



Acoustics Bulletin

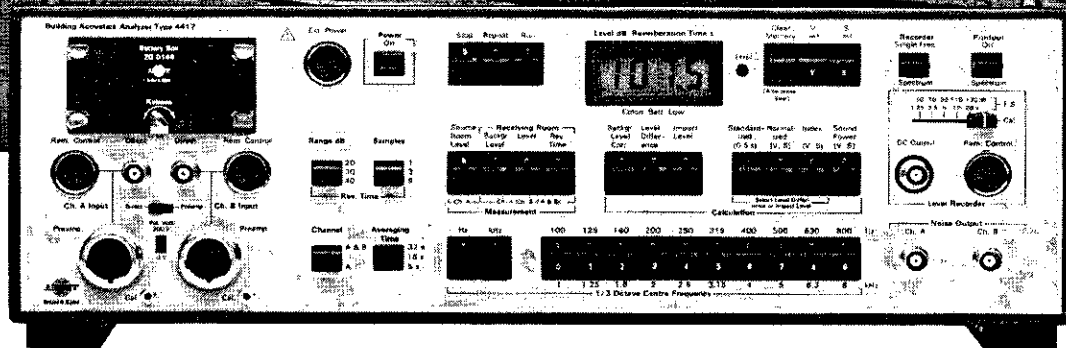
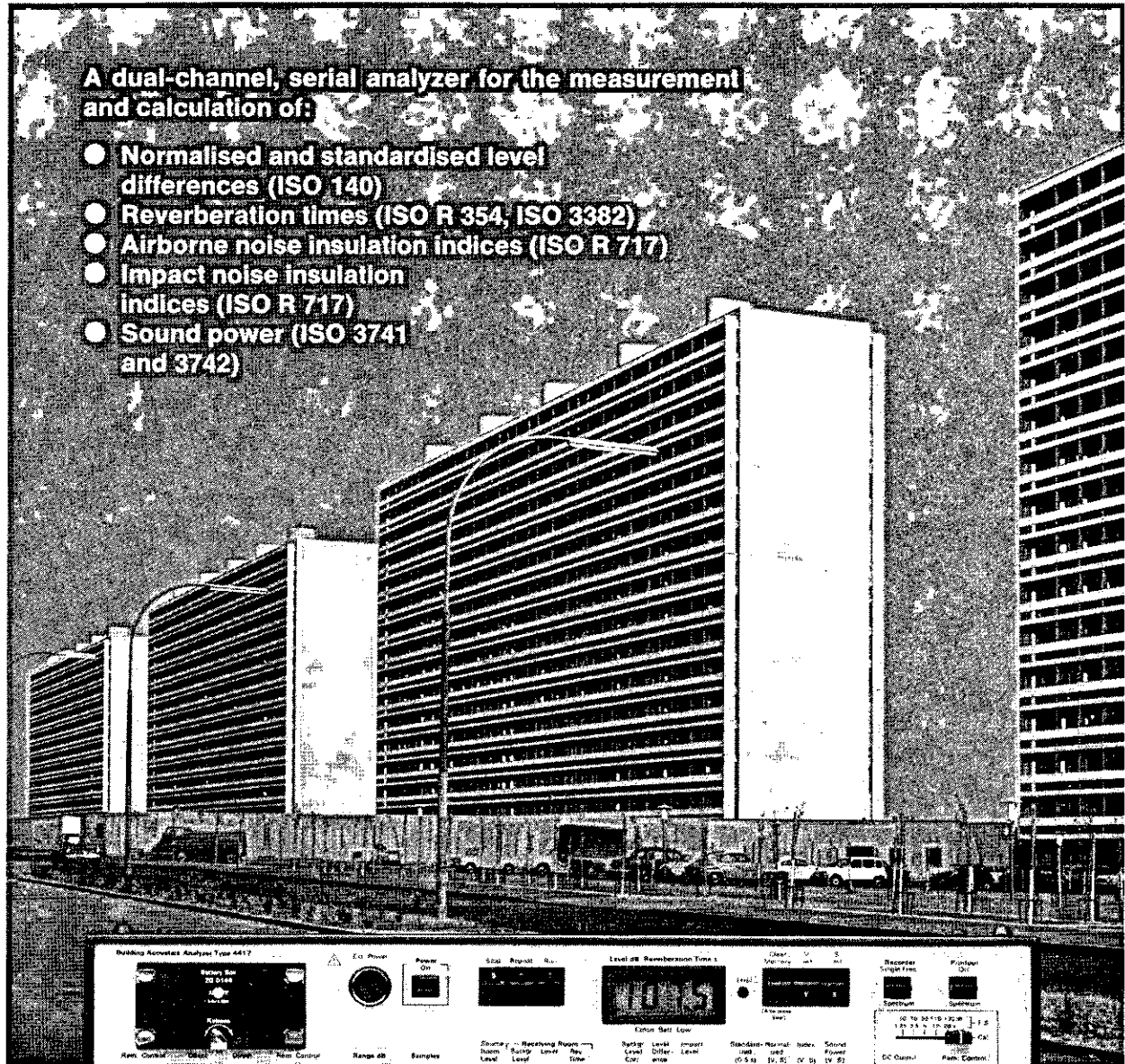
January 1981 Volume 6 Number 1

INSTITUTE OF ACOUSTICS

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January 1981

Volume 6

Number 1

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The Institute of Acoustics was formed in 1974 by the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society and is now the largest organisation in the United Kingdom concerned with acoustics. The present membership is in excess of one thousand and since the beginning of 1977 it is a fully professional Institute.

The Institute has representation in practically all the major research, educational, planning and industrial establishments covering all aspects of acoustics including aerodynamic noise, environmental acoustics, architectural acoustics, audiology, building acoustics, hearing, electroacoustics, infrasound, ultrasonics, noise, physical acoustics, speech, transportation noise, underwater acoustics and vibration.

Membership of the Institute of Acoustics

Membership of the Institute is generally open to all individuals concerned with the study or application of acoustics. There are two main categories of membership, Corporate and Non-corporate. Corporate Membership (Honorary Fellow, Fellow, Member) confers the right to attend and vote at all Institute General Meetings and to stand for election to Council; it also confers recognition of high professional standing. A brief outline of the various membership grades is given below.

Honorary Fellow (HonFIOA)

Honorary Fellowship of the Institute is conferred by Council on distinguished persons intimately connected with acoustics whom it specially desires to honour.

Fellow (FIOA)

Candidates for election to Fellow shall normally have attained the age of 35 years, have had at least seven years of responsible work in acoustics or its application, and have made a significant contribution to the science or profession of acoustics.

Member (MIOA)

Candidates for election to Member shall normally have attained the age of 25 years, must either (a) have obtained a degree or diploma acceptable to Council and have had experience of at least three years of responsible work in acoustics, or (b) possess an equivalent knowledge of

acoustics and cognate subjects, have had experience for not less than seven years of responsible work in acoustics or its application, and must have been a Non-corporate member of the Institute in the class of Associate for not less than three years.

Associate

Candidates for election to the class of Associate shall have attained the age of 18 years and (a) be a graduate in acoustics or a discipline approved by Council, or (b) be a technician in a branch of acoustics approved by Council, or (c) be engaged or interested in acoustics or a related discipline.

Student

Candidates for election to the class of Student shall have attained the age of 16 years and at the time of application be a bona-fide student in acoustics or in a related subject to which acoustics forms an integral part. Normally a student shall cease to be a Student at the end of the year in which he attains the age of 25 years or after five years in the class of Student, whichever is the earlier.

Full details and membership application form are available from: The Secretary,
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25 Chambers Street
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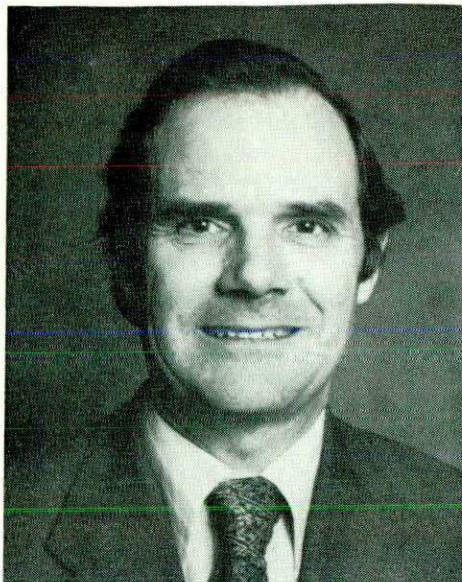
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President's Letter

Institute of Acoustics

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ISVR, Southampton University

Dear Member,

I am very pleased to report the success of the second Autumn meeting to be held in Windermere. This year we were fortunate to have beautiful weather to complement the excellent technical programme. Many contributions of high standard were made and although the attendance was not quite so high as last year, everyone who attended felt that it was a valuable meeting. We now seem to have established a good tradition for our young Institute and can look forward with pleasure to the third meeting in the Lake District. Well done Roy and the Secretariat!

On a less happy note I am bound to report that continuing inflation has caused our costs to increase. The secretarial arrangements are now fully established in Edinburgh and we can now have a realistic estimate of the costs of running the Institute. In the light of these circumstances, Council has decided that the membership fees should be increased approximately in line with inflation. It is now even more important that we improve the services which we offer to members and therefore I appeal to you to let me have any ideas which you think could be of value to the continuing development of the Institute.

B. L. Clarkson

Calls for Papers

The Meetings Committee of the Institute of Acoustics is always pleased to receive offers of contributions to any of its Meetings. Contributions are particularly sought for the following:

New Techniques in Speech Audiometry

(Joint with British Society of Audiology)
Polytechnic of Central London, 6 April 1981
Meeting Organiser: Dr W Ainsworth FIOA
Department of Communications & Neuroscience
University of Keele, Keele, Staffordshire ST5 5BG
(200 word abstracts as soon as possible)

Noise Source Location

Portsmouth Polytechnic, 15 May 1981
Meeting Organiser: Dr J Billingsley FIOA
Department of Electrical Engineering, Portsmouth Polytechnic
King Henry I Street, Portsmouth, Hants PO1 2DY
(200 word abstracts as soon as possible)

An Introduction to Microprocessors and Their Use in Acoustics

Open University, Milton Keynes, 9 June 1981
Meeting Organiser: Mr N Heap MIOA, The Open University
Faculty of Technology, Walton Hall, Milton Keynes, MK7 6AA
(200 word abstracts by 28 February)

Non-verbal Auditory Communication

ISVR, Southampton, July 1981
Meeting Organiser: Dr P Wilkins, ISVR, The University,
Southampton
(200 word abstracts by 28 February)

Acoustic Emission and Photo-Acoustic Spectroscopy

Chelsea College, London, 21 - 23 July 1981
Conference Organiser: Dr R W B Stephens FIOA
Department of Physics, Chelsea College, Pulton Place, London SW6 5PR
(200 word abstracts by 31 March)

Industrial Applications of Ultrasound

Birkbeck College, London, November 1981
Meeting Organiser: Mr A W Crawford FIOA
DDS Engineering Co Ltd, West Ham Lane East, West Ham,
Basingstoke, Hants RG22 6PP
(200 word abstracts by 30 June)

Sound Propagation Outdoors

Open University, Milton Keynes, December 1981
Meeting Organiser: Dr K Attenborough FIOA, Faculty of
Technology, Open University, Milton Keynes
(200 word abstracts by 31 July)

CITATION

A B WOOD MEDAL AND PRIZE FOR 1979

**P H Rogers, Naval Research
Laboratory, Florida**

Peter H Rogers studied physics at the Massachusetts Institute of Technology, receiving his BS in 1965. For his graduate studies he moved to Brown University, well known as a centre for acoustics, to gain a PhD in 1970. His thesis concerned second harmonic generation in the acoustic radiation from a piston, and thus combined two subjects which were to be of continuing interest to him — non-linear acoustics and transducers. In 1969 he joined the Transducer Branch of the Naval Research Laboratory, in Washington DC, working on theoretical problems. He transferred in 1975 to the Underwater Sound Reference Division of NRL at Orlando, Florida, at the same time broadening the scope of his work to include more measurement and more administrative problems.

