of the test signal although it is very difficult to quantify the effect of these reflections in the transfer function. However if an inverse Fourier Transformation of the signal is performed the broad band impulse response appears giving the possibility of differentiating the direct and reflected components in the time domain.

If the time delay between the arrival of the direct sound and the first reflection is sufficiently long, as is normally the case for broad band transducers, the reflections are easy to distinguish on the time axis from the direct sound. The direct sound may therefore be effectively isolated by multiplying the signal with a time window the weighting of which is designed to remove the reflected components.

The resulting signal now contains only the direct component and may be returned to the frequency domain by Fourier Transformation. The example in Figure 1 demonstrates the measurement of the frequency response of a loudspeaker using the method and shows the frequency response function before the removal of the reflected components. These can be seen as flutter on the frequency response and this effect is to be expected since the reflections, depending on their frequency and phase

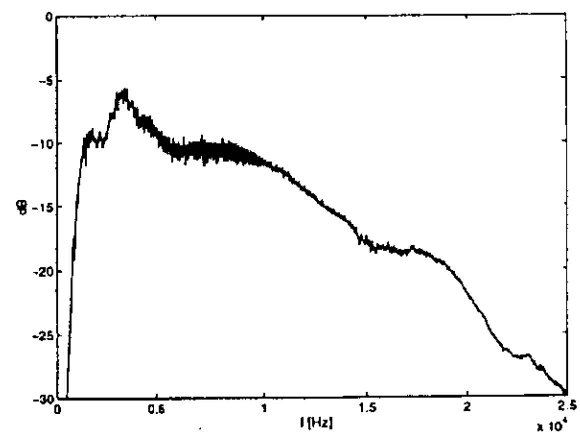

Fig. 1. Measured frequency response of a loudspeaker

represent constructive and destructive interference with the direct sound.

A software package applies the inverse Fourier Transformation and yields the impulse response shown in Figure 2. In this the reflected components can be clearly seen and removed by applying a weighting to the time axis to give the corrected impulse response. Having removed the reflections the mathematical package is again used to transfer the impulse response back to the frequency domain to yield the frequency response of the loudspeaker under test, as shown in Figure 3. The complete measurement is completed within a few seconds and the analyser may even be programmed to compare the results obtained with pre-set production tolerances and set signal output lines to indicate pass or fail.

The method is sufficiently flexible to allow it to be programmed to correct for the response of the measurement microphone where this may be deviating from the ideal requirements.

The main limitation for this method is that the system has to be time-invariant and linear, a condition which is generally satisfied for loudspeaker testing.

A further problem could arise if reflections of significant size appear with a time lag longer than the period of excitation signal as they may not be separated properly. This corresponds to a transmission distance of about 11 metres for sound in air when the analyser is set for a measurement bandwidth of 25 kHz and would be longer if the bandwidth were reduced. As the gating affects the low frequency response the set-up should be arranged so a suitable time period is obtained before the first reflection appears.

By application of the method described loudspeakers may be tested effectively in normal production facilities with only the modest acoustic requirements being specified for the area where the measurements are to be performed.

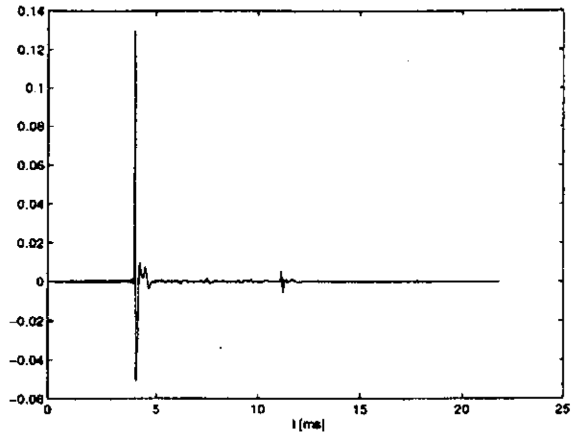

Fig. 2. Impulse response of the measured loudspeaker. After inverse Fourier transform is applied, the reflections can be identified and removed by applying a time window.

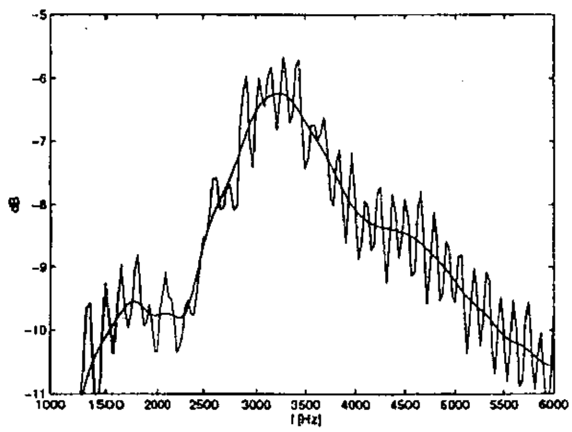

Fig. 3. Zoomed part of the frequency response function before and after removal of the reflections.

** The Norsonic NOR-840 dual channel analyser, when fitted with the FFT extension, includes such a signal source. The NOR-840 analyser with the PC option will run Microsoft® Windows™ applications that may control the set up of the analyser and control the measurement via an appropriate DLL. It may therefore be loaded with a suitable mathematical program that runs under Windows, and used for post processing the transfer function.*

Bjorn Winsvold & Ole-Herman Bjor are with Norsonic AS, PO Box 24, N-3420 Lierskogen, Norway ❖

ANNOUNCEMENT & CALL FOR PAPERS

1998 Spring Conference

Acoustics '98

TRANSPORTATION NOISE: NOISE ON THE MOVE

(Organised by the IOA Meetings Committee)

Cranfield University

31 March - 2 April 1998

The 1998 Spring Conference re-establishes the event at which Institute members can meet to discuss their latest concerns, findings and discoveries. Therefore, this Call for Papers seeks wide-ranging contributions. To initiate the Conference planning, the theme of transportation noise has been adopted, but your contributions will resolve the final programme of our annual Spring meeting.

The 1998 AGM and Annual Dinner will take place during the Conference.

Offers of contributed papers should be sent with a 100-word abstract to the Institute office before 1 December 1997. Written papers will appear in the Proceedings of the Institute of Acoustics which will be available to delegates upon arrival. Completed manuscripts, normally no more than eight pages, must be with the Institute before 1 March 1998. Intending authors should indicate if it is their intention to have their paper refereed under the new procedure.

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

The meeting will include, as well as your lecture presentations, student poster sessions, specialist workshops, IOA medal lectures and refreshments.

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

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Fax: +44 (0)171 625 0250
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Royle, P
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Chinnery, P A
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Dyne, S J C
Edgington, C M
Essert, R D
Harker, R J
Harland, E J
Henson, R J
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Kang, J
Lee, J W
Ng, K K
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Poon, W Y
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Parker, S J
Parkin, A J
Phillips, D V
Pitt-Kerby, K B
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Pullin, M V
Quashie, V E
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Reynolds, P L
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Stone, L C
Street, N A
Suri, S S
Tomsett, G J
Turner, G
Urbanski, I D
Weston, M D
While, P J
White, R
Wilkinson, A
Wright, M A

Associate
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Fausti, P
Simpson, A B
Smail, L R

Student
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Copley, L D
Lynch, P
Parkin, S P

1997 Autumn Conference

Noise and Vibration

(Codes, Standards and Criteria)

27 – 30 November 1997

Hydro Hotel, Bowness on Windermere

The programme is now available from the Institute office.

Institute of Acoustics, 5 Holywell Hill, St Albans, Herts AL1 1EU
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ONE-DAY MEETING NOTICE

Sound Intensity - Theory and Practice

Organised by the Measurement and Instrumentation Group

Tuesday 11 November 1997

Building Research Establishment, Watford, Herts

The meeting will be relevant both to practitioners already familiar with intensity measurements and to those considering the technique for the first time. There will be some opportunity for 'hands on' experience in the afternoon workshop sessions.

0945 Registration and refreshments
1015 Welcome and introduction
1020 ISO 9614, *Svein-Arne Nordby, Norsonic*
1045 Sound Intensity Microphones and Probes, *Gunnar Rasmussen, GRAS Sound & Vibration*
1110 PC-based Sound Intensity Systems, *John Shelton, AcSoft*
1135 Refreshments
1150 Title awaiting confirmation, *Kevin Bernard Ginn, Brüel & Kjær*
1215 Sound Intensity in Building Acoustics, *John Seller, Building Research Establishment*
1240 Sound Power Level and Environmental Corrections, *Dick Whitson & Ivan Arbuckle, National Engineering Laboratory*
1305 Lunch
1400 Workshops
- Calibration, *led by Stephen Watkins, National Physical Laboratory*
- PC Data Acquisition, *led by John Shelton, AcSoft*
- Microphones and Probes, *led by Gunnar Rasmussen, GRAS Sound & Vibration*
- Sound Intensity Mapping, *led by Ian Campbell, Gracey & Associates*

1630 Open Forum
1700 Close

Certificates of attendance for CPD purposes will be available to delegates.

Meeting organiser :
Alistair Mackinnon MIOA, National Engineering Laboratory, East Kilbride, Glasgow, G75 0QU
Tel: 01355 272531 Fax: 01355 272999 email: amackinnon@nel.uk

Sound Intensity - Theory and Practice, BRE, 11 November 1997

Name:

Organisation:

Address:

Tel: Fax: email:

☐ Please register me as a delegate to the one-day technical meeting and invoice me for the meeting fee which includes lunch & proceedings ☐ Members £95.00 + £16.63 VAT = £111.63 ☐ Others £125.00 + £21.88 VAT = £146.88 .