Peter Rogers' work in underwater acoustics has covered a wide variety of subjects related to transducers — including parabolic reflectors, magnetostriction rings and shells, acoustic slow waveguide antennae, hydrophone calibration and parametric sources.

Recently through his studies of underwater acoustic shock waves he became involved in an investigation of some mysterious loud booms heard on the East Coast of the USA. In a very short time he identified these as sonic booms from military aircraft, propagating in unusual atmospheric conditions. His interest in aerial acoustics has continued with studies of the attenuations of booms in the thermosphere.

The sonic boom work attracted much attention, and resulted in the Superior Civilian Service Award from the Chief of Naval Research. Peter Rogers is a Fellow of the Acoustical Society of America, and to bring this account right up to date the Society are giving him their prestigious Biennial Award.

The Institute of Acoustics have chosen Peter Rogers as highly suitable to receive the A B Wood Medal and Prize, noting his contributions not only to underwater acoustics but also to the neighbouring fields of noise, engineering and physical acoustics. □

Autumn Conference

Windermere, 2-4 November 1980

The Lake District weather was kinder this year but this is unlikely to have been of material benefit to the ninety delegates and wives who attended the IOA Autumn Conference for, as last year, the busy programme left little time for enjoying the scenery. The venue for the conference was again the Hydro Hotel at Windermere and in spite of the travelling distances this involved for many it again proved to be a satisfactory location with the obvious benefits of having all the activities and accommodation under one roof.

It was a particular pleasure for all concerned that Mrs E Wood, in spite of her advancing years, was able to come to Windermere and present two medals that celebrate the life and work of her late husband. The 1979 A B Wood Medal and Prize was awarded to Dr Peter Rogers of the Naval Research Laboratory at Washington, USA, whilst the current year's Medal was presented to Dr Ian Roebuck of the Admiralty Underwater Weapons Establishment at Portland. Both recipients gave their Medal Lectures during the conference.

The main conference business comprised technical sessions involving a total of thirty contributions arranged as two parallel programmes. The first, which ran throughout the two days, was devoted to impulse techniques, whilst the second covered topics in aerodynamic and environmental noise together with an open session. The number of contributions offered in the aerodynamic and environmental noise sessions was disappointingly small—a testimony, it appears, to the difficulty many would-be contributors face in attempting to obtain release and support to attend conferences. Yet this in no way reflected upon the high quality of the papers presented, frequently in front of understandably small audiences.

The social activities, although perhaps less vigorous than the previous year, nevertheless acted as a suitable counterweight to the intensive nature of the technical programme. Eight manufacturers took stands in the associated exhibition and it is important to reflect from time to time on the essential role played by exhibitors in virtually ensuring, through their support, the financial success of confer-

ences of this nature. The exhibitors gave a reception for delegates soon after arrival on the Sunday, whilst on Monday evening the South Lakeland District Council gave a civic reception and the Institute was honoured to welcome the Chairman of that Council, Alderman Adam Ward, as the principal guest at the Conference Dinner later that evening. An IOA Extraordinary General Meeting resolved the question of changing the Institute auditors through a very brief show of hands. Musical entertainment of contrasting styles was provided on the two evenings; one ex-Vice-Chancellor and one present Deputy Vice-Chancellor were seen dancing an Irish jig with commendable energy.

Dealing with the main items of conference business separately, Dr Rogers' Medal Lecture was entitled *Propagation of Sonic Booms in the Upper Atmosphere* and presented studies of abnormal propagation paths predicted from known sound velocity variations in the upper atmosphere. Focussing and shadow zones not unlike those occurring in underwater propagation are held to be possible causes of spatial fluctuations in the audibility of sonic booms from, for example, Concorde as it approaches the East Coast of the United States. Dr Rogers entertained his audience with stories of attempting

to capture sonic booms at various heights above the earth by means of parachuting acoustic measuring devices from rockets launched from various locations for the purpose.

Dr Roebuck's Medal Lecture was entitled *An Underwater Acoustician Looks at Source Detection, Location and Cancellation*. This contribution was presented with commendable lucidity so that the ideas and methods discussed were readily appreciated by those possessing no previous background in underwater acoustics. Both Medal Lectures will be published under the Institute's name.

Impulse Techniques

The two-day programme of papers on impulse techniques was introduced by the Chairman of the first session, P T Lewis (UWIST) who described the aims of the programme as being to provide (a) an introduction to the theory, instrumentation and techniques that have been developed in connection with impulse sound and (b) a review of applications in different areas of acoustics.

The first paper was given by C Thomsen (Brüel and Kjær, Denmark) and consisted of a survey of modern signal processing. Placing an emphasis on the concepts involved rather than mathematical detail, this excellent introductory paper covered the characteristics of signal representation in different domains, transforms



Presentation of the A B Wood Medal and Prize for 1979 to Dr Peter Rogers. Left to right: Prof Lord, Dr Rogers, Mrs A B Wood, Prof Clarkson



Dr Roebuck receives the A B Wood Medal and Prize for 1980

(the Hilbert transform being seen as having considerable future potential), practical test signals and analysis techniques. B Heald (B & K Laboratories) then demonstrated the technique of Time Delay Spectrometry which employs a rapidly swept sine wave as the source and a synchronised slave filter with variable time delay offset for signal capture. First proposed in Heyser in 1967, this method would seem to offer advantages in terms of higher measurement speed and signal/noise ratio compared with established FFT based methods in those cases where the excitation of the system can be controlled.

R G White (ISVR) presented an informative review of the transient testing of structures for vibration control, basing his paper on some ten years' work in this subject area at ISVR. The relative merits of experimental techniques employing resonant testing, slow frequency sweep and transient excitation were compared, transient testing using a rapid frequency sweep being seen as the most appropriate for field testing. Practical difficulties associated with the measurement of point and transfer characteristics of structures and methods of overcoming them were then discussed. A structural model based on measured data was seen as being an important recent development in the work on vibration control.

C Chinoy and P T Lewis (UWIST) reviewed the use of impulse techniques for analysing airborne sound trans-

mission through buildings and compared results obtained with those from steady state techniques. The data presented showed that propagation of sound within rooms does not correspond to a direct/reverberant field pattern; instead, the sound level continues to fall throughout a room as a function of log (distance). Where sound transmission occurs through a wall, the results were found to depend on the fraction of the time interval over which the energy is integrated. Differences as high as 15 dB were reported between measurements based on the 0-50 msec energy fraction and those obtained using the total energy.

The Chairman of the second session was B Gibbs (Liverpool University). M Barron (Cambridge University) reviewed the developments in concert hall acoustics that have occurred in recent years and which have resulted in the importance that is now attributed to the temporal pattern of energy arrival. Methods of obtaining the impulse response of auditoria and calculating the associated energy characteristics were described with particular reference to the requirements of the impulse source. It was pointed out, however, that many aspects of the relationship between the physical properties of an auditorium and its subjective characteristics remain unclear.

H G Latham and P I Newman (Heriot Watt University) reported their work on the intelligibility and quality of speech in auditoria. The development of a signal/noise ratio for speech intelligibility which includes early, late and ambient noise energy was described and shown to correlate closely with subjective tests. The elusive concept of speech quality in rooms was investigated using a simulation of an auditorium sound field using an array of loudspeakers in an anechoic room and the results of a factorial analysis of the data were reported.

J Roland (CSTB, France) was the second overseas speaker and reviewed the work of CSTB on the development of impulse testing for measuring airborne sound insulation in buildings. Basing his remarks on an extensive period of technique development, it was reported that very close agreement can be obtained between the results obtained using impulse and steady state procedures. The advantages of a short on-site period, lightweight equipment and high signal/noise ratio that are obtained with impulse testing were seen as offering significant benefits

compared with conventional methods for routine testing.

The final paper of the first day was presented by B Day (Bristol University) and provided a healthy contrast with most earlier contributions with its emphasis on non-digital processing of impulse data. Displaying considerable ingenuity, a number of analogue methods of obtaining the impulse response of a system were described using the reversing, inversion, speed change of recorded transient and swept frequency signals.

The third session was chaired by M Barron (University of Cambridge). J C Godwin and J M Bowsher demonstrated how a modified sparking plug for a petrol engine provides a simple, but effective, source for studying the impulse characteristics of brass musical instruments. The quality of these instruments has been found to be strongly influenced by the internal bore shape and this in turn can be related to the impulse reflection response. The technique was suggested as offering particular advantage in fault finding on defective instruments where this is caused by bore irregularities.

The next three papers were concerned with the use of impulse techniques in studies of transmission through structures. R J M Craik (Heriot Watt University) described how the use of a simple impact source, a rubber faced hammer, and a hand held accelerometer linked to a tape recorder can be used for recording the damping characteristics of building structures. The results of a large number of measurements were presented which showed that consistent data are obtained which correlate well with predicted values.

The use of an impulse technique to measure oblique incidence transmission through walls was described by J C Davies. Using a loudspeaker in a tube as a source and a digital recorder for signal capture, measurements on a free-standing perspex panel over a 0-60° range of angles of incidence were reported. Good agreement was found between measured values and theoretical predictions. The work described by B M Gibbs concerned the transmission of bending waves on plates forming a T-junction. The test rig was again made of free-standing perspex sheets and was excited by a speech coil bolted directly to one of the plates. Some difficulty was experienced in separating the direct bending

wave from reflections and vibration modes other than flexural and, in general, agreement between measurement and prediction was not close.

The final session on impulse techniques was chaired by B Day (Bristol University) and consisted of two papers on cepstral techniques. In the first part of a joint paper, J K Hammond gave a lucid account of the general principles of cepstral analysis in the analysis of room response including the theoretical basis, methods of data acquisition and computational techniques. This was followed by a description by J Mourjopoulos of the results obtained for a small absorbant room in which the impulse response was separated into minimum and maximum phase components and into equivalent minimum phase and all pass components.

J S Bolton and E Gold (ISVR) concluded the sessions with a description of how the ability of cepstral analysis to separate overlapping signals can be utilised to measure reflection coefficients *in situ*. Various methods of enhancing the power spectra were described which aided the extraction of the impulse response data together with the use of an electrical analogue to facilitate the development and checking of the analysis process.

One paper which, although included in the proceedings, was unfortunately not able to be presented in person, was that by L R Fincham (KEF Electronics).

Aerodynamic and Environmental Noise

In that part of the programme dealing with aerodynamic noise, Professor Ellyn Richards made a powerful plea for acousticians as a body to resist the seductive attractions of present-day developments in automatic data collection and analysis and return their attention to the art and science of acoustics. The mechanisms of sound generation and control were in many cases still incompletely understood and, he argued, the present-day pre-occupation of many with microprocessor technology was in danger of obscuring the real issues for investigation. Professor Richards gave emphasis to this point in the part of his two contributions in which he reviewed the present situation on the uses, type selection and noise generation properties of industrial jets. More research in this field was evidently called for.

Two contributions from John Leverton of Westland Helicopters dis-

cussed aspects of helicopter noise. In the first of these, details of the design, development and performance of a quiet tail rotor were presented. The design of the tail rotor aimed to reduce noise levels on approach by attacking two distinct main rotor/tail rotor interactions. Up to 15 dB(A) noise reduction on approach and 5 dB(A) on fly-over were reported, together with a favourable change in the subjective character of the noise.

The second of Dr Leverton's contributions, this one being co-authored by Ruth Williams of the same company, concerned corrections to standard dB(A) and EPNL values in order to account for the subjective response to the impulsive contribution arising from blade slap. Typical corrections of 8 dB(A) or 6 EPNdB were suggested.

In the environmental noise sessions David Revill of Environmental Noise Studies discussed the prediction of noise levels at a distance from clay pigeon shooting grounds. Mr A G Sills of the Meteorological Office, Larkhill, presented details of a method for predicting the noise intensity at distances from an explosive source. Information on the explosive used, together with wind and temperature profiles to a height of 2 km has produced preliminary results which suggest 80% of predicted levels will be within 5 dB of measured values. The effect of this work has been an encouraging reduction in the number of complaints during the past eighteen months.

Mr P P Riley of AIRO presented an interesting paper on entertainment noise which included a suggestion that the basic approach of BS 4142 be used to assess the likelihood of complaints, provided a specific correction factor was applied — a figure of 10 dB(A) added to the measured level was discussed. Mr B Whittaker of Bolton Metropolitan Council highlighted the difficulties facing Environmental Health Officers when dealing with planning applications on the basis of inadequate information from the developer and ended with a plea that a revised Circular 10/73 should include an explicit requirement that adequate details be provided in any application for planning permission.

Mr Z Susic concluded this part of the conference with a discussion of the first occasion when environmental noise considerations have entered into the planning process for a railway line in Yugoslavia.

The Open Session attracted four suitably diverse but nonetheless interesting contributions. Mr Bento Coelho of ISVR discussed some of the benefits of Prony analysis in contrast with Fourier analysis and Dr G C McCullagh of Ulster Polytechnic's School of Building reported measurements made of noise levels in occupied and unoccupied baby incubators. The latter work was related to concern regarding a reported possible link between premature birth and hearing loss in childhood.

Dr J L Wearing of Sheffield University presented a paper on predicting the sound attenuation achieved by a finite barrier and included an interesting comparison between theory and experimentally observed figures. The Open Session finished with a discussion of the measurement of loudspeaker performance by Mr A Kalus of Portsmouth Polytechnic. The testing method involved was held to give information which relates well to the programme content applicable to a loudspeaker in use.

The organisation of the conference and the provision of technical facilities were undertaken jointly by the Institute's Meetings Assistant and the staff and research students of Liverpool Polytechnic's Acoustics Group. □

R Lawrence
P T Lewis

SEE Programme

The following events have been arranged for Spring 1981 by the Society of Environmental Engineers.

Events are open to members and non-members of the Society; further information is available from the Secretary, Owles Hall, Buntingford, Herts. Telephone: Royston (0763) 71209.

January 21-23: Vibration Group Course, Vibration Testing for Technicians and Engineers, at Cranfield Institute of Technology, Cranfield, Beds.

February 18: Symposium, Vibration Research in British Universities, at Imperial College, London.

March 19: A G M and Dinner at Imperial College, London.

24-27 March: Fatigue 81, at Warwick University.

Courses in Vibration and Acoustics at ISVR, Southampton

The Institute of Sound and Vibration Research is well known for its contribution to research in acoustics, vibration and related areas. However, it also provides what is probably the most comprehensive range of educational and training courses in these subjects. In this article the three members of the Institute responsible for the Department's undergraduate, postgraduate and short courses outline the scope of the training on offer.

THE INSTITUTE of Sound and Vibration Research was formed in 1963 and has a total staff in excess of 300 persons. It is part of the Faculty of Engineering and Applied Sciences at Southampton University and functions as a Department of the University. However, it is unique with respect to its emphasis on research and in consequence research funding has always been greater than that received from the University Grants Committee for teaching purposes. Notwithstanding its commitment to research, the ISVR has become increasingly active in teaching.

The Institute now provides a complete range of courses including a BSc course in Vibration and Acoustical Engineering, three MSc courses and a number of short advanced courses in a wide variety of subjects related to sound and vibration.

THE BSc COURSE IN ENGINEERING ACOUSTICS AND VIBRATION

The BSc course in Vibration and Acoustical Engineering at Southampton is already well known to regular readers of this journal. Many may also be familiar with the course brochure and some may have personal experience of the course.

October 1980 sees the sixth intake to the course and it is interesting to look back at its development over those years. The structure of the course is linked closely with the degree course in Mechanical Engineering to provide a specialist course with a broad and firm foundation in Mechanical Engineering. In this way, the course is complementary to that at Salford which is closely linked to Electrical and Electronic Engineering.

Like all engineering courses, the first half of the first term presents the greatest problems for most students since considerable social and academic adjustments are being made. Strengths and weaknesses of sixth form studies become very apparent. Often these are

weaknesses magnified, no doubt, by the break in study between June and October. Private musical and electronic interests seem to have figured greatly in the choice of this course rather than interest through 'sound' in school physics courses or 'noise' in environmental studies. This reflects the inadequacy of the treatment of acoustics in present day sixth form studies and a dearth of knowledge of job opportunities by career advisers.

The first week of term in the first year of the course operates as an introductory session during which early steps

are taken to introduce the concept of pleasure and attainment from sustained hard work! Many schools do not give adequate practice at taking notes, using books and references and writing technical reports. Much has to be done in the early weeks of the course to correct this.

It is important for any engineering student to get a broad training in basic engineering theory and practice in his first year. The Southampton course provides this, while at the same time introducing some acoustics and tailoring some other lecture series to the acoustician.

In addition to the normal three-year course, a four-year course, leading to the award of both the BSc and the Diploma of Engineering, is now offered. The three- and four-year courses are identical for the first two years but in the final two years of the four-year course more emphasis is given to industrial liaison and project work. This, together with a wider range of academic subjects, provides the four-year student with a correspondingly

Table 1. Outline Syllabus of the BSc Course in Engineering Acoustics and Vibration

Part I

The subjects for Part I are common, for the most part, to the BSc courses in Acoustical Engineering, Mechanical Engineering, Aeronautical Engineering and Ship Science. They include the following: Mathematics, Principles of Dynamics*, Electricity and Magnetism*, Signal and Network Analysis*, Thermodynamics, Fluid Mechanics, Elasticity, Properties of Materials, Engineering Drawing, Technology and Society.

Part II

The subjects taken at Part II include the following: Mathematics and Computation, Dynamics*, Electronics*, Thermodynamics, Fluid Dynamics, Mechanics of Solids, Properties of Materials, Economics, Control*, Methods of Engineering Experimentation*, Engineering Acoustics*, Sound Perception*.

Part III (Three-year Course)

In Part III of the course students will take either all four of the following subjects: Vibration*, Engineering Acoustics*, Electroacoustics and Data Analysis*, Noise and Vibration – Subjective Assessment and Control*; or three of the preceding subjects and one of the following: Automobile Engineering, Human Factors in Engineering, Mathematics, Numerical Methods, Control, Fluid Mechanics, Mechanics of Solids, Thermodynamics, Properties of Materials.

In addition, all students will undertake a Project* and an Engineering Management Course.

Part III (Four-year Course)**

In the third year of the four-year course, students will take three of the third-year subjects from the three-year course, plus the following subjects: Mathematics for Acousticians, Acoustical Design, Engineering Management. Interdisciplinary, group project work will also be carried out.

Part IV (Four-year Course)**

In the fourth year, students will take two of the third-year subjects from the three-year course plus two advanced level courses in Sound and Vibration, one of which will be Experimental Techniques, Instrumentation and Analysis. A period of study will be spent in a University Consultancy Unit and, in addition, all students will carry out individual project work.

* Acoustical Engineering specialist subject

**Industrial Experience

Approximately 20 weeks in industry are included as part of the four-year course. This is in two periods during the Summer Vacations between the second and third, and third and fourth, years.

higher level of professional training. The outline three-year and four-year course syllabuses are listed in Table 1.

The quota for the course is only about 15 students. Small groups can be very advantageous in the first year when students often have problems adjusting to University life. They clearly benefit from the increased interaction between staff and class members that is possible.

THE MSc COURSES

One of a number of methods used by the ISVR to disseminate the results of its expertise and research is the provision of three MSc courses. The titles of these courses are *Sound and Vibration Studies*, *Energy and Environmental Aspects of Automotive Engine Design* and *Audiology*. Each course is of 12 months' duration and commences every October. The Autumn and Spring terms are occupied with an intensive series of lectures, terminating with qualifying examinations. These are followed by a six-month research project and the production of a thesis. It is, however, possible to terminate the course prior to the research project – successful candidates at this stage qualify for a Diploma award. This option is attractive to applicants from industry, particularly mid-career engineers in need of re-training, because of the significant reduction in the time commitment.

Formally the entry qualification for all courses is a degree in physics or engineering from a recognised University but others may be admitted with the approval of the Faculty. In practice considerable flexibility is exercised in this respect, particularly towards those with previous industrial experience and proven ability.

The Sound and Vibration Studies Course

Historically the oldest of the MSc programmes, this course has been run continuously for more than 20 years. A wide range of topics are covered ranging from aerodynamic noise to the effects of vibration on the human body.

Clinical Audiology

Noise and Vibration Control for Environmental Health Officers

Applications of Time Series Analysis

Occupational Deafness

Industrial Audiology and Hearing Conservation

Advanced Noise and Vibration

Technical Audiology

Noise Control in Process Industries

Instrumentation and Measurement Techniques for Noise and Vibration Control

Machinery Noise Control

Table 2. Some of the short courses offered by the Institute of Sound and Vibration Research – most of these courses are of three to five days' duration.