☐ I cannot attend but wish to purchase the Proceedings ☐ Members £12.00 ☐ Non-members £18.00

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INSTITUTE DIARY 1997/8

1997

1 NOV
Acoustics Bulletin Copy Date (Nov/December)

4 NOV
Environmental Assessment Code of Practice Working Party
St Albans

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

7-9 NOV
IOA Diploma Distance Learning Laboratory Weekend 97/1
St Albans

11 NOV
Instrumentation & Measurement Group One-day Mtg Sound Intensity – Theory and Practice
BRE Watford

12 NOV
Midlands Branch Evening Mtg
TBA

13 NOV
IOA Publications, Meetings Committee
St Albans

14-16 NOV
IOA Diploma Distance Learning Laboratory Weekend 97/2
St Albans

19 NOV
North West Branch Technical Visit to Salford University and Presentation on MIDI.
Salford

19 NOV
Engineering Council Conference and Exhibition
London

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

5-7 DEC
IOA Diploma Distance Learning Laboratory Weekend 97/3
St Albans

11 DEC
IOA Medals & Awards, Council
St Albans

16-17 DEC
Underwater Acoustics Group Conference: Underwater Bio-Sonar Systems and Bioacoustics
Loughborough

17 DEC
Acoustics Bulletin Management Board
St Albans

1998

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

JAN
North West Branch Evening Mtg – Sound Insulation Around Manchester Airport.
Manchester

5 FEB
IOA Publications, Meetings Committee
St Albans

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

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

12 FEB
IOA Membership, Education Committee
St Albans

26 FEB
IOA Medals & Awards, Council
St Albans

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

3 MAR
Instrumentation & Measurement Group One-day Mtg – Noise Act
Leeds

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

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

31 MAR – 2 APR
Acoustics 98. IOA Spring Conference
Cranfield University

23 APR
IOA Publications, Meetings Committee
St Albans

30 APR
IOA Membership, Education Committee
St Albans

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

14 MAY
IOA Medals & Awards, Council
St Albans

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

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

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

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

18-19 JUN
Diploma examinations
Accredited Centres

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

17 SEP
IOA Publications, Meetings Committee
St Albans

24 SEP
IOA Membership, Education Committee
St Albans

1 OCT
IOA Medals & Awards, Council
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9 OCT
IOA CofC in W'place Noise Exam
Accredited Centres

22-25 OCT
Reproduced Sound 14
Electroacoustics Group

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

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

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

12 NOV
IOA Publications, Meetings Committee
St Albans

26-29 NOV
Autumn Conference: Speech & Hearing
Speech Group

3 DEC
IOA Membership, Education Committee
St Albans

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

10 DEC
IOA Medals & Awards, Council
St Albans

Association of Noise Consultants Council Meetings
24 November 1997
26 January 1998
23 March 1998

THE ASSOCIATION OF NOISE CONSULTANTS SOUND LEVEL METER CALIBRATION KIT

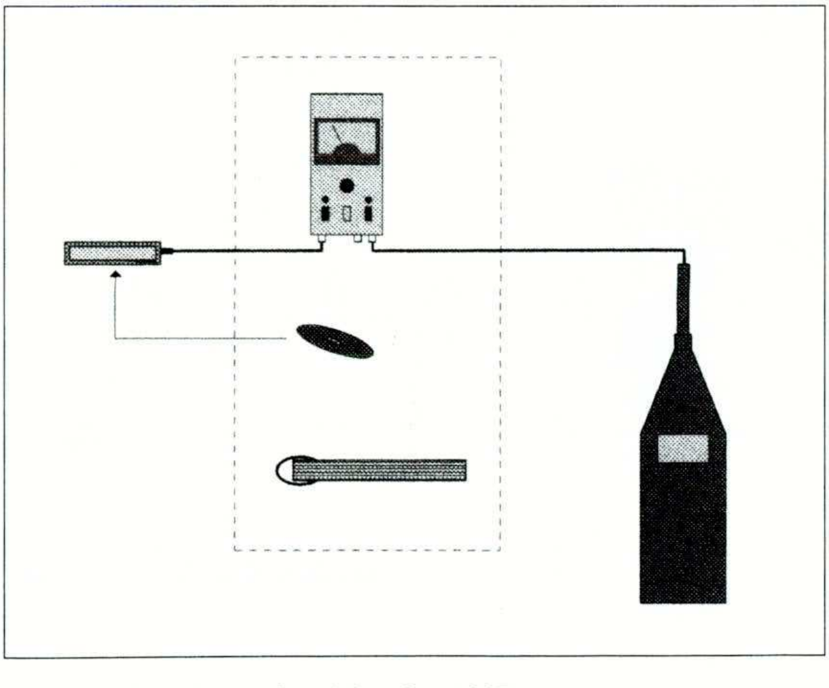
David Fleming

It is conventional wisdom that we should periodically check our sound level meters, calibrators and pistonphones to ensure they are working correctly. Thus we were encouraged by BS4142:1990 to have our instruments verified by a NAMAS accredited laboratory every two years and in BS4142:1997, for the highest level of verification, are exhorted to have this done by a UKAS accredited laboratory as prescribed in BS7580: Part 1. As a ready reference to unassailable aspirations clients increasingly demand this level of verification and as a defence against bellicose barristers some consultants eagerly comply. But to others, the cost of verification and instrument down time is not warranted by their experience of instrument malfunction, which is perceived to be rare or detectable by 'competent operators', nor is a two year interval between checks sufficiently frequent to detect malfunctions which do occur. In day to day consultancy, disputes over measurement results which can be directly attributed to reliability of the measuring instruments themselves are very rare; as stated in BS5969:1981 clause 2.5, 'the method of use has at least as much effect on a measurement as the quality of the instrument itself'.

In recognition of the disproportionate cost of BS7580:1992 verification of type 2 sound level meters, relative to the purchase price of the instrument itself, this standard has been divided into two parts. Broadly speaking, the original BS7580 comprises Part 1 and is applicable to type 1 instruments while the new Part 2 is a shortened procedure and applies to type 2 instruments. Part 2 is expected to be useful to health and safety officers monitoring noise levels in connection with Noise at Work but does not address the concerns of consultants, many of whom have type 1 instruments which they use for a wide range of environmental noise and acoustics measurements.

Fundamentally, what is lacking is a proper review of instrument reliability taking account of the nature and frequency of instrument malfunction, aggregate instrument tolerances for particular tasks relative to individual function tolerances within the instrument, and systematic and random errors in the physical variable being measured and in the measurement procedure. This analysis would not be a trivial undertaking. In particular, the relationship between tolerances in individual functions (in for instance, linearity, frequency weighting, time averaging, etc) and overall instrument tolerance (ie in L_{eq} measurement) is unclear. Furthermore, we do not yet have a standardised algorithm for obtaining percentile measurement results.

More practically, there is a need for an economic checking procedure which can be carried out regularly in-house, by which operators can be reasonably sure that their sound level meters are working satisfactorily and have not suffered a significant malfunction during a recent field excursion. Some five years ago The Association of Noise Consultants set up a working party to explore these issues, the outcome of which has been the production of The ANC Sound Level Calibration Kit which provides just this facility.



Conceivably, a complex, wide band noise signal, of sufficient dynamic range, could be synthesised having calculable values of the commonest noise descriptors, (dB(A) Fast and Slow, L_{eq}, $L_{n\%}$, etc) and applied to a sound level meter to test that the overall performance of the meter was within specific tolerances for these descriptors. This is not an easy task, even if the tolerances are agreed, which they are not.

The more straightforward alternative is to follow the method of BS7580 (in which the majority of tests are electrical) and check individual functions of the meter against stipulated tolerances, on the basis that its overall performance is, in a vague sense, equal to the sum of its parts. This has been the strategy behind the design of the ANC Calibration Kit, the provisions of which are to supply on Compact Disc a set of audio test signals similar to those prescribed in BS7580:1992

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and an Interface Unit to enable these signals to be applied electrically to the input of the sound level meter under test.

The audio CD can be played on a standard domestic CD player, a portable (battery operated) CD player or on a CD-ROM drive configured as a standard audio player on a personal computer. In the latter case the drive is not used to derive .WAV files; the PC simply provides, with appropriate software, a convenient means of compiling play lists by which a bank of test tracks can be played sequentially, the signal being taken from the lineout or headphone socket of the drive.

The Interface Unit is required essentially to amplify and set the output signal of the CD player to an appropriate reference level and to ensure that the frequency response of the player system is level. The Unit has a 30 dB attenuator to permit either a 124 dB or 94 dB reference level to be adopted. The Unit itself will need to be calibrated periodically and it is intended that a fast and inexpensive service will be provided by an organisation approved by the ANC.

An understanding of the test signals and their purpose is desirable but not essential to the use of the Kit; the manual describes setting-up and testing in detail. For the tests duplicated from BS7580:1992 the tolerances are stated in the manual. Blank calibration forms are included for recording the test results. The signals on the CD provide for electrical testing of the following:

sensitivity • self-generated noise • linearity and range control accuracy • frequency weightings • time weightings (slow/fast/impulse) • RMS accuracy • time averaging • sound exposure leve • overload indication • octave band filter response • statistical percentile levels • microphone open circuit correction factor (using a valid sound level calibrator)

The Kit and the tests it provides do not replace verification according to BS7580. Acoustics tests (ie of the microphone) are not included, nor does ANC insist that the entire battery of electrical tests be carried out. The system is recommended by ANC for regular in-house testing of users sound level meters in conjunction with:

a calibrated acoustic calibrator or pistonphone • periodic acoustic checks of microphone function • the keeping of a proper user's log of the test results • regular (annual) re-calibration of the Interface Unit

With familiarity, the tests will take about 30 minutes to conduct (excluding octave band filter characteristics) and can be undertaken on more than one sound level meter simultaneously in parallel. Because the Interface Unit is battery operated (with a battery level indicator) tests can be carried out in the field using a portable CD player.

One kit is being installed in the Distance Learning laboratory at the Institute's office in St Albans. Members wishing to examine it in operation should ring 01727 851475 regarding its availability.

The Kit is protected by patent registration. Enquiries regarding purchase should be made to The Association of Noise Consultants, 6 Trap Road, Guilden Morden, Nr Royston, Herts SG8 0JE, Tel 01763 852 958. ❖

International Symposium on Musical Acoustics

University of Edinburgh, 19–22 August 1997

Musical acoustics is one of the oldest sciences, and over the centuries some great mathematicians and physicists, including Euler, Bernoulli, Helmholtz and Rayleigh, have made major contributions to its development. Nevertheless, many theoretical and practical questions about the nature of musical sound and the functioning of musical instruments remain unresolved, and musical acoustics is currently a flourishing research area. Every year or two the practitioners of this art meet in an International Symposium on Musical Acoustics (ISMA). Two years ago, after the highly successful ISMA'95 at Dourdan, just outside Paris, members of the IOA Musical Acoustics Group were successful in a bid to bring the next ISMA to the United Kingdom. So it was that on the evening of Tuesday 18th August 1997 around 150 delegates and partners assembled at the Pollock Halls of Residence of the University of Edinburgh for the Welcome Reception marking the start of ISMA'97.

Musical acoustics is by its nature an interdisciplinary subject, and this was emphasised by the fact that the Welcome Reception was hosted jointly by the University's Faculty of Music and Department of Physics and Astronomy. The Dean of Music, Professor David Kimbell, and the Head of Department of Physics and Astronomy, Professor Richard Kenway, were on hand to extend personal greetings. The University provided considerable support for the Symposium, both through direct financial aid and by releasing secretarial and technical staff to back up the familiar IOA team of Cathy Mackenzie and Linda Beck. An enthusiastic body of postdocs and research students, in the distinctive ISMA'97 tee-shirts, were also invaluable in keeping the show running smoothly.