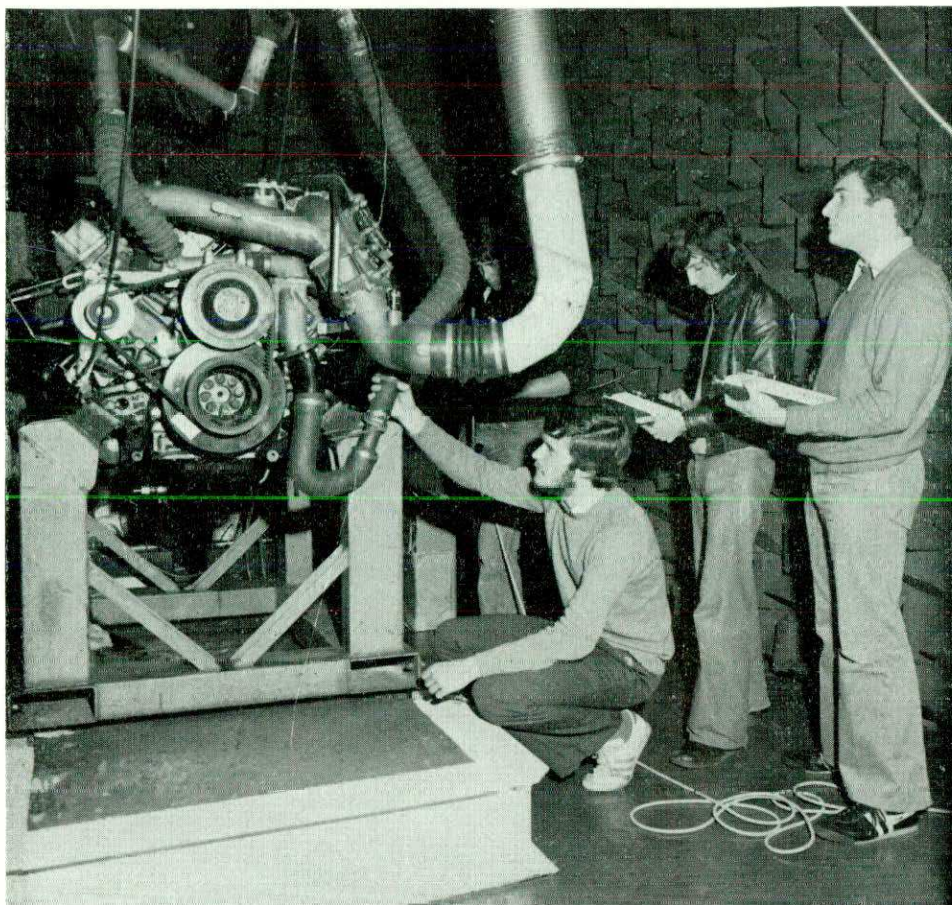


Figure 1. Undergraduate students measuring diesel engine noise in one of the ISVR engine test cells

In the first term all students take a common syllabus aimed at providing the necessary foundation material for subsequent more detailed studies. In the second term four alternative courses of study are offered, namely:

- (a) Physical Acoustics
- (b) Operational Acoustics
- (c) Machine and Factory Noise
- (d) Vibration Studies

Research projects are normally proposed and supervised by members of academic staff on the basis of the wide-ranging research activities of the Institute. Examples in recent years range from the vibrational characteristics of north sea oil rigs, through the

noise of punch presses to a study of the discomfort due to vibration of car seats. The extensive experimental facilities of the Institute and its advanced Data Analysis Centre provide unique support for these research projects.

The Energy and Environmental Aspects of Automotive Engine Design Course

This course was developed initially as the result of the extensive research at ISVR on the noise of internal combustion engines. However, as its full title suggests it is now more far-ranging and includes detailed studies of emissions and methods of fuel conservation.

Common subjects, taken by all students in the first term, include engine vibration, the acoustics of exhaust systems and combustion processes. In the second term students may choose between two principal options concentrating on either engine design for low noise or energy conservation and emissions control.

The research projects associated with the course are frequently of a highly practical nature involving work on full-scale diesel engines and, on occasions, complete vehicles at the Institute's engine test facilities. For those

with theoretical interests the development of finite element techniques for optimum engine design can provide an alternative challenge.

The Audiology Course

Of the three courses this is arguably the most vocational, concentrating principally on the training of audiological scientists for the National Health Service. Since many practising audiologists hold single-handed posts considerable emphasis is placed on the development of clinical expertise and diagnostic skills. The ISVR is in a unique position to offer such training as it provides clinical facilities in support of the Southampton Area Health Authority. Students thus receive training under realistic conditions with the guidance of practising audiologists, who also lecture part-time on the course.

The close association between the Department and the Institute of Hearing Research makes it possible to provide a considerable range of research projects. These may range from development of new diagnostic methods through rehabilitation techniques for hearing aid users to examining the success achieved in industrial hearing conservation programmes.

Social Activities

The ISVR MSc programmes provide a wide range of training enhanced by the very cosmopolitan atmosphere engendered by the diversity of backgrounds and nationalities of the participating students. In any year, more than half the students are from abroad: from America, Australia, Europe, New Zealand and the developing countries. Travellers abroad often comment on the difficulty of finding an organisation engaged in noise or vibration work which does not contain at least one ISVR graduate.

Lasting friendships are encouraged by an active social committee which organises bowling evenings, barbecues, etc, which culminate in an annual cricket match between ISVR staff and the MSc students; a fixture which the staff expect to win. Indeed, this is an opportunity to deny that any undue restrictions have been placed on the entry of antipodean students following an unexpected defeat of the staff three years ago!

SHORT COURSES AND CONFERENCES

Since the establishment of the ISVR, short courses, conferences, workshops, etc, have been an important feature in

the activities of the Institute. There is an obligation on the Institute to provide this type of activity because one of the primary functions and aims of the Institute is 'to disseminate information about sound and vibration to professional groups and members of the public by means of conferences, special courses, extra-mural lectures, publications and private consultations'.

Some courses are specific to employees in a particular industry, whilst others cover general sound and vibration subjects. In addition to the annual courses, single courses are also run, with some of these taking the form of workshops and seminars. Some of the current courses are listed in Table 2.

The courses are presented in a professional manner and are financially self-supporting. They are initiated by ISVR's appreciation of the needs for courses and they are constantly under review to maintain the high standard and international reputation gained over the years. In this way it is also possible to develop courses in any areas in which there is special demand. The programme complements the existing teaching and research activities of ISVR and makes use of the special expertise available in the Institute. Interestingly, the Institute provides

ISVR SHORT COURSES AND CONFERENCES PROGRAMME

ANNUAL COURSES — 1981

23 - 26 March	Engine Noise and Vibration Control
30 March - 3 April	Noise and Vibration Control for Environmental Health Officers (Wolfson Unit)
30 March - 3 April	Clinical Audiology
5 - 10 April	Applications of Time Series Analysis (6 Day Course)
7 - 11 September	Industrial Audiology and Hearing Conservation
14 - 18 September	10th Advanced Noise and Vibration Course
14 - 18 September	Technical Audiology 'B' Course
October (dates to be finalised)	ISVR/CONCAWE Noise Course for Process Plant Engineers (Wolfson Unit)

MODULAR COURSES — 1981

5 - 9 January	D2 Module: Instrumentation and Measurement Techniques for Vibration Control
15 - 19 June	D1 Module: Instrumentation and Measurement Techniques for Noise Control

OTHER COURSES — 1981

Dates to be finalised	Industrial Deafness and Hearing Conservation (in co-operation with Bilsom International Limited)
June/July (dates to be finalised)	One Week Course on Tests of Vestibular Function/Auditory Electrophysiology

Further information may be obtained from Mrs O G Hyde, The University, Southampton SO9 5NH. Tel: (0703) 559122 Ext 2310 (Mrs Hyde); 752 (Dr Walker, Short Course Organiser); 2291 for Modular Courses; 751/756 for Wolfson Unit Courses. Telex: 47661.

50% of the total number of short courses provided by the whole of Southampton University.

Of particular interest is the development of courses run in conjunction with other bodies such as EEC and CONCAWE.

Short Courses

These are usually of three to five days' duration and each is aimed at a specific group of people including audiology technicians, industrial medical officers, engineers from the process or petrochemical industries, environmental health officers, acoustical engineers in industry and ear, nose and throat consultants. They deal with a range of subjects of interest to the specific group and include information about recent developments in the field. A comprehensive set of lecture notes is usually provided. The Institute has co-operated with bodies such as the EEC in presenting joint courses.

Post-Experience Modular Courses

These are short training courses for engineers in industry concerned with noise control or transportation noise

problems. They are of a modular form, each module being of five days' duration. The modules recur at regular intervals.

Seminars and Courses in Industry

These are usually provided for specific industries and deal with problems specific to that industry. They may be of one or two days' duration.

Conferences, Workshops, etc

ISVR's international reputation in noise and vibration studies and its expertise in running short courses has meant that the Institute has been asked to run conferences or workshops on behalf of scientific societies such as the ICA and IOA. The Institute also develops its own conference and workshop programme, either independently or in co-operation with other organisations.

The Subjects Covered

The programme of courses has always reflected the research and teaching expertise in the Institute and has therefore continually developed into new areas as the interests of the staff have expanded. Thus the subjects

covered have changed over the years – although some of the fundamental courses have remained, being up-dated as the subject develops. An example is the Advanced Noise and Vibration Course, being presented for the ninth time in 1980. This one-week course initially deals with fundamentals and then broadens into several specialist topics on noise and vibration. Recently, for example, lectures on mechanical noise sources which reflect the ISVR's growing expertise and interest on this important subject have been introduced.

The Noise and Vibration Course covers a wide range of topics and as such it is unique in our programme. Typically, the courses are aimed at specific subjects, such as aspects of audiology, machinery noise, time series analysis, or environmental topics (see Table 2).

The Audiology Group in the Institute has always been active in the short course programme. They currently present four courses each year in Clinical Audiology, Technical Audiology, Industrial Audiology and Hearing Conservation, Occupational Deafness (bi-annually) and Electro-physiological testing in neuro-otology (bi-annually). The reputation of the Group is such that there is rarely a problem in filling the courses and early application is always advised.

The Level of the Courses

Although each course is aimed at covering the latest developments in any field, we are also conscious of the need to provide a choice of basic and highly specialised courses. Thus some of the courses are designed for technical staff and will have a large practical content whilst others are for the senior research staff and will be more theoretical in content.

What is Provided

Most of the courses are residential, accommodation being provided in the University Halls of Residence. Some courses are held during term time but accommodation must then be in local hotels. It is Departmental policy to provide comprehensive lecture notes for all courses. It is particularly valuable for delegates to receive written versions of the basis for each course and the lecturers are then able to concentrate on specific applications and up-to-the-minute developments.

Publicity

Most publicity is achieved by direct circulation of the course programme to existing contacts. This list is continually growing but this method of publicity is



Figure 2. Subject involved in the assessment of different types of hearing protectors

supplemented by regular announcements in Journals, Magazines, etc, including the IOA Bulletin.

Conferences

In parallel with the programme of short courses, the Institute regularly hosts major conferences. For example, in Spring 1979 the ISVR hosted the Spring Conference of the Institute of Acoustics attended by nearly 200 delegates. In 1979 the Institute was also the venue for an International Symposium on Internal Noise in Helicopters. The Symposium was arranged jointly by ISVR and the Royal Aircraft Establishment, Farnborough, in association with the Royal Aeronautical Society's Rotorcraft Section. Fifty invited participants from the USA, Europe and UK attended. A major international symposium on recent Advances in Structural Dynamics was held in July this year with over 100 delegates and nearly 70 papers.

Administration

The Short Courses and Conferences Programme is administered by a secretariat which is responsible for the overall planning, organisation and co-ordination of the programme, as well as the day-to-day running of the courses. In this way the administrative burden is removed from the academic staff of the ISVR who are able to concentrate solely on the technical aspects of the courses.

Future Developments

The future programme of short courses is based on those courses which have proved most successful. New courses, such as the Time Series Analysis course presented for the first time in 1980, are introduced from time to time. An increase in the short in-house courses for specific industries is also expected. □

M J Fisher
M J B Shelton
J G Walker

AES Secretariat Change

Carole Atkinson has retired as Secretary to the British Section of the AES. All enquiries regarding membership, subscriptions etc should now be directed to the new Secretary:

Mrs E A Cohen
8 Granville Road
Sevenoaks
Kent.

Letters to the Editor

Dear Madam,

The Uncertainty of BS2750 — 1980 and 1956

Although BS2750 — 1956 has been withdrawn by the British Standards Institution it would still appear to be the legally required standard method of test (cf The Building Regulations 1976 and Amendments Part G) and after some 25 years can be said to have withstood the test of time.

This year's BS 2750 — 1980 (a copy of ISO 140 — 1978) is already under revision in its ISO form.

From the above comments it may be judged as not too soon to ask for some form of justification of the changes that have been made to 2750, or to establish if a change in method or expression has made a difference in practical terms and what is the magnitude of that difference.

First let us look at that Legal Standard of Measurement of Sound Reduction Index in Britain, BS2750—1956, where a wealth of information is to be found in the Appendix. It will be seen that the number of loudspeakers and microphone positions to be used is not specified since the condition and accuracy required will determine these. However, we may note that the suggested experimental set-up, ie 6 microphone positions below 500 Hz and 3 microphone positions above 400 Hz, results in level differences at the specific frequencies being determined with standard deviation of less than 2 dB.

My term uncertainty is used to encompass the ideas of error, accuracy and precision, Repeatability and Reproducibility. Uncertainty has always been measured by some function of standard deviation (eg BS2750 — 1956 which used standard deviation $\sigma = 2$ dB for field measurements in dwellings) and BS2750—1980 and BS5497 — 1979 quote a related function:

$$\begin{aligned}\text{Repeatability } r &\approx 2 \sqrt{2}\sigma^2 \\ \text{Repeatability } r &\approx 2.8\sigma\end{aligned}$$

Let us examine this relationship. If a 2 dB standard deviation is acceptable (as in BS2750 — 1956) this translates to about 1 dB Probable Error, (the

Probable Error, $PE = 0.67\sigma$, is the commonly used scientific convention for a 50 per cent confidence interval) and to a value of Repeatability r of 5.6 dB. This is not so different from the Repeatability $r = 5$ dB at low frequencies of BS2750 — 1980 and so BS2750 — 1956 and BS2750 — 1980 can be said to be alike in their requirement of uncertainty at low frequencies. However, given that Repeatability $r = 1$ dB as required at mid frequencies in BS2750 — 1980, the standard deviation will need to be reduced to about 0.3 dB.

Questions that may be asked here: Who works to this small degree of uncertainty and who would need such data? What is wrong with the uncertainty levels we have been seeking to achieve these past 25 years? Why should uncertainty be less tolerated at high frequencies than at low, as is required by BS2750 — 1980? Will government legal standards of insulation change with such a projected and standardised reduction of uncertainty? What incentive is there for producing all results to such a level?

BS2750 — 1956 would appear to have approached the area of uncertainty from a pragmatic point of view by allowing the degree of uncertainty to be ascertained and corrected if necessary by the experimenter. However, by making the note on 2 dB standard deviation in the field at each specific frequency, the old standard leads one to accept this value as "good practice".

BS2750 — 1980 only sets uncertainty limits to laboratory measurements, and these limits appear to have been set by reference to what is achievable in the laboratory rather than what is necessary in practice and under differing conditions of test.

A different approach might be to keep the $\sigma = 2$ dB requirement (or for international *entente* use a Repeatability r notation of equivalent value) of BS2750 — 1956, or to calculate what uncertainty is acceptable at each specific frequency with respect to the end use to which these measured values are put. Three grades of uncertainty might well be established: Laboratory, Field and Quick Field Order of Magnitude. The Laboratory grade might be a slightly relaxed form of BS2750

— 1980, say Repeatability $r = 3$ or $\sigma = 1$. The Field grade might be of the form BS2750 — 1956, say Repeatability $r = 6$ or $\sigma = 2$. The Quick Field test grade would possibly have such large uncertainty (say Repeatability $r = 15$ or $\sigma = 5$) that the normalisation and standardisation procedures would not be required to be performed on the raw data (Note BS2750 — 1956 authors had this form of measurement in mind).

Finally may I question the wisdom of taking a step towards BS5497 — 1979 with its attendant Panel, Statistical Expert, 8 - 15 Specialised Laboratories, etc which would require separate precision experiments for field tests and laboratory tests. If we take the statement of BS2750 — 1980 that for field measurements the overall Repeatability *in situ* cannot be stated, we might well consider a return to standard deviation as the measure of uncertainty.

Yours faithfully,
for Hann Tucker Associates Ltd
M D G Randall

Dear Madam,

Can BS 3539 help you to trust your Sound Level Meter?

Anyone who uses a sound level meter will I am sure be interested in the article in the October issue of Acoustics Bulletin. Before getting my meter checked or even buying a new one I should be interested to know what type of meters were studied in the survey. If the meters tested to BS 3539 were all precision grade then the situation is serious. Moreover, to what extent did the meters fail to meet the standard? The odd 0.5 dB at say 50 Hz is not particularly serious, whereas 5 dB at 1 kHz is a different matter.

Yours sincerely,
L W Bean MIOA

Rayleigh Medal

Professor Uno Ingard of Massachusetts Institute of Technology is to be the recipient of the Rayleigh Medal for 1981. The Medal is awarded 'to persons of undoubted acoustic renown for outstanding contributions to acoustics'.

Diesel Engine Noise Research

IOA Conference at Loughborough, 21-23 September 1980

Loughborough has a reputation as a very pleasant location for conferences with its good facilities, surroundings and friendly hospitality. This conference lived up to this reputation in full and provided the one hundred delegates with an exceptionally fine event. With stimulating technical sessions, an absorbing exhibition, local industries and laboratory tours and an excellent conference banquet at Rothley Court Hotel honoured by the presence of the Vice-Chancellor Dr Butler and Mrs Butler, it was a full two days. The opportunity to visit the ancient chapel at Rothley Court after the banquet was very much appreciated by the guests.

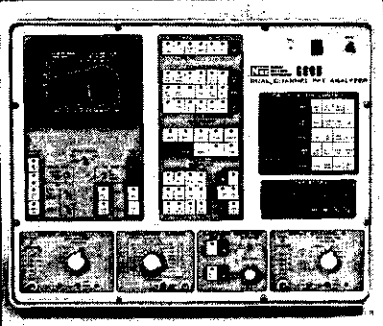
The conference was attended by many internationally known experts from countries as far apart as Sweden, France, Germany, Denmark, Holland, Switzerland, Japan and America showing how important this aspect of engine design has become. The papers presented were concerned with the

generation of noise in diesel engines and its control; the design of low noise diesel engines; combustion and piston slap noise; damping of components; the TRRL quiet Heavy Vehicle; test procedures for the measurement of diesel engine noise; mathematical modelling of engine structures; steady state and transient engine operation and gear noise in diesel drive trains. Abstracts of these papers appeared in the October issue of Acoustics Bulletin. This wide range of topics promoted much detailed discussion and the conference as a whole presented a very comprehensive picture of current activities in the subject, both nationally and internationally.

It was quite clear from the conference that the engine manufacturers are making great efforts to reduce the noise of engines in response to public opinion and legislation. They felt this effort could be helped by a more clearly defined programme of future

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legislation because of the long lead times required to introduce modifications or new models. The conference emphasised the complexity of the noise problem and of the solutions required and showed in many cases that whilst noise can be reduced, this is often at the expense of other important design parameters, for example fuel consumption and gaseous emissions. Despite this it is clear that diesel engines with noise levels approaching 90 dB(A) at 1 metre will be developed and that truck noise will approach 80 dB(A) at 7.5 m in the not too distant future, providing that the appropriate noise legislation is forthcoming. Of particular importance to the IOA were the criticisms from both

industrialists and research organisations directed against the various standard noise measurement procedures for machine noise assessments which, when applied to engines, gave very different results. It appears that the acousticians have not yet solved the problem of machine noise measurement to the satisfaction of those of us who have to assess engine noise.

This was an excellent conference and we must thank the IOA, the Department of Transport Technology at Loughborough University of Technology and Dr Sam Haddad, the Conference Organiser, for arranging it. □

D Anderton

Material for the April issue of Acoustics Bulletin should reach Mrs F A Hill at 25 Elm Drive, St Albans, Herts AL4 0EJ no later than 20 February.

IOA ANNUAL SUBSCRIPTIONS

As stated in a circular sent to all members, the following rates of subscription will apply for 1981:

Fellow	£35
Member	£25
Associate (over 30)	£22
Associate (under 30)	£18
Student	£10

Lost Members

The IOA appears to have lost contact with two more members, whose last known addresses are given below. If anyone recognises a colleague — or himself — as one of those mentioned, please contact the Institute's Secretariat in Edinburgh.

Mr B C Munday, MIOA
c/o Brown and Root/NPC
PO Box 535
1301 Sandvika
Norway

Dr E J Thompson, MIOA
18822 Barry Lane
Santa Ana
California 92705
USA

THE PROBLEM OF ASSESSING ENVIRONMENTAL NOISE

A one day symposium will be held on

**Wednesday
25th March 1981**

at the Carnarvon Hotel, London W5

Programme and registration details from

The Secretary
Association of Consulting Scientists
Owles Hall
BUNTINGFORD
Herts SG9 9PL

Telephone : Royston (0763) 72665

ACOUSTICS LETTERS

...for people who read and write about acoustics...

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Proceedings of The Institute of Acoustics-Abstracts Acoustic Pattern Recognition

Joint meeting with British Pattern Recognition Society, 15 December 1980 at
the University of Surrey

An Instrument for the Automatic Identification of Sources of Noise Pollution

P Moukas

Department of System Science,
The City University, London

For the monitoring and control of Noise Pollution, a simple and inexpensive instrument that can identify sources of noise using properties of the acoustic signals is needed. In collaboration with the GLC, we are developing a device of this kind which can recognise sources of common noise nuisances such as aircraft, helicopters, trains, vehicles and so on. The methodology is to examine spectra and cepstra of recorded sounds in order to determine features useful for the identification. Feature space analysis and related techniques of Pattern Recognition are then used for the classification. This talk will describe spectra from a variety of sources and show how the adjustment of the parameters of spectral analysis emphasise features reflecting the constructional and operational characteristics of the sources. The performance of a linear classifier operating on features based on certain frequency and quefrency bands will be discussed. Finally it will be shown that further processing of the spectra and cepstra to enhance the differences between the various classes of sounds and the utilisation of their temporal variation enable the extraction of features which considerably improve the performance of the classifier.