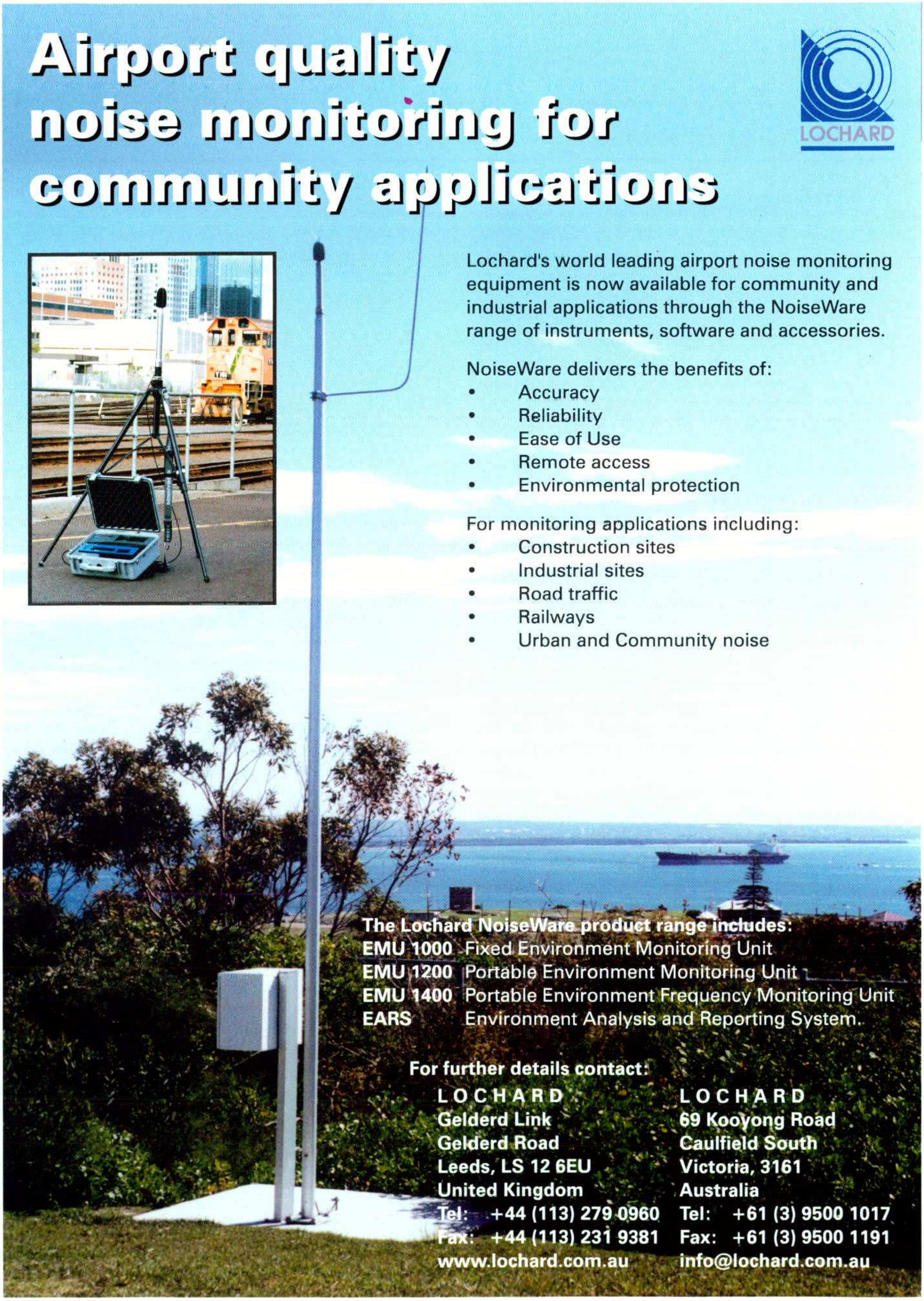
On the Wednesday morning the scene shifted to the Reid Concert Hall, built in the mid nineteenth century as part of the Music School of the University. It is interesting to note that some of the earliest lectures on musical acoustics in Britain were given in this hall, which now also houses the University's magnificent Collection of Historic Musical Instruments. The Curator of the Collection is Arnold Myers, a member of the Organising Committee, who had arranged a special exhibition of some of the surviving nineteenth century acoustical demonstration apparatus.

Serenaded by the skirl of the Great Highland Pipes, the delegates assembled for the opening ceremony. Sir Stewart Sutherland, the Vice Chancellor, expressed the delight of the University in hosting the meeting. The indefatigable IOA President, Bernard Berry, welcomed the international gathering, including participants from Australia, Japan, North and South America, and numerous delegates from Eastern Europe. On this occasion Bernard also represented the European Acoustical Association, which had recognised the meeting as an EAA Symposium. Finally there was a speech of welcome from Carleen Hutchins, Permanent Secretary of the Catgut Acoustical Society. The CAS originated this series of symposia, and it was a particular delight that Mrs Hutchins was able to attend in person.

The sessions on Tuesday were devoted to aspects of the acoustics of stringed instruments and percussion. The technical side of the meeting got off to a spectacular start with an Invited Paper by Knut Guettler of the Norwegian State Academy of Music in Oslo, entitled 'Bow Notes'. Knut is not only one of the leading scientists studying the dynamics and acoustics of the bow-string interaction, but he is also a highly accomplished player of the double bass, and his talk was illustrated by live musical demonstrations. Six contributed papers on bowed strings and three on plucked strings completed the morning sessions.

The setting for the Symposium lunches was a surprise: rather than the expected student refectory, the venue was the University Playfair Library, generally thought to be one of Edinburgh's most gracious and splendid classical rooms. This was also the location of the two poster sessions which were held in the afternoons of Tuesday and Wednesday. On the Tuesday, following the theme of the day, the fourteen posters were on aspects of stringed instrument acoustics, and were introduced by Jim Woodhouse. The second Invited Paper was a remarkable and unusual view of 'Materials Selection for Musical Instruments', by Claire Barlow of the Department of Engineering at the University of Cambridge. The mechanical property maps which were presented and discussed were clearly of very general relevance to a wide range of instrumental types. Four papers on piano acoustics and four on aspects of percussion instruments completed the formal part of the day.

The dates of ISMA'97 had been chosen to coincide with the Edinburgh International Festival of the Arts, and quite a few delegates had booked seats at some of the many concerts and theatrical events taking place in Edinburgh in the evenings. However, around a hundred ISMA participants took up the offer of an informal Social Evening with self-generated musical entertainment in St Cecilia's Hall, another of the University Music Faculty's concert halls. The world famous Russell Collection of Early Keyboard Instruments is housed in this building, and the Curator, Grant O'Brien, was present to introduce some of the most significant instruments. John Kitchen, the University Organist and a noted harpsichordist, gave an impromptu recital on a clavichord, virginals, spinet and harpsichord from the Collection. The music provided by the ISMA participants was perhaps not all of the same calibre, but included such delights as an improvisation on the didgeridoo by Leo-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nardo Fuks, a spine-tingling rendition of Greek folk songs by Maria Pavlidou, and a cheerful medley of traditional jazz standards from an ad hoc band including the legendary clarinet of Kees Nederveen.

Back to business the next morning, with a day largely devoted to computer modelling and wind instrument acoustics. Six papers on stringed instrument computer simulations made up the first session. Seiji Adachi, of ATR Human Information Processing Research Laboratories in Kyoto, then gave the third Invited Paper, which was an expert review of 'Time-domain Modelling and Computer Simulation of an Organ Flue Pipe'; this was followed by four contributions on reed instruments. Research into the acoustics of flue organ pipes is particularly active at present, and this field was given a magisterial review by Judit Angster, with her Invited Paper on 'The Stationary Spectrum and Attack Transient of a Flue Organ Pipe'. Four further contributions in this general area followed; notable among them was the presentation of Mico Hirschberg of Eindhoven University of Technology, who departed from his printed text to give a typically energetic and thoughtprovoking discussion of the problems of a fluid dynamic approach to wind instruments. The afternoon poster session contained twelve papers on wind instrument acoustics, which were introduced by Mico Hirschberg.

One of the ideas behind the timing of ISMA'97 to coincide with the Edinburgh Festival was that it might stimulate exchanges of ideas between acousticians, composers, performers and the concertgoing public. To help achieve this two special public sessions were organised; the first took place on Wednesday evening at 6pm. The session started with a talk on 'Recent Developments in the Synthesis of Musical Sounds' by Julius Smith of the Center for Computer Research in Music and Acoustics at Stanford University. This lively and informative talk was followed by a concert of electronic music, organised by the University of Edinburgh Electronic Music Studio under its Director, Peter Nelson.

Thursday morning started with a bang – in fact with 'four hundred sonic bangs per second'! This was the intriguing way in which Joel Gilbert, of the University du Maine in Le Mans, described the non-linear propagation effects which he illustrated on both a bass trombone and a plastic tube in the course of his Invited Paper on 'Brass Instruments'. Eight papers on brass and woodwind instruments made up the rest of the morning session. After an early lunch, delegates were back in the Reid Concert Hall for one of the highlights of the Symposium. This was the second public session: a talk by Carleen Hutchins on the Violin Octet, followed by a concert of music for this fascinating family of instruments designed and constructed by Mrs Hutchins. Ranging from the tiny treble, an octave above the normal violin, to the monster double bass which towers over the player, the instruments have been scientifically scaled so that their principal body resonances are at the same relative pitches for each instrument, giving a remarkable homogeneity to the ensemble sound. The University of Edinburgh now owns the first set of instruments to be completed, and two years ago it commissioned new works from two of Scotland's leading contemporary composers, Lyell Cresswell and Edward Harper. After Mrs Hutchins' historical survey of the origins of the Octet, Edward Harper conducted a concert in which these new works were performed, to an enthusiastic response from the packed hall.

Six papers on wind instruments and the human voice were presented in the first technical session on Thursday afternoon; the second session contained three papers on psychoacoustical theory and experiment. In the evening the Symposium Banquet took place in the spectacular setting of Gosford House, the historic mansion about twenty miles from Edinburgh which is the home of the Earl and Countess of Wemyss. Background music was provided by the Edinburgh Renaissance Band, with the dance group Polyhymnia providing a short cabaret demonstration at the end of the meal.

The final day of ISMA'97 overlapped with the first day of a two-day Colloquium on Historical Musical Instrument Acoustics and Technology organised by the Galpin Society. The day started with an Invited Paper by Christopher Field, former Dean of the Faculty of Music at Edinburgh, on 'John Donaldson and the Teaching of Acoustics at Edinburgh in the Mid-Nineteenth Century'. Fifteen papers followed on various aspects of the history of the subject of musical acoustics and the acoustical properties of wind, stringed and percussion instruments. The final two papers in the meeting, on the acoustics of historical bells, were given by Xavier Boutillon, one of the principal organisers of ISMA'95, and Tom Rossing, a prime mover of ISMA'98 which will take place near Seattle next summer. The Proceedings of ISMA'97 have been published as Volume 19, Part 5 of the Proceedings of the Institute of Acoustics.

Murray Campbell MIOA

The ISMA '97 All-Stars jazz band at St Cecilia's Hall

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

All members of the Institute shall at all times so order their conduct as to uphold the dignity and reputation of the profession and of the Institute of Acoustics and to safeguard the public interest in matters of safety, health and the environment. They shall exercise their professional skill and judgement to the best of their ability and discharge their 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. Members have a responsibility to upgrade their professional knowledge and skill and shall maintain an adequate awareness of technological developments, procedures, standards, laws and statutory regulations which are relevant to their field and shall encourage their 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/her 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. Members shall not do anything, or permit anything under their authority to be done, of which the probable and involuntary consequences would, in their 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 their work, members shall respect all relevant laws and statutory regulations.

Duty to Employers

6. When discharging their professional duties members shall:

(a) satisfy themselves as to their scope, obtaining in advance any necessary clarification or confirmation, and shall not accept professional obligations which they believe they have not sufficient competence or authority to perform;

(b) accept responsibility for all work carried out by them, or under their supervision or direction, and shall take all reasonable steps to ensure that persons working under their 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 their advice is aware of the possible consequences;

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

(e) neither communicate to any person, nor publish any information or matter not previously known by them or

published in the public domain, which has been communicated to them 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/her 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/she 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.

CPD

Are you a CEng or IEng through the Institute of Acoustics?

If so, then you should take note that the Engineering Council will be visiting the Institute in January to examine 10% of CPD records of EC registrants. This applies both to those who are on the Institute Scheme and those who are managing their CPD in another way.

If you are on the Institute Scheme please make sure your CPD record for 1996 has been sent to your area representative. If you are not on the Institute scheme please make sure your CPD record is available should the EC wish to examine it. Remember, you are obliged to plan and record your CPD and produce evidence of it. This is part of being a professional engineer.

Additionally, would everyone on the Institute scheme please submit their record for 1997 as soon as possible after the end of the year.

Sue Bird MIOA
Chair, CPD Committee

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

* In these rules 'member' means an individual member of any class referred to in the Bylaws and 'employer' includes client. Chartered Engineers and Incorporated Engineers are also subject to the Code and Rules of Conduct of the Engineering Council.

This document replaces the version published in the March/April 1997 issue.

IOA Support for Schools Initiative – Request for Information

The Education Committee, with the support of Council, wishes to explore possible ways in which the Institute can assist and encourage schools to become more aware of acoustics and its applications in society. One of the aims would be to encourage more students to embark on a career in acoustics.

In the past we have supported a series of very successful lectures, aimed at sixth form level, but we feel that this is only one of a series of measures which should be considered, and that our target audience should include lower secondary and primary school levels as well as sixth forms. The school curriculum is now so crowded that one of the urgent needs seems to be for suitable teaching resource material, such as slides, videos, Multi-media CD Roms etc together with suitable supporting text. One possibility is that the Institute could extend its stock of audio/visual material used for the Diploma Distance Learning course by gathering together a library of such material as already exists, for use by schools, and if a need is demonstrated, to develop our own materials. We have made a start by acquiring 01dB's Mediacoustic CD Rom, courtesy of the distributors, AcSoft, and plan to make this available on loan to schools.

I am aware that many members, and their organisations already give support to their local schools by giving talks in schools, providing visits, loan of sound level meters etc although we do not know the extent of such activities.

I would therefore like to invite members to give the committee the benefit of their views on how best the Institute could assist schools, and further interest students in our profession. If you can provide advice or assistance please write to me as Chairman of the Education Committee, via the Institute or contact me directly on Tel/fax: 0181 642 5155 or email: bob.peters@virgin.net by 24 November 1997, so that your contribution can be considered at the next Education Committee meeting. Thank you.

Bob Peters FIOA

Research in Progress

Heriot-Watt University

Department of Building Engineering and Surveying

The effect of the cavity and cavity absorption on sound transmission through double walls

A development of existing work to study the effect of cavity absorption on the properties of the structure and on transmission through the structure.

Duration: 3 years to August 2000
Supervisor: Professor R M Craik FIOA
Researcher: Not appointed
Collaborators: Dr R Wilson, University of Nottingham and Professor A Cummings, University of Hull
Funding: £58,885 EPSRC and DERA, (Heriot-Watt part)

Sound transmission through orthotropic building structures

A study of airborne and structure-borne sound and vibration transmission in buildings where the components are orthotropic (have a bending stiffness that is higher in one direction than the other). The work is developing theoretical models for both airborne and structure-borne sound and these theories are being compared with laboratory experiments and with full size buildings.

Duration: 3 years 6 months to March 1998
Supervisor: Professor R M Craik FIOA
Researcher: A Al-Ghonamy
Funding: Saudi-Arabia Scholarship

Sound transmission through offshore and marine structures using statistical energy analysis

With Department of Mechanical and Process Engineering. A study into the application of SEA to ships and other off shore type structures. This project is part of a multi-team project. Funding by the EPSRC through the MTD. SEA has been successfully applied to a wide range of building type structures and it is being developed so as to establish the extent to which it can be applied to marine structures.

Duration: 3 years to March 1998
Supervisor: Professor R M Craik FIOA and Dr J A Steel
Researcher: T Connolly
Funding: EPSRC through MTD, £11,6970

Sound transmission through aircraft structures

A study of sound transmission through aircraft structures using statistical energy analysis. This includes the development of theoretical models to predict both structural vibration along the structure and airborne transmission through the structure.

Duration: 3 years to October 1997
Supervisor: Professor R M Craik FIOA
Researcher: M Platten
Funding: Alexander Neilson Bequest Scholarship

Speech intelligibility in classrooms

A study of speech intelligibility of classrooms including a survey of criteria for assessing classrooms. A survey of the actual behaviour of classrooms and an initial study of whether or not poor acoustics will affect the learning of children.

Duration: 2 years to December 1997
Supervisor: Mr D Mackenzie MIOA and Professor R M Craik FIOA
Researcher: S L Airey
Funding: £76,777 EPSRC

Department of Mechanical and Chemical Process Engineering

Sound transmission in cars

A study to develop a statistical energy analysis model to predict sound transmission through cars and similar structures. This builds on experience of the application of SEA to building structures and seeks to apply this to cars.

Duration: 3 years to October 1997
Supervisor: Dr J A Steel
Researcher: G Fraser
Funding: Alexander Neilson Bequest Scholarship

Salford University

Department of Acoustics and Audio Engineering

Quantifying Room Acoustic Quality Using Artificial Neural Networks

This project will investigate a system to enable measurements of occupied spaces where speech communication is important. The new system will measure the quality of the room from a speech signal as received by a microphone in the room. Neural networks will learn how to extract the determining characteristics from these speech signals and hence estimate objective parameters such as reverberation time.

Duration: 3 years, from 1 January 1997
Supervisors: Dr T J Cox and Dr P Darlington
Researchers: To be recruited
Funding: £90,000
Source of Funding: EPSRC

Items should be sent to Dr Bridget Shield MIOA, South Bank University, School of Engineering Systems and Design, 103 Borough Road, London SE1 0AA

BSI News

Drafts for Public Comment

(for information only)
97/105644 DCEN 12354-3 Building acoustics – Estimation of acoustic performance of buildings from the performance of products – Part 3: Airborne sound insulation against outdoor sound (prEN 12354-3)
97/105645 DCEN 12354-4 Building acoustics – Estimation of acoustic performance of buildings from the performance of products – Part 4: Transmission of indoor sound to the outside (prEN 12354-4)
97/105886 DC Revision of BS 8233: 1987 Code of practice for sound insulation and noise reduction for buildings

BS EN Publications

The following are British Standard implementations of the English language versions of European Standards
BS EN 60704: Household and similar electrical appliances – Test code for the determination of airborne acoustical noise
BS EN 60704-2-8 Particular requirements for electrical shavers. No current standard is superseded
BS EN 60645: Audiometers. Equipment for speech audiometry. Specifies requirements for audiometers designed to present speech sounds to a subject in a standardised manner, eg for the measurement of speech recognition. No current standard is superseded
BS EN 61606: 1997 Audio and audiovisual equipment – Digital audio parts – Basic methods of measurement of audio characteristics. Describes terms, measuring conditions and methods of measurement for the digital part of audio and audiovisual equipment for consumer and professional use. No current standard is superseded
BS EN ISO 717: Acoustics – Rating of sound insulation in buildings and of building elements
BS EN ISO 717-1: 1997 Airborne sound insulation. Supersedes BS 5821: Part 1: 1984
BS EN ISO 717-2: 1997 Impact sound insulation. Supersedes BS 5821: Part 2: 1984
BS EN ISO 3822: Acoustics – Laboratory tests on noise emission from appliances and equipment used in water supply installations
BS EN ISO 3822-3: 1997 Mounting and operating conditions for in-line valves and appliances. Supersedes BS 6864: Part 3: 1987
BS EN ISO 3822-4: 1997 Mounting & operating conditions for special appliances. Supersedes BS 6864: Part 4: 1987
BS EN ISO 4871: 1997 Acoustics – Declaration and verification of noise emission values of machinery and equipment. No current standard is superseded
BS EN ISO 11689: 1997 Acoustics – Procedure for the comparison of noise emission data for machinery and equipment. No current standard is superseded
BS EN ISO 11820: 1997 Acoustics – Measurements on silencers in situ. No current standard is superseded
BS EN ISO 11957: 1997 Acoustics – Determination of sound insulation performance of cabins – Laboratory and in-situ measurements. No current standard is superseded
BS EN ISO 12001: 1997 Acoustics – Noise emitted by machinery & equipment. Rules for drafting & presentation of a noise test code. No current standard superseded

European New Work Started

Road traffic noise reducing devices – Specification for product (CEN/TC 226/WG through B/509/6)

International New Work Started

ISO 15186 Acoustics – Measurement of sound insulation in buildings and of building elements using sound intensity under laboratory conditions

ISO Standards

ISO 2631-1: 1997 Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Part 1: General requirements. Note: This a corrected and reprinted version – June 1997
ISO 3382: 1997 (Edition 2) Acoustics – Measurement of the reverberation time of rooms with reference to other acoustical parameters
ISO 8727: 1997 Mechanical vibration and shock – Human exposure – Biodynamic co-ordinate systems
ISO 10847: 1997 Acoustics – In situ determination of insertion loss of outdoor noise barriers of all types. Will be implemented as BS ISO 10847: 1997
This information, provided by John W Tyler FIOA was announced in the Aug & Sept 1997 issues of BSI News

HMSO

The following information has been supplied by HMSO using a search on keywords Sound, Acoustics and Vibration. The information has been reorganised into date order.

The first line of each entry carries the date of publication (where recorded), and the ISBN number. The second line comprises the title, a code regading availability etc and the cost.

Publications that are out of print, revoked, superceded etc will be included here for information. The keyword(s) do not appear in all of the abbreviated titles supplied with the result that the full titles of some of the entries may show that they do not refer to the topic that initially seemed the case.