A Speech Recognition System using Walsh Analysis with a Small Computer

Monira A Abu El-Ata and J Seymour
School of Electrical and Electronic
Engineering, Thames Polytechnic,
London

The Walsh-Hadamard transform was used for the recognition of isolated words, by varied speakers in real time on a small computer using a hybrid system. The hardware part of the system consisted mainly of a Walsh-Hadamard Transformer and included circuitry to provide zero crossing and energy counts.

The coefficients from the transformer were combined to produce a power spectrum and features were extracted to give small patterns of dimensions 8×16 . One-second utterances were accommodated in the 16 time slots and the eight frequency slots covered an input range of 5 kHz.

Master patterns were formed for each utterance of 10 word vocabularies by repeating the utterance five times. Recognition was achieved by comparing an input utterance with each master pattern in turn and selecting the one with the best correlation. Three different methods of producing master patterns were compared, with a 'tree' method producing the best results.

The system gave recognition scores in the range of 50–70% at early stages of testing. Introduction of linear time normalisation of the input coefficients enhanced recognition to a great extent, and a range of 70–100% recognition scores was achieved. Some 25 test subjects and more than 200 recognition test runs with a variety of vocabularies have been investigated. The system is seen as a step towards a reliable low-cost recognition system.

Pattern Recognition: an Empirical Bridge Between Technology and Human Perception in Diagnostic Ultrasonics

R C Chivers

Physics Department, University of
Surrey

Initial attempts at ultrasonic diagnosis (in both industrial and medical contexts) used the one-dimensional A-scan display of information in the search for gross inhomogeneities in the propagating medium. However, in A-scans from materials with microstructural heterogeneity, there are numerous low level signals which originate from the regions of the material which lie between the major discontinuities that give rise to the strong echoes. There have been continual suggestions that these smaller signals may be related to the type or structure of the material present, and thus that pattern recognition techniques may be developed as objective diagnostic aids.

The majority of the developments have been initiated in the field of medical ultrasonics for the remote investigation of soft tissues and although the discussion is relevant to all inhomogeneous materials, for simplicity only the soft tissue problem will be specifically covered. For most investigations the diffractive nature of the acoustical transducers used, the relatively wide bandwidths (to obtain good spatial resolution) and the vagaries of the propagating medium make analysis of the simple A-scan an approach for which there are an infinitude of variations amongst which the optimum lies, whether it is useful or not!

Considerable effort has been expended in developing two-dimensional visualisation procedures (which display the major features of a number of coplanar A-scans). This involves the introduction of yet more steps of uncertainty (in the parameters associated with the signal processing involved). The paper discusses the problems outlined above to argue that quantitative pattern recognition techniques applied to two-dimensional (B-scan) images may be able to provide an arbitrary but objective bridge between the acoustic and electronic variables and the perceptual psychology of textural analysis. In this way it may be possible to take full advantage of the unique capabilities of human visual perception in optimising the

instrumentation to them, without a detailed understanding of all the physical mechanisms involved in the production of the image.

Developments and Challenges in Automatic Speech Recognition

J S Bridle

Joint Speech Research Unit,
Cheltenham

Until a few years ago there seemed to be two distinct approaches possible to speech recognition. For isolated words, fairly straightforward whole-word pattern recognition methods gave usefully good results, at least when the system could be set up for a specific user. For anything more ambitious it seemed necessary to segment the speech into units such as phones or syllables, decide on the identity of the units, then 'make sense' of the sequence. It is now apparent that brute-force pattern recognition techniques can be extended successfully to work on connected speech. The new methods 'decode' speech in terms of a sequence of words (or other units) without performing a separate segmentation phase. Based on these new methods we shall soon see connected word recognition systems commercially available, suitable for use with specialised, limited vocabularies (1), and the way seems open for more dramatic advances to be made (2). The methods rely heavily on the use of Dynamic Programming to solve the problems of time alignment and for making decisions about the best sequences (1, 3, 4, 5). I shall describe the approach needed to use these methods, and offer some insight into their mechanisms. It is surprising that these 'new' methods were described in the Russian literature as long ago as 1971 (6). I shall conclude by pointing out some of the many challenging problems that must be dealt with before speech can be used widely as a convenient method of communicating with the complex machines which will play an increasing part in everyone's lives.

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1. H Sakoe, Two-level DP matching – A Dynamic Programming-based pattern matching algorithm for connected word recognition, IEEE Trans ASSP-27, Num 6, pp 588–595, December 1979.
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Transducers for Sonar Applications

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6. T K Vintsyuk, Element-wise recognition of continuous speech composed of words from a specified dictionary, Cybernetics (USA) 1971, vol 7, part 2, pp 361-372.

Approximations to Melody

A J Watkins

Department of Psychology,
University of Reading

This work forms part of a computational and experimental project designed to investigate perception and memory for tonal sequences computed in various ways. An initial aim was to generate sequences varying in perceived 'melodiousness'. Three constraints were identified on *a priori* grounds. Small pitch changes from note to note will be more probable; the notes of the 'diatonic scale' will have high probability; finally, according to the dictates of the 'Classical Theory of Tonality' certain transitional rules and probabilities will apply.

Two octaves of the equal temperament tuning system were used. A program called 'Liszt' was used to compute an array of 25 (current notes) by 25 (probability of next notes) values. A program called 'Brahms' generated a series of note values via a random number routine and the probability distributions previously computed. Sequences

of 21 notes were generated in even tempo; melody variables other than those mentioned (eg contour) were completely randomised. Perceived melodiousness was scaled by 'Paired Comparisons' and the effect of the constraints was examined by analysis of variance of the 'melodiousness' scores.

The results indicate that observers are quite systematic in their judgements and that the various constraints have perceptual significance. Various aspects of these data will be discussed.

Foundations of a Descriptive Approach to M/C Perception of Speech

P D Green and P J Grace

Department of Computing, North
Staffordshire Polytechnic

We propose an approach to continuous speech understanding based on the production of a rich, symbolic description of an utterance, rather than a segmentation and labelling process of the kind used in the ARPA projects (1). This idea follows the 'primal sketch' work in m/c vision by Marr *et al.* (2).

From a parametric representation of an utterance (comprising LPC, FFT, pitch, zero crossing and energy information), we form a hierarchical data structure, whose elements explicitly describe the systematic changes with time in the parameter vectors. The primitive elements of this data structure describe 'parameter continuities', which ap-

proximate the behaviour of an individual parameter by a straight line over a short time interval.

We view the process of understanding an utterance as one of interpreting the symbolic description. Our approach to this utilises Minsky's idea of 'frames' (3). In this sense, a 'frame' is a data structure describing something (for instance, a manifestation of a phoneme) which one expects to find in the symbolic description of an utterance. The frame structure is compatible with that of the symbolic description but allows for alternative ways of instantiating the object it describes and contains various other information necessary in the interpreting process.

The interpretation of an utterance then amounts to finding a compatible sequence of frames which match the utterances' symbolic description. We hope to take some account of transition phenomena such as co-articulation by linking individual frames into a network, so that the expected instantiation of a frame can be made to depend on neighbouring frame matches.

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Transducers for Sonar Applications

16-17 December 1980, at the University of Birmingham

Twenty-Year Life Hydrophones

A C Tims, C K Brown and R W Timme
Underwater Sound Reference
Detachment, Naval Research
Laboratory, Orlando, Florida, USA

An in-depth knowledge of transducer designs, materials, and craftsmanship has been used to develop a deep-submergence hydrophone with an expected service life of 20 years. It is expected that this hydrophone will demonstrate that sonar equipment can be made with reliability equal to space-age equipment. The use of reliability modelling, careful selection of materials, and construction techniques will be important to other designs. The particular application led to a hydrophone configuration that provides a nominal crystal sensitivity of -180 dB re 1 V/ μ Pa, smooth response to frequencies above 40 kHz, omnidirectionality in the horizontal plane, a cardioid pattern in the vertical plane, and stability with hydrostatic pressures to 20 MPa.

All of the hydrophone parts exposed to seawater are cadmium plated carbon steel.

All mating metal parts have two O-ring seals for redundant protection. Double butyl boots over the sensor element, with castor oil as the coupling medium, provide low water-vapor permeability and added physical protection. If the outer boot is damaged or deteriorates, the inner boot can provide years of additional service. The sensor is encapsulated in an elastomer that serves as a mount and, in conjunction with O-rings, seals the assembly for additional protection. The

hydrophone has two independent linear preamplifiers, remotely operable by a unique switching circuit. All functions - preamp power, signal output, and preamp switching - are accomplished over a single coaxial cable up to 20 km long. The preamps are sealed in the housing separate from the cable interface in a nitrogen atmosphere to prevent moisture condensation with changes in temperature. Transient voltage suppressors protect the preamplifiers from voltage transients associated with power disturbances, switching and lighting effects.

This paper will discuss alternate design approaches, predictions of lifetime based upon reliability modelling, choices of materials, and successful operation of hydrophones to date.

Piezoelectric Polymer Hydrophones

James M Powers

Naval Underwater Systems Center,
New London, CT 06320 USA

Three hydrophones are described which use piezoelectric polymer (PVDF) as the active element. These hydrophones are designed to withstand high hydrostatic pressure and to provide good signal to noise ratio at low audio frequencies. Of the three designs, the compliant tube hydrophone has the highest signal to noise ratio and can be used to 4 MPa static pressure. The cylindrical hydrophone has positive buoyancy and can be used to 12 MPa. The hydrostatic mode hydrophone can be used to 'unlimited'

pressure and is mechanically semi-flexible. Also discussed are expected performance improvements to be obtained by using recently developed thick film polymer.

PVDF Membrane Hydrophones for the Study of High Frequency and Non-Linear Acoustic Fields

D R Bacon and K C Shotton
National Physical Laboratory,
Teddington

The PVDF membrane hydrophone and its mode of operation will be described, and its potential advantages over hydrophones of more conventional design discussed. Its performance characteristics, including its broad-band frequency response, directionality and lack of internal reverberations, will be demonstrated and explained briefly in terms of a simple theoretical model, and the way in which the electrical properties of the device determine the optimum signal recovery system for use under different experimental conditions will be discussed. Various electrical screening configurations, including those based on a bilaminar membrane, will also be covered.

The performance of the hydrophone at frequencies up to 100 MHz will be illustrated by reference to the harmonic content detected in the almost triangular acoustic waveforms generated by non-linear propagation in water. The use of membrane hydrophones and non-linear fields for calibration purposes will also be discussed.