The codes are:
BE = Available from the Belfast bookshop only
NH = Not published or sold by HMSO
NS = Not stocked but can be obtained through HMSO
OP = Out of print
RV = Revoked
SU = Superceded
SX = Can be ordered using the HMSO Scanfax system.
TO = Temporarily out of print

Undated entries

• 0000163848
NOISE AT WORK POSTER • – £4.25

• 0119096633
UN/ECE Motor vehicle regulation no.41 • NS £14.75

• 0119096730
UN/ECE Motor vehicle regulation no.51 • NS £15.25

• 0119096854
UN/ECE Motor vehicle regulation no.63 • NS £15.25

• 0119845687
NCM Tema Nord 94:525 Noise Prediction Methods/Nordic Countries • NS £6.50

• 0119845741
NCM Tema Nord 94:542 Health Effects/ Community Noise • NS £6.50

• 0119845644
NCM Tema Nord 94:512 Vehicle Noise Emission/Time Period up to Year 2010 • NS £6.50

• 0337083509
MODIFICATIONS OF THE TECHNICAL MEMORANDUM NOISE INSULATION REGULATIONS 1995 • – £1.00

• 9251012342
FAO/EIFAC Occasional Papers No.14 EIFAC Experiment/Pelagic Fish Stock • NS £7.00

• 9251016046
FAO Manual/Method/Fisheries Resource Survey/Appraisal Pt.2 Use Acoustic Inst. • NS £8.50

• 9277839708
EC COM(94)655 am. DIR 86/662 -limitation noise/earthmoving machinery • SX £4.34

• 9278107301
EC COM(96)540 future noise policy: European Commission green paper • SX £20.00

• 9282679993
EC EUR 15445 2nd European conference/ underwater acoustics 1994 [2 vol. set] • NS £84.00

• 000014178X
IND G 175 L HAND ARM VIBRATION • NH £0.00

• 0000141798
IND G 126 L HAND ARM VIBRATION ADVICE , • NH £0.00

• 0101596502
CMND 5965 National Insurance (Indust.Injuries) Act 1965 ; Vibration Syndrome • OP £0.26

• 0119737205
EC DIR 70/157 laws rel./ permissable sound level/exhaust/ motor vehicles • SX £30.48

• 0119095734
UN/ECE: Motor Vehicle Regulation No.9 , • NS £15.25

• 0119364522
EC Official Journal L 105 Vol.20 28/04/77 • NS £1.50

• 0119910527
EC Official Journal L 33 Vol.22 08/02/79 • – £1.20

• 0119919575
EC. Official Journal L 18 Vol.23 24/01/80 • SX £0.00

0110967135
SI 1989/713 The Motorcycles (Sound Level Meas.Certificates) (Amdt.) Regs. 1989 • OP £5.10

Dated Entries

4 MAY 72 • 0115102434
Marine Echo Sounder Performance Specification 1972. • OP £0.21

22 APR 74 • 0116705280
BRE.Report: Structural Vibration and Damage • OP £2.15

21 MAR 75 • 0118807269
Seis.Bull.No.3 Seis.Noise Meas/ Yugo/Greece:Surv.Prior/Stat.Inst • TO £0.45

22 OCT 75 • 0112703488
DES.Building Bulletin No.51. Acoustics in Educational Bldgs. • OP £2.00

11 AUG 76 • 0117240885
BRED No.192 : REFER TO ISBN 7777001183 No Longer Available from HMSO • OP £0.07

2 JUN 78 • 011883083X
Asbestos. Work/Thermal/Acoustic Insulation/Sprayed Coatings. • SU £0.50

4 JUL 78 • 0117513113
Guide/Measure.& Predict.of the Equiv.Contin.Sound Level L,eq • OP £3.00

6 JUN 79 • 011725035X
BRED No.226 : REFER TO ISBN 7777001183 No Longer Available from HMSO • OP £0.50

27 FEB 80 • 011883326X
HSE Form 2381.COP./Redu./ Expo./Empl.Pers./Noise:Appendix 5. • SU £0.90

12 JUN 80 • 0110067657
SI 1980/765 The Motorcycles (Sound Level Measurement Certificates) • OP £5.10

12 JUN 80 • 0110067665
SI 1980/766 The Motorcycles (Sound Level Measurement Certs.) (Fees) • RV £5.10

19 AUG 80 • 0853561281
UKAEA ND-R-249(D):Acoustic technique /determination/liquor level/ Tanks 1980 • NS £1.00

9 OCT 80 • 0118832719
H&SE.Res.Paper No.9.Vibration Injuries of the Hand and Arm. • SU £1.50

14 OCT 80 • 0116707674
BRE.Acoustics Demonstration Package. • OP £8.50

29 OCT 80 • 0115268405
Bus.Mon.PQ365.2(Second Qtr.1980) Broadcast rec./sound rep.equip. • OP £0.00

11 SEP 81 • 0853561400
UKAEA;ND-R-153(D);Noise Analysis Techniques Developed in DFR • NS £2.00

22 SEP 81 • 0101835000
CMND 8350 SES5.80/81 Vibration White Finger • – £1.90

8 OCT 81 • 0117250902
BRED No.187 : REFER TO ISBN 7777001183 No Longer Available from HMSO • OP £0.55

27 NOV 81 • 0107010828
HL DEBATES VOL.425 NO.10. WEDNESDAY,25/11/81. SESS.81/82. • OP £0.80

8 JAN 82 • 0110178297
SI 1981/1829 Control of Noise (COP/Noise/Audi.Intruder Alarms)Order 1981 • – £0.65

12 JAN 82 • 0119939363
EC Official Journal L 376 Vol.24. 30¡l2/81. • SX £0.00

12 MAY 82 • 0115280944
Bus.Mon.PQ 365.2 (4th Qtr.1981) Broad.Rece/Sound Reprod.Equip. • OP £0.00

21 JUN 82 • 0110268059
SI 1982/805 .Motorcycles (Sound Level Measure. Certif)EFees) (Amdt) Regs • RV £5.10

26 NOV 82 • 0115285326
Bus.Mon.PQ 365.2 (2nd Qtr. 1982) Broad.Rece/Sound Reprod. Equip. • OP £0.00

12 MAY 83 • 0119953293
EC Official Journal L 117 Vol.26 04/05/83 • SX £0.00

27 JUN 83 • 0115137017
Marine Echo Sounder Performance Specification 1983 • OP £2.50

26 MAR 84 • 9251014493
FAO Fisheries Technical Paper No.240 Fish.Acoust.Prac.Manual/ Aqua.Biom.Esti. • OP £16.50

17 MAY 84 • 9251014507
FAO Fisheries Report No.300 Symposium on Fisheries Acoustics • – £10.80

23 AUG 84 • 0119395649
EC EUR 7887 : Acoustic Emission : Past Expe.within ECSC Cont.and Future Trends • NS £2.30

7 JAN 85 • 0110479920
SI 1984/1992 Control of Noise (Codes of Practice/Construct.& Open Sites) 0.1984 • – £0.65

18 JAN 85 • 011939765X
EC EUR 9364:Fast Reactor Core Monitoring by Analysis of Temperature Noise • NS £6.50

2 AUG 85 • 0118838172
HSE Damage/hearing arising from leisure noise : A review of the literature • – £9.00

8 AUG 85 • 0117518220
Building Regs.1985 Approved Document E- • OP £4.40

10 SEP 85 • 0119976579
EC Official Journal L 233 Vol.28 30/08/85 • SX £0.00

13 NOV 85 • 0705810011
UKAEA AERE R11653 : Meas.boil.tube wall thic./ ther.power plan./elec.acou.tran. • NS £5.50

10 DEC 85 • 0-19838001
BS Building Regs.1985 Complete Package referred to in Approved Documents • NS £1025.00

7 JAN 86 • 0118835297
HSE Guidance Note PM 56 Noise/ Pneumatic Systems • – £2.50

28 JAN 86 • 9251022682
FAO/EIFAC Occasional Paper No.15 Expe/Pela.Fish Stock Asse/ Acou.Meth.etc • NS £4.00

27 FEB 86 • 0119706806
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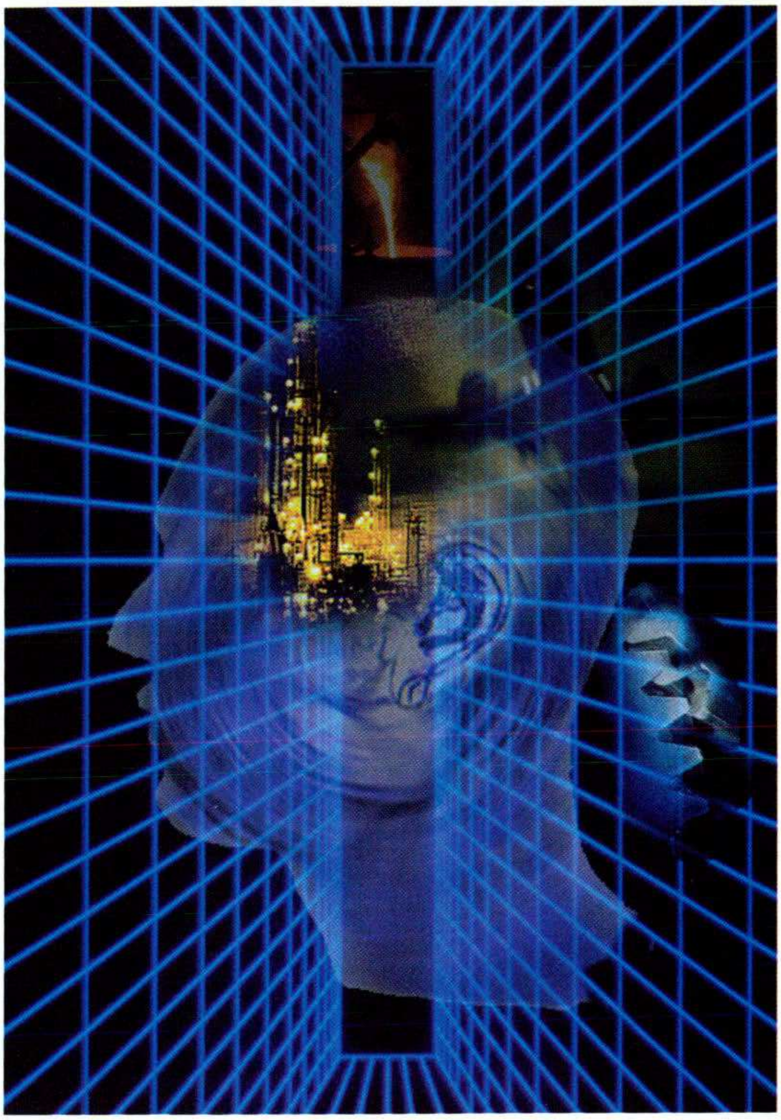
Footnote

Major General Bill O'Callaghan, aged 76, the UN's first Force Commander in the Lebanon, has joined the queue of 9,000 personnel and former personnel of the Irish Army in claiming compensation for hearing impairment arising from their military activities. The claims are believed likely to cost the Irish government around £350 million. – Report in the Dublin Evening Herald 10/10/97.

(Population of Ireland is 3.52 million – Ed)



New Products

CEL INSTRUMENTS LTD

A New Loudness Meter

The international standard, ISO 532 Part B: 1975, based on work by Dr Zwicker, establishes a single number descriptor to define the audible effect of 'loudness' as perceived by a listener. It is based on steady state noises which can be measured in full octaves or 1/3 octave bandwidths. Groups of frequency bands are added together and amplitude based corrections are then applied to determine a unit which can be expressed as 'Sones' or 'Phons'.

'Loudness' measurements require considerable processing power usually only provided by large and complex laboratory analysis systems but the 500 range of Real-Time Analysers from CEL Instruments uses Digital Signal Processing (DSP) technology to offer the equivalent power but with the convenience of a hand-held instrument that can be used with equal effect under field or laboratory conditions.

CEL's 500 Series Real-Time Sound Level Analysers can calculate a steady state spectrum, in 1/3 octaves, of either 100 or 500 ms duration. This is possible because the instrument uses group averaging of 10 ms spectral data. These steady state spectra can then be used to calculate the Loudness value, the Loudness level and the Loudness/Time history profile.

The 500 series can be specified with a standard 500 kb or 2 Mb memory to enable the instruments to cope with the most demanding measurement sequences. The stored data can then be output directly to a standard printer, in a preset report format, or down-loaded to a computer for further processing or the preparation of full reports.

The Loudness application can be specified at the time of ordering a CEL 500 series Real-Time Sound Level Analyser or it can be added at any time to an existing CEL analyser.

CEL 400 series Sound Level Meters

A new series of sound level meters from CEL have an icon based keypad and a large screen that displays information on the chosen criteria and the measurement results in a clear and legible format. The screen icons are arranged to reflect the position and functions of the buttons on the keypad which makes the selection of parameters and functions intuitive and therefore easy to learn.

A CEL Type 900 Series Sound Level Meter

The 400 series, based on the advanced technology used in CEL's 500 real-time sound level analyzers, are also modular in nature to provide a wide choice of models. Purchasers can specify instruments to include just broad-band measurements or to add frequency measurement capability. Here too the customer has a choice of octave, or octave and third octave band functionality. All variants are available as Type 1 (precision) or Type 2 (industrial) instruments. Clear upgrade paths exist to enable users to choose a model that suits their current needs and to have the freedom to add further functionality as and when required.

There are two main models in the range, the 440 standard version and the 480 which offers additional timed measurement functions that can be used to automatically start, stop and store a number of measurement runs during a working period.

A comprehensive choice of measurement criteria and ranges are available in each model to enable the instruments to meet the demands of differing regulatory requirements for noise assessments and product compliance testing.

To eliminate the need for hand-written records the 400 series have on-board memories and data download capabilities. It is possible to store measurements automatically or by manual instruction and data can be printed out, in a preset report format, to any standard printer. Results can also be downloaded to computers, using a CEL Windows™ software program, for further processing and report writing.

For more information contact CEL Instruments Ltd, 35–37 Bury Mead Road, Hitchin, Herts SG5 1RT Tel: 01462 422411 Fax: 01462 422511 Email: sales@cel.ltd.uk Website: http//www.cel.ltd.uk

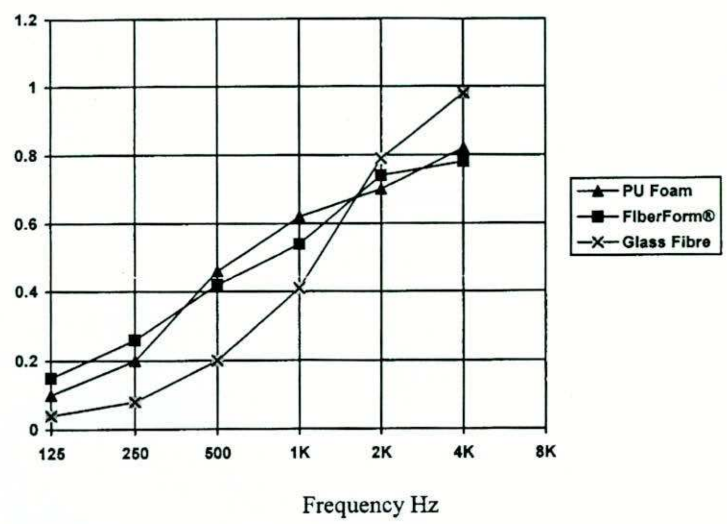
CEL Instruments is a Key Sponsor of the Institute.

THE NOISE CONTROL CENTRE

FiberForm®

In addition to its extensive range of sound absorption products, The Noise Control Centre has launched its latest innovation, FiberForm® the friendly alternative to glass fibre and mineral wool.

FiberForm® is a totally new type of noise absorption material based on a special structure of polyester fibres containing no resins or binders. The fibres, which are locked together during the manufacturing process, are non-irritant and do not



Comparison of 25 mm thick FiberForm® with Glass Fibre & PU Foam. All materials of a similar density.

release into the atmosphere even in high velocity air streams or when subjected to serious vibration. The product is fire resistant to Class 0 Building Regulations, odourless and gives off no harmful/toxic fumes when consumed in a fire.

FiberForm® is available in standard sheet form at either 25 mm or 50 mm thickness and can be supplied in a variety of surface finishes, with the option of self adhesive backing. Custom made components can be produced and can include cut shapes, edge sealed and three dimensionally moulded design features. The acoustic performance of FiberForm® compares very favourably with both fibre and absorptive foam products, (see graph).

For further information on FiberForm® and other products within the Noisco Product range contact The Noise Control Centre, Crown Business Park, Old Dalby, Melton Mowbray, Leics LE14 3NQ Tel: 01664 821810 Fax: 01664 821820.

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

LOCHARD

Portable Outdoor Noise Measurement with the EMU 1200

Lochard has announced the release of the EMU 1200 portable noise monitoring unit which is available as part of the NoiseWare range of unattended outdoor noise monitoring instruments.

The EMU 1200 is functionally identical to its bigger brother, the EMU 1000 permanent Environment Monitoring Unit. Currently over 200 units are in use around the world.

The EMU 1200 can be used in applications that require unattended measurement from periods of a few hours up to several months, such as construction noise, road traffic surveys or railway noise monitoring. It is also ideal as a roving measurement unit as part of a larger noise monitoring system.

The unit monitors three types of noise data (i) the overall noise climate which reports a number of acoustic metrics over three different simultaneous time periods, (ii) noise events based on threshold detection (iii) one second time history data. Optionally the unit will report noise event information in one-third octave bands, and simultaneously monitor weather conditions.

The EMU 1200 incorporates the Lochard-GRAS 41 DM digital microphone, which represents the state of the art in outdoor microphone technology. Its digital output results in a very low noise floor, high dynamic range and the flexibility of cable lengths in excess of 50 m. Optionally the unit comes with a Digital Mobile phone, built into the unit, for remote access to all functions.

Like all the NoiseWare range of instruments the unit is custom designed for outdoor use and incorporates a number of features to ensure reliability and ease of deployment, data collection and reporting.

The unit exceeds the requirements of IEC 651, IEC 804 Type 1 and also the draft standard IEC 1672 class 1. It is currently in the process of obtaining PTB pattern approval.

For further details see the Lochard web page or contact: Phil Stollery, Lochard, Gelderd Link, Gelderd Road, Leeds LS12 6EU Tel: 0113 279 0960 Fax: 0113 231 9381 Email.info@lochard.com.au. Internet:http://www.lochard.com.au

THELCASTLE

Faster Flow of Fans

Thelcastle are now offering customers computerised Fan Selections aimed at improving the quality and amount of information on fans and reducing the time from enquiry to quotation and ultimately delivery: usually a same-day quotation is normal.

The programme enables Thelcastle to match all the criteria requested by customers; volume, pressure, sound power and sound pressure spectrums. The programme also enables Thelcastle to meet the required performance with a fan absorbing the lowest amount of power.

Thelcastle carry a wide stock range, axial and bifurcated units up to 22' diameter, while units up to 50' are available. The computer programme will produce technical data sheets including performance curves and charts to show sound characteristics.

Established for over 23 years, Thelcastle are able to offer customer specific tailor-made axial, bifurcated and centrifugal fans to meet special requirements and a full back up service.

For more information contact Roger Heap, Product Manager, Thelcastle, Newhaven Business Park, Barton Lane, Eccles, Manchester, M30 0HN.

CSTB

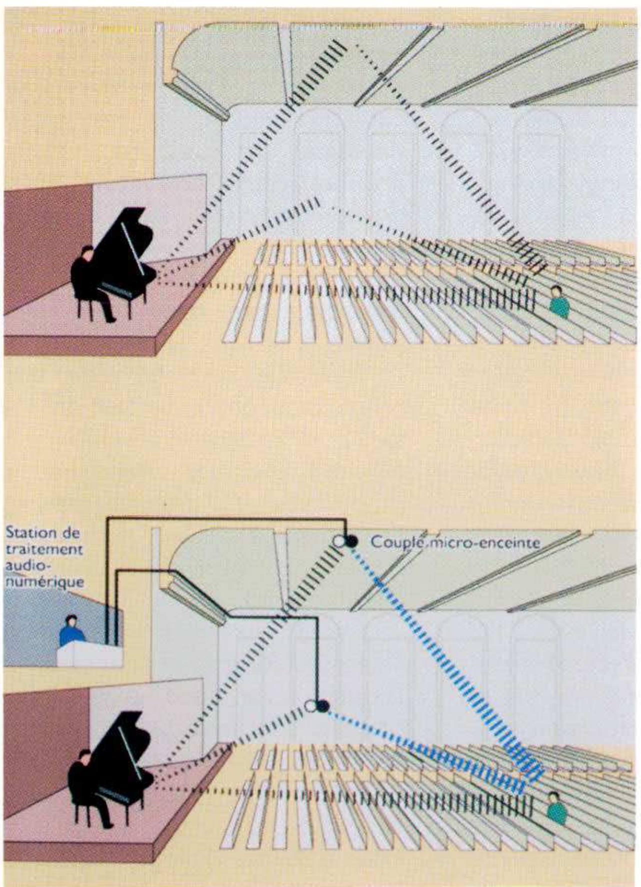
CARMEN

The French Centre for Science and Techniques of Building, the CSTB, has designed an electro-acoustic system that modulates the acoustics of an auditorium according to its use. Based on the virtual wall principle, the system can be used for conferences, theatre productions, classical or rock concerts, opera and other events. Called CARMEN, it has been designed to obtain the best natural reverberation effect for each event, this without modifying the architecture of the auditorium or using on-stage microphones.

CARMEN comprises a number of active cells (ranging from 16 to 32), each containing a microphone, an electronic filtering unit, a power amplifier and a loud-speaker. Placed around the walls and ceiling of the auditorium, the cells form virtual walls.