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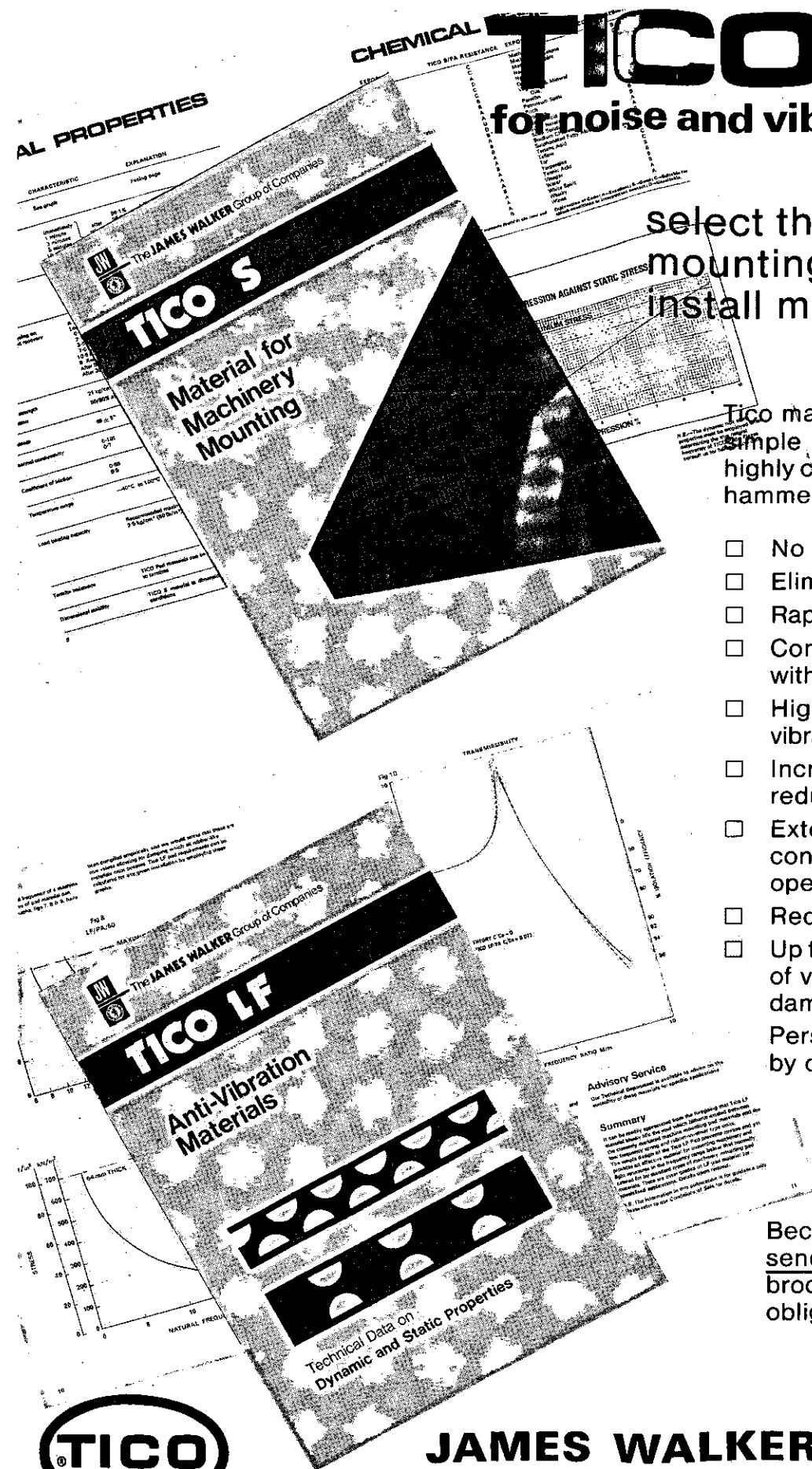
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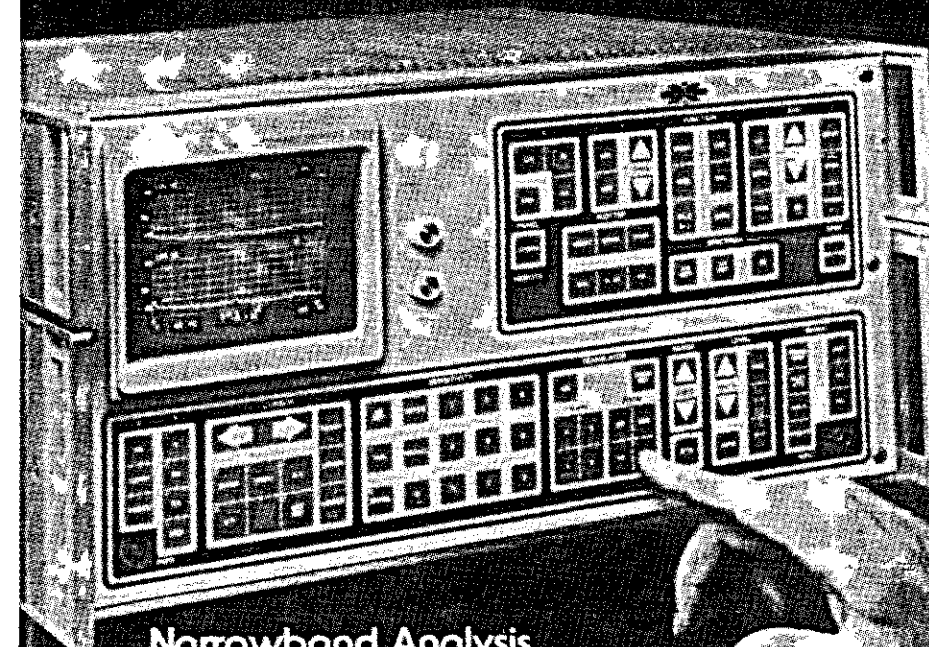
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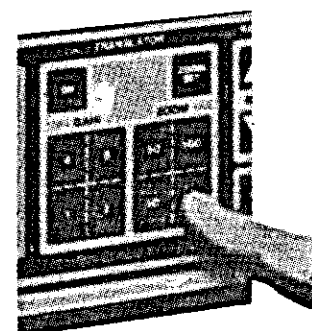


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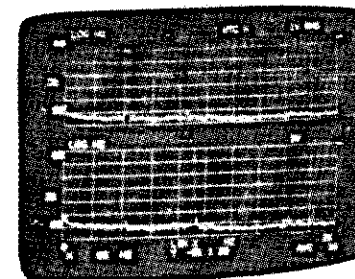
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SPRING CONFERENCE

TECHNICAL PROGRAMME

Acoustics '81 has four parallel technical sessions and an open 'Poster' session. In addition there will be technical visits appropriate to each main subject.

The efforts of Brian Clarkson at ISVR have produced an excellent range of papers for the **Structural Dynamics** session. At least five professors, namely Bishop, Earles, Johns, Jones and Warburton, head a list of well known authors who will be presenting papers.

Brian Oakes of Newcastle Polytechnic is co-ordinating presentations for the **Industrial Noise** session. This is a broad topic which traditionally produces a crop of good papers. The papers offered this year promise to maintain variety and quality with subjects dealing with noise prediction, the engineering of noise control at source, and acoustical path treatments, in a range of industrial environments.

A review paper by Mark Haggard, Director of the MRC, is one of the important papers to be given during the **Speech and Hearing** session. Ron Beresford and his colleagues of the Speech Group are putting together another group of excellent papers for this session.

For the session on **Musical Acoustics**, John Bowsher at Surrey University has tempted a number of overseas visitors into making long journeys to the conference. Papers will be given by Dr Ing Jürgen Meyer of Brunswick University and Ursula Angster from Hungary. In addition there will be many papers from UK workers in the subject.

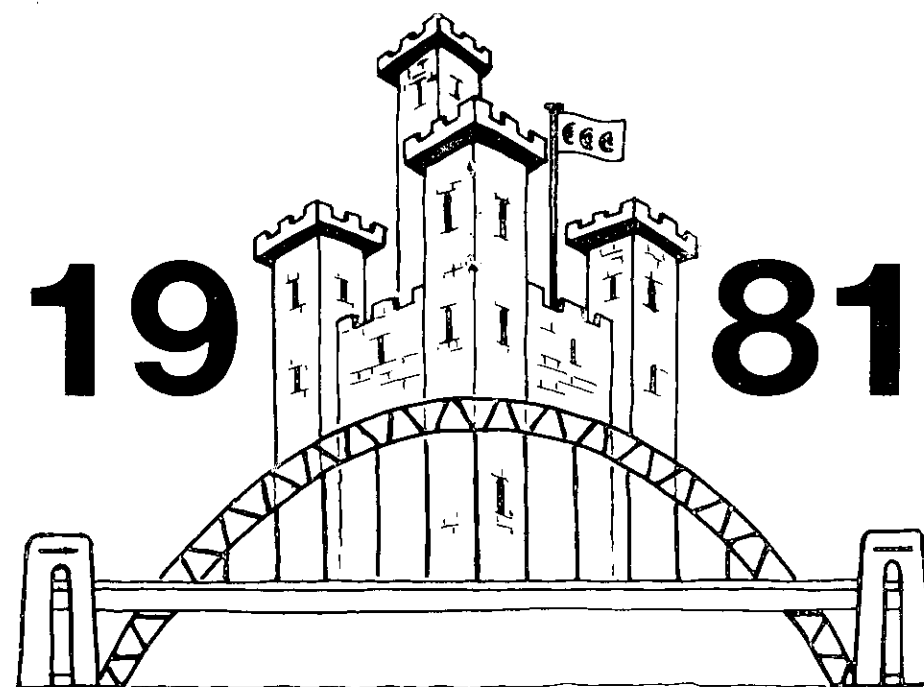
We are disappointed so far with the response to our request for contributions to the **Open Poster Session**. Probably because this is a new feature you may not know what is required. The idea is to attract short summaries of work, and for the author to be available for discussion with interested parties. No formal paper is needed. The summaries are displayed at the Conference; all the authors will attend at a specified time and informal small group meetings can be organised at short notice. The arrangement suits contributions of shorter pieces of work from industry or academic groups which might otherwise go unpublished. Heads of Department might wish to encourage their junior staffs to contribute. So don't be shy; don't be afraid of criticism or controversy; get your summaries in to Ian Diggory, at British Gas, Engineering Research Station. ASAP please!

TECHNICAL VISITS

To complement the technical sessions, visits have already been arranged to:

British Ship Research Association, Wallsend (Structural Dynamics)
Burgess Industrial Silencing, South Shields (Industrial Noise)
Harrison and Harrison, Organ Builders, Durham City (Musical Acoustics)
Newcastle University (Speech and Hearing)

The timing of these visits will avoid any conflict with the presentations during the major sessions.



ACOUSTICS '81

22 - 24 April

at

Castle Leazes,
Newcastle University

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TRAVEL

Contrary to popular myth in the far South and the far North, Newcastle upon Tyne is readily reached from all parts of the country by rail, air, or road.

Inter-city trains link Newcastle upon Tyne to most major towns and cities in under 4 hours; London to Newcastle for example is 3½ hours and Edinburgh to Newcastle is under 2 hours.