The CARMEN system is not a classical sound reinforcement system. The innovative layout of the microphones and loud-speakers produces completely natural acoustics. Most auditoriums can thus become multi-purpose, simply by increasing the reverberation factor over the entire frequency range as required. CARMEN also adjusts a certain number of other parameters, such as the intelligibility of speech or the submergence of listeners in musical sound. It is even possible to use the system to create an auditorium effect for open-air entertainment.

CARMEN's design gives the user precise control over all processing parameters, and also provides a user-friendly command and control interface. The operator merely adjusts the system from a control panel by selecting the appropriate setting, such as 'conference', 'theatre' or 'symphony'.



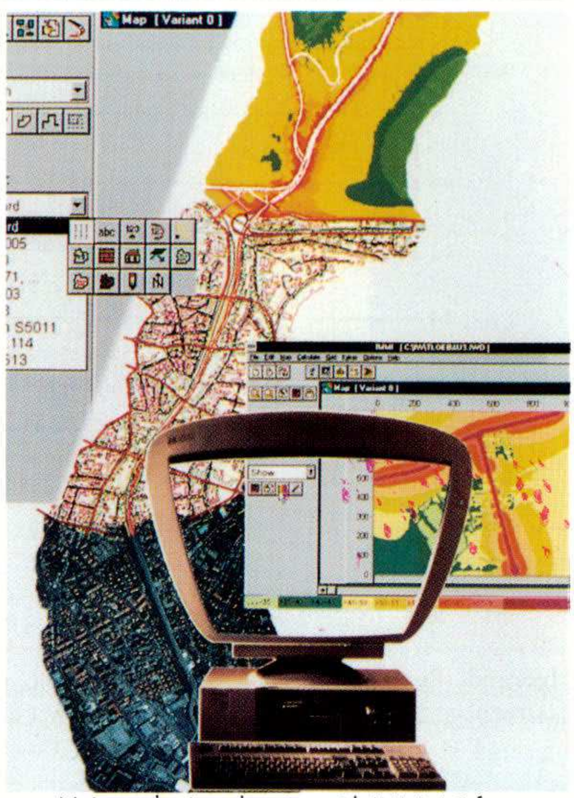
Top: Normal acoustics. Bottom: Acoustics improved by the CARMEN system from CSTB

For more information contact: Mme M Heros, CSTB, 4 avenue du Recteur Poincaré, 75782 Paris CEDEX 16 Tel: 00 33 140 50 28 56 Fax: 00 33 140 50 28 48 Email: heros@cstb. fr

WÖLFEL

IMMI 4.0 for Windows

IMMI 4.0 for Windows, the noise prediction software, from German company Wölfel has been enhanced by adding new international calculation methods (ISO 9613-2 and NMPB), and NOISY (NOise Information SYstem), a module allowing for management of measurement data, calibration of model calculation and reporting.


Noise reduction planning with IMMI 4.0 for Windows – shown for the city of Würzburg

New Calculation Methods Implemented.

The range of noise prediction methods available in IMMI 4.0 for Windows has been enlarged to include the French road noise guideline NMPB (developed by CERTU) and the international industrial noise guideline ISO 9613–2.

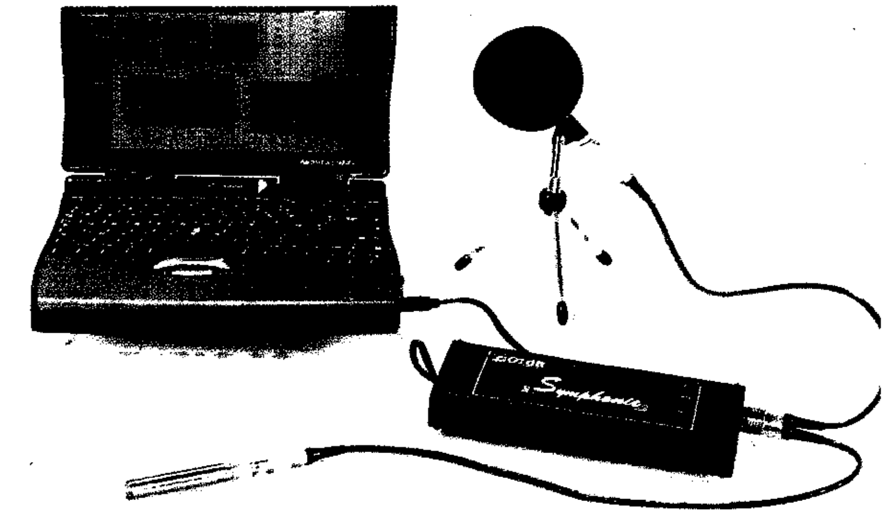
NOISY, a NOise Information SYstem:

Now the software goes beyond noise prediction software, with NOISY giving the means of combining geographic information describing the site, predicted noise levels and measured levels. With NOISY, IMMI 4.0 for Windows now uses its full potential for GIS-like functionality to give:

Detection of Critical Measurement Points: Reduces the number of measurements and simultaneously selects the most critical points by using IMMI 4.0 for Windows with normalized emission data even in the most complex situations.

Reporting of Measurement Cam-

paigns: Measurement data is linked to a map of the site designed in IMMI 4.0 for Windows and uses the combination of geographic and acoustic data to generate reports.
Calibration of Model Calculations: The calculation model may be calibrated with IMMI 4.0 for Windows using the measured data: A tuner gives hands-on access to source description.
For further information contact Wölfel International Sales Office, Mr Edgar Wetzel, International Sales Manager, Vervierser Str 43 B-4700 Eupen, Belgium Tel: +32 87 56 10 02 Fax: +32 87 56 10 04 E-mail: WoelfelMess@ Compuserve. com



01dB's Symphonie dual-channel, real-time acoustic and vibration measurement system

ACSOFT LTD

Advanced Real-Time Sound and Vibration Analysis System

AcSoft is now offering 01dB's Symphonie dual-channel real-time acoustic and vibration measurement system, updating the company's acclaimed Concerto to provide a range of facilities unique in notebook PC-based systems.

Through plug and play connection to a notebook running 01dB software, the small but versatile Symphonie data acquisition unit provides the functionality of a high-accuracy sound level meter, spectrum analyser, intensity meter and DAT recorder. The system has almost limitless application in environmental monitoring, design verification and building acoustics. Its realtime performance allows simultaneous analyses in both time and frequency domains.

Symphonie is a full-featured Type 1 integrating data logging sound level meter. It is a narrowband dual-channel frequency analyser operating in real time up to 20 kHz. Spectrum analysis using

800-line FFT or digital filtering in octaves or third-octaves enables characterisation of noise sources as well as vibration analysis in structural and human-body applications.

Connect an intensity probe and Symphonie becomes a real-time sound intensity measurement system providing acoustic power calculations to ISO 9614. It is also a building acoustics analyser with capability for single or dual-channel acquisition of octave and third octave spectra, and integral noise generator for reverberation time analysis. And it functions as a digital tape recorder with playback capability.

Signal conditioning handles all kinds of transducers, and application flexibility is further enhanced by inputs for tacho signal, remote control and loudspeaker connection.

With advanced Windows-based software, Symphonie is easy to use. Compatibility with common spreadsheet and wordprocessor packages makes report generation fast and simple.

For further information contact John Shelton, AcSoft Ltd, 6 Church Lane, Cheddington, Leighton Buzzard LU7 0RU Tel: 01296 662852 Fax: 01296 661400.

AcSoft is a Sponsor Member of the Institute.

LITTON DATA SYSTEMS

SEA Software Package

Litton Data Systems has announced AutoSEA™, a fully graphical, object-orientated implementation of Statistical Energy Analysis (SEA) for acoustic design. AutoSEA enables engineers to take a systems approach to vibro-acoustic design and analysis, allowing it to be moved out of the test laboratory into the CAE concept design process.

AutoSEA is an interactive package that allows the system model to be assembled using experimentally defined SEA parameters or its own library of analytical 'subsystem' components – or a combination of both.

Within AutoSEA, the engineer can apply multiple vibroacoustic inputs to the system model and obtain the response of each structural and acoustic sub-system. Noise, shock and vibration applications include the prediction of noise and vibration levels, path analysis, source ranking, analytic model correlation and damping optimisation.

The software is fully compatible with industry standard CAE and FE databases, enabling the SEA model to be rapidly assembled. The speed of analysis and AutoSEA's dynamic graph windows provides a truly interactive means of identifying problems and evaluating potential design solutions.

Ongoing support for the product in the UK is provided by two organisations. Litton Data Systems, Cambridge, has nearly 20 years experience in sound and vibration consultancy in the Defence Sector. The Institute of Sound and Vibration Research (ISVR) at Southampton has a world class reputation in noise and vibration. In combination, the experience of these organisations covers noise and vibration applications in all industrial sectors.

Litton Data Systems' European Operation, based in the UK, was formed as a result of the acquisition by Litton Industries, Inc of SAIC's (Science Applications International Corporation) European defence business in February 1997. The new company is a large supplier of mobile rugged computers, displays and systems for defence and associated markets. Litton is a leader in world-wide technology markets for advanced electronic and defence systems, and a major designer and builder of surface combat ships for the US Navy and allied nations.

For further information contact John Yale, Litton UK Ltd, Data Systems Division, 26 Craven Court, Stanhope Road, Camberley, Surrey, GU15 3BW Tel: 01276 675511 Fax: 01276 676262.

OSCAR ACOUSTICS

Sonaspray K13 Spray-on Acoustic System

SonaSpray K13, a versatile spray on acoustic system produced by The International Cellulose Corporation of Houston Texas, is now available in the United Kingdom from Oscar Acoustics. It is a product said to have been extensively and successfully used across the USA and Europe and that the acoustic characteristics of SonaSpray K13 provide a simple, easily applied and cost effective means of significantly reducing noise reverberation in all types of manufacturing, assembly and processing areas.

The seamless finish of SonaSpray K13 is said to provide an ideal solution for the ceilings and walls of all industrial buildings, no problems being created by difficult contours such as domes or vaults and it can be simply applied around pipe or duct runs. The new product is applied onto most surfaces including concrete, wood, gypsum board, metal or glass, it is relatively light in weight, will be carried by virtually all structures without the need for additional support and requires no retaining clips or other fixing devices.

As SonaSpray K13 contains no asbestos, fibre glass or other man made fibres and the adhesive is a water based material, it is an acoustic product that is totally free of any potential health hazards both during application and once in place. It is sprayed, by specially trained Oscar staff, in thicknesses from 12 mm up to 100 mm in a single spray operation, the product thickness being selected to achieve the required acoustic performance for each particular application.

Most industrial type buildings have 'hard' internal wall and roof surfaces and any noise generated internally will reverberate. Using SonaSpray K13 to line buildings introduces highly absorptive acoustic surfaces which are said to reduce noise build up by reverberation. This treatment can also reduce significantly the need and cost for acoustic treatment that may be required for noisy equipment, ie because the building fabric will not reflect the noise around the work area open top enclosures may provide sufficient noise reduction or simple barriers may give adequate reduction to direct paths of noise to nearby work stations.

SonaSpray K13 provides some noise transmission loss, can be provided in any colour to meet client requirements, gives a high quality textured surface finish and due to the excellent thermal qualities of the product ensures buildings are insulated to keep out the cold in winter and the heat in summer.

For further information contact John Hancock or Mike Johnson, Oscar Acoustics, Michaels Lane, West Yoke, Ash, Kent, TN15 7HT Tel: 01474 873122 Fax: 01474 8795544

NEWS ITEMS

ECKEL

New European Headquarters

One of the world's leading noise control equipment manufucturers has recently opened its new European headquarters in the UK. Eckel Noise Control Technologies, based in Hampshire will supply all the products currently available from the US owned company.

The company claims to offer 'tried and tested' products for all industries including modular acoustic enclosures, doors, windows and sound absorbing panels, audiometric testing rooms, television and radio recording studios, heavy duty silencers, aero-engine test facilities and anechoic and reverberation chambers.

Founded forty-five years ago, the company has gained experience in every aspect of noise control. Directing the Europeon operations are Brian Harris and Andrew Plater, who both have backgrounds in the noise control industry.

New Metal Anechoic Wedge

Eckel Noise Control Technologies is launching its new metal anechoic wedge, the Eckoustic Metallic Wedge {EMW), to the European market.

Stated to be very successful in the USA and tested to conform to ISO and ASTM standards, the wedge is made from virtually acoustically transparent perforated steel or aluminium containing high performance mineral fibre acoustic fill. It is also up to 20% lighter than other metal designs. The wedges are structurally durable and resistant to climate and can be individually replaced. Coated with a tough enamel paint or a plastisol finish they can be supplied in a range of colours.

The EMW represents a significant breakthrough in the development of efficient and safe anechoic chambers. The wedges need less maintenance than their foam counterparts and because of the fire retardant surface they help to achieve better safety standards within test chambers.

The acoustically absorptive material within the EMW is long fibre, which by its nature is resistant to release. It is also encapsulated in an acoustically transparent non-woven nylon fabric that is highly chemically resistant ond has a class one fire rating. Fibre migration is eliminated without affecting the performance of the wedge.

For more information on the EMW and other anechoic wedges and complete anechoic test facilities available from Eckel contact Brian Harris, Eckel Noise Control Tech-

Ecomax acoustic treatment for Verco

nologies, Lysons Avenue, Ash Vale, Hampshire GU12 5QF Tel: 01252 375000 Fax: 01252 522842.

HENRY VENABLES

An Acoustic Solution

Specifiers at the Audiology Suite at York District Hospital were looking for an acoustic product which would give the suite excellent sound control. Mr Richard Addis, senior chief audiologist states that they found the right product in the Applied Acoustics range from timber specialist, Henry Venables.

The suite is used for sensitive work including vestibular and brain stem testing where near silence is required, as well as for counselling and rehabilitation work. Woodacoustic panels, which had been veneered for a paint finish were affixed to mineral wool slabs on softwood battens and skirting and other trims were also fixed.

Applied Acoustics product range includes cladding in solid timber, veneered panels, slatted steel wall linings, the Illsonic foam sound absorption range, acoustic operable partitions and Compactdoors – acoustic intemal timber doors.

Henry Venables claims to be the UK's leading authority on timber and its uses and applications. Recent projects undertaken by the joinery division include the anteroom to St George's Hall at Windsor Castle, The Globe Theatre, London and timber windows for the refurbishment of the Royal Opera House.

Further information from Henry Venables Ltd, Castletown, Stafford ST16 2EN Tel: 01785 259131 Fax: 01785 215087.

ECOMAX ACOUSTICS

Quiet Production of Office Furniture for Verco

A range of noise control products from acoustic specialist, Ecomax Acoustics, ensures quiet production of high quality goods at Verco Office Furniture Limited's new purpose-built manufacturing facility in High Wycombe Verco Office Furniture is one of the UK's leading suppliers of office chairs, desks and cabinets plus other associated equipment.

To support increasing demand for its extensive product range, the company appointed HAP Chartered Architects to design a new manufacturing plant. Located only a few metres from a residential area, the facility houses production machinery which creates noise levels in excess of 90 dB(A). These noise problems prompted the architects to appoint Ecomax Acoustics to assist in the design of the building.

Utilising various complementary items from its range of products, Ecomax Acoustics worked closely with the architects to design a building which would support an increased manufacturing output without causing excessive noise pollution for Verco's workforce or close residential neighbours.

The Ecomax Acoustics solution comprises Soundslab roof and wall insulation, selfsupporting Decosound acoustic ceiling panels and robust steel acoustic doors from the company's Silentdoor range. Incor-

Audiology suite at York District Hospital – sound control wall linings from Henry Venables Ltd porating high performance materials, these acoustic products are said to combine to provide excellent noise control whilst offering a modern aesthetic finish.

The occupants of adjacent houses stated that they had been completely unaware of the presence of any heavy machinery at the facility.
Further information from Ecomax Acoustics Limited, Gomm Road, High Wycombe, Bucks HP13 7DJ.
Ecomax is a Sponsor Member of the Institute.

ALLAWAY ACOUSTICS

Ventilation system attenuators for Wimbledon

Over £100,000-worth of attenuators were designed and manufactured by the company, which specialises in noise and vibration control, for use in the new four storey, 11,000 seat stadium at Wimbledon.

The new Number One Court has been built to provide world class facilities for the most prestigious event in the tennis calendar. Allaway Acoustics' noise attenuators operate in areas such as a broadcasting centre, hospitality suites, public restaurants and accommodation blocks. As M and E consultant, Building Design Partnership's brief from the All England Lawn Tennis and Croquet Club was to create a complex that offered the character of 'tennis in an English garden'. Noise levels in both the air conditioned areas and the external environment were clearly an important consideration in successfully achieving this objective.

Allaway Acoustics is unusual in combining both design and production capabilities. For this project, a number of the attenuators manufactured for services contractor Andrews Weatherfoil Ltd featured a special 'fire rated' construction, offering stability, integrity and insulation against a temperature of 400°C for two hours.

Founded in 1969, Allaway Acoustics is now one of the UK's foremost designers of products for controlling noise and vibration, with an active research and development programme and extensive production facilities. A qualified team of technical and sales engineers operate from Hertford and Bradford, and a manufacturing plant at Thetford, Norfolk.
For further information contact Jim Grieves, Allaway Acoustics, The Old Police Station, 1 Queen's Road, Hertford SG14 1EN Tel: 01992 550825 Fax: 01992 554982.

SOUND ATTENUATORS

Staff Appointment

Gordon David has been appointed as Sales Director, General Industrial Products for leading noise control company Sound Attenuators Ltd.

He joins SAL from IAC Ltd where he was Associate Director of the Acoustic Structures Division. During seventeen years spent with IAC, Gordon was deeply involved in all aspects of engineering noise control. In particular, he gained extensive knowledge of the medical, studio, printing, automotive and industrial sectors.
The Salex Group is a Sponsor Member of the Institute.

Items for this section should be sent to John Sargent MIOA, Oak Tree House, 26 Stratford Way, Watford

Non-Institute Meetings

November 5–7, 1997: XXIII Meeting of the Spanish Acoustical Society, TECNIACUSTICA '97, Oviedo, Spain
Contact: Spanish Acoustical Society, c/ Serrano 144, 28006 Madrid, Spain; Tel: 341 561 88 06; Fax: 341 411 76 51; e-mail: ssantiago@fresno.csic.es

November 19–21,1997: WESTPRAC '97, (Western Pacific Region Acoustics Congress), Hong Kong
Contact: S K Tang, WESTPRAC Sectretary, Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong; Fax: +852 277 461 46; e-mail: besktang@polyu.edu.hk

December 1–5, 1997: 134th Meeting of the Acoustical Society of America, San Diego, CA, USA
Contact: M Pierucci, Dept of Aerospace Engineering and Engineering Mechanics, San Diego State Univ , San Diego, CA, USA; Fax: +1 619 594 6005; e-mail: mpierucci@sciences.sdsu.edu

December 15–18, 1997: 5th International Congress on Sound and Vibration, Adelaide, Australia
Contact: ICSV5 Secretariat, Department of Mechanical Engineering, University of Adelaide, South Australia 5005, Australia; Fax: +61 8 8303 4367; e-mail: icsv5@mecheng.adelaide.edu.au

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

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

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

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

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

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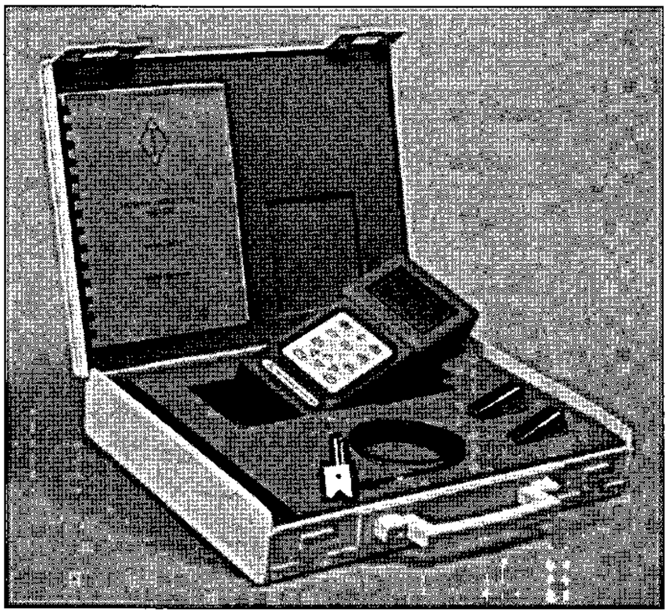

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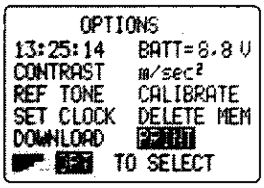

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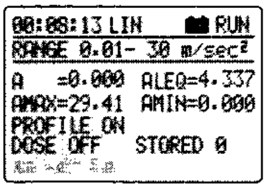
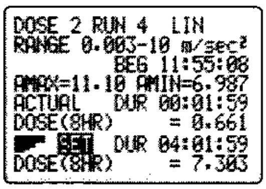


Comprehensive display of all measurement parameters both in memory and while collecting data.



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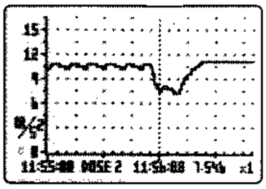

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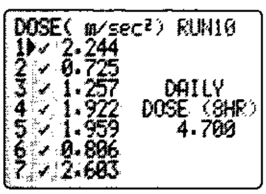

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