Scheduled flights connect Newcastle to Heathrow, Gatwick, and all other major airports in the UK and Europe.

The road network into the region is highly developed with the A1 (Great North Road) being the main North-South trunk route.

Advantage will be taken of Group travel arrangements where these can be organised. It seems likely that a party could be formed of those travelling from London to Newcastle on 21 April. Booking forms will contain further suggestions.

ACCOMMODATION

Castle Leazes is an attractive, modern complex on a seven-acre site overlooking Leazes Moor. It is within 15 minutes walk of the University and Newcastle City Centre, and has large car parking facilities.

All accommodation is in single rooms, with adjoining rooms for accompanied delegates. Each room is centrally heated, fully furnished, and fitted with wash basin and razor socket. There are ample toilet and bathroom facilities on each floor and a number of small kitchens for provision of tea and coffee when required.

SOCIAL PROGRAMME

The technical programme is going to be quite intensive. To enable delegates to unwind in the evenings and to relax in the company of friends, both old and new, we have arranged a programme of evening events and entertainment. This includes the Exhibitors' Reception and the Annual Dinner of the Institute.

Bar facilities will be available on site during the lunch and evening periods.

The area in and around Newcastle has plenty of attractions for visitors. It will be our aim to show our guests some of these attractions and to make them feel welcome in Northumbria. During the conference there will be trips out to Durham Cathedral (11th Century), Wallington Hall and Gardens (National Trust), and Hadrian's Wall (Roman Antiquities). Further details of the social programme will accompany the conference booking form which all members of the Institute will receive.

Experimental Performance of Fibre Optic Hydrophones

M L Henning and T Hoyes
Plessey Company Limited,
Templecombe, Somerset

Optical fibres exhibit microphonic properties as a result of mechanical stressing, and can therefore be used as sensors of acoustic waves. One of the more sensitive detection methods is to observe the phase changes in coherent light passing through the fibre when it is subjected to mechanical stress. These phase changes are due to changes in the optical path length during the stressing. Past work on hydrophones constructed on these principles indicated their promise as a novel transducer, and therefore a programme was started to characterise the typical properties of hydrophones of this type.

A range of coils was constructed, incorporating different types of fibre and sizes of coil. Their beam patterns and sensitivities were measured over a range of acoustic frequencies between 1 kHz and 50 kHz. The optical detection system consisted of a Mach Zehnder heterodyning interferometer, using an He Ne laser and phase demodulation techniques.

Results were compared with theoretical expectations and were found to be in general agreement. Beam patterns are typical of free flooding ring transducers, and the resonances appear to be chiefly due to the cavity and ring modes of vibration.

Extrapolation of the experimental results allows an estimate to be made of the ultimate practicable sensitivity of the system. This appears to be typically better than 25 dB below Sea State zero at 10 kHz acoustic frequency.

Design, Construction and Matching of a 3.8 kHz, 4.3 degree conical beam transducer

P J Stevens
Universal Sonar

(Abstract not available)

Nonlinearity of Cylindrical Hydrophones Used for the Measurement of Parametric Arrays

V F Humphrey and C H Hsu
Bath University

Although the subject of nonlinearity in piezoelectric materials used for transmission at high drive levels is now being considered, little attention has been given to the possibility of nonlinear effects on reception. This is because hydrophones are more than adequately linear when used for conventional reception. However, the investigation of parametric arrays, where the aim is to observe a difference frequency signal, generated in the propagation medium, in the presence of two relatively high level primary signals, may place much more stringent requirements on hydrophone linearity and thus be a very sensitive test of any such nonlinearity.

In experimental studies of parametric sources operating at primary frequencies of about 100 kHz and 1 MHz we have observed significant intermodulation occurring in a number of cylindrical hydrophones. These effects are most noticeable where the

difference frequency pressure is small compared with the primary pressure, as is the case in the transducer nearfield where most of these measurements were performed. This non-linearity also becomes more significant as the difference frequency and, hence, conversion efficiency of the parametric source is reduced. The problem may be overcome by making measurements at an increased range where spherical spreading and attenuation reduce the relatively high levels of the primary signals.

The presence of such a nonlinearity, provided it is at least comparable with the real signal level, can be identified by the resulting characteristic beam profile and investigated by use of an acoustic filter that reduces the primary pressure levels incident on the hydrophone.

Low Frequency Standard Hydrophone for Calibrating Line Hydrophone Arrays (Seismic Streamers) and Marine Seismic Sources

M H Safar
The British Petroleum Company
Limited, London

P Newman
Horizon Exploration Limited, Swanley,
Kent

The marine seismic source and streamer (line hydrophone array) are essential parts of a highly complex seismic data acquisition system used in offshore oil prospecting. Therefore, proper quality control of their performance is an important consideration in ensuring high data quality standards. An effective quality control can only be achieved by using a reliable calibrated hydrophone.

The design of a standard hydrophone having a maximally flat (Butterworth) response in the frequency range 8.0 Hz to 1.0 kHz is described.

The standard hydrophone has been used successfully in the North Sea during the past eight years for monitoring the output of a single air-gun. The use of the standard hydrophone for calibrating a marine seismic streamer is discussed.

Matched Sensors for Structure Borne Noise Cancellation on Hull Mounted Hydrophones

E Kjellsby
Norwegian Defence Research
Establishment

A hydrophone to suppress self-noise was built based on the principle of cancelling acceleration sensitivity. Two sensors are mechanically coupled to the hull but only one of them is exposed to the water. Subtracting the two signals cancels structure borne noise by destructive interference while a water borne signal remains unaltered.

The principle demands that the noise signal from the two sensors be in phase. Structure borne noise has its origin in a complex form of vibration with poor correlation properties. To obtain sufficient correlation, both sensors have to sense the vibration at approximately the same point. By coupling two concentric cylindrical ceramic tubes of different diameter to the hull, this condition is nearly fulfilled. The outer tube is end capped and airfilled. To compensate the inner tube for the water load

Transducers for Sonar Applications

at the end cap of the outer, it is equipped with an inertial mass load.

The vibration sensitivity of a ceramic tube will normally not be equal in all planes. However, if the ratio between the sensitivities of the two main directions of vibration of the two tubes is made equal, cancellation will occur in both planes. This matching can be done by adjusting the mass load and weighting of the two sensitivities.

New Transducer Concepts at the Naval Research Laboratory

A L Van Buren, Peter H Rogers,
Joseph F Zalesak and Ronald L Phillips
Underwater Sound Reference
Detachment, Naval Research
Laboratory, Orlando, Florida, USA

Several new sonar transducer concepts being developed at the Naval Research Laboratory are described. Included are a low-frequency, directional, ring hydrophone, a constant beamwidth transducer, a dielectric liquid hydrophone and a critical-angle, fibre-optic hydrophone. The low-frequency directional ring hydrophone is a free-flooded circumferentially polarised piezoceramic ring. Over an approximately 0.5-octave wide band of very low frequencies, this hydrophone possesses a $\cos^2\theta$ directivity pattern relative to the symmetry axis. Two different techniques are available for extending the bandwidth of operation. Furthermore, the $\cos^2\theta$ pattern can be steered within a plane if the outputs of three rings are combined. The constant beamwidth transducer is a spherical cap of arbitrary half angle α with a normal velocity that is shaded according to the Legendre function whose root of smallest angle occurs at $\theta = \alpha$. Theoretical calculations show this transducer to have uniform acoustic loading, extremely low sidelobes, virtually no nearfield, an essentially constant beam pattern for all frequencies above a certain cut-off frequency, and a flat transmitting current response over a broad band for piezoelectric drive. The dielectric liquid hydrophone is a pillbox-shaped device that has rubbery walls, is filled with a dielectric liquid, and has flexible electrodes on both the top and bottom surfaces. An incoming sound wave distorts the entire hydrophone and provides a modulation of a large dc bias voltage. The hydrophone is predicted to have a quadrupole-like directivity pattern together with a flat receiving voltage sensitivity over a broad band. The critical-angle fibre-optic hydrophone consists essentially of a short optical fibre whose end face is cut near the critical angle. An incoming sound wave acousto-optically modulates the critical angle, thereby modulating an optical wave travelling in the fibre when it reflects from the end face.

A Pressure-Compensated Ring-Shell Projector

G W McMahon and B A Armstrong
Defence Research Establishment
Atlantic, Dartmouth, Nova Scotia,
Canada

The ring-shell projector comprises a piezoceramic ring attached to a pair of shallow spherical shell segments which vibrate in flexure. An internal water bag, open to the sea, provides passive pressure compensation to extend the operational depth and protect the transducer against damage due to

Transducers for Sonar Applications

excessive depth. The operating depth region is further extended by increasing the initial air pressure in the transducer.

A 220 Hz experimental unit weighing 15 kg has been built and calibrated at depths to 30 meters. Efficiencies near resonance of 70–80% are observed and the –3 dB bandwidth is about 6.5% of the resonance frequency. The resonance frequency increases somewhat with depth due to the decreasing compliance of the internal air. The expected source level is 197 dB re 1 μ Pa at 1 m. With an initial internal air pressure of 2 atm absolute, the predicted maximum operating depth is 190 metres. The maximum safe immersion depth will be 3 or 4 times the maximum operating depth.

Extensive finite element modelling has been used in the design and testing of this projector, allowing reliable acoustic calibrations to be carried out with a test distance of only 50 cm. The experimental results are in excellent agreement with the finite element model predictions.

Fluid-Filled Tube Projectors

P A Crowther
Marconi Space and Defence Systems Ltd, Frimley, Surrey

Extending results reported in an earlier paper on the theoretical and experimental properties of the flooded tube as a multiple-resonant or broad band source, the present paper outlines design principles for the use of ceramic and magnetostrictive flooded tubes for several applications requiring either multiple spot frequency or broad band response. Approximate equivalent circuits are derived, as an aid in initial stages of design, and are compared with drive admittance computed from more exact theory, and with experimental measurements. 'Trade-offs' between bandwidth, electrical admittance, electroacoustic coupling and power handling capacity are discussed. Attention is given to the use of such transducers in line arrays, with reference to inter-element interaction and the effect of element proximity on resonant frequency and sensitivity. Experimental beam patterns for single transducers and line arrays are presented. Design criteria are illustrated with reference to a number of practical examples. The paper ends with a review of relative merits and limitations of flooded tubes compared with other transducer types.

Theoretical Model for Evaluating the Boomer Acoustic Source

M H Safar
The British Petroleum Company Limited, London

The Boomer underwater acoustic source is one of the vital tools used when carrying out marine engineering geophysical surveys.

A simple theoretical model is developed for evaluating the Boomer. It is shown that the pressure pulse radiated by the Boomer is largely determined by three parameters, namely the effective damping resistance, the effective inductance of the Boomer discharge circuit and the effective Boomer plate-coil spacing. These parameters are determined by matching the predicted and measured pressure pulses radiated by the Boomer.

The use of the theoretical model as a diagnostic tool is illustrated in evaluating and

comparing the performance of two different Boomer units.

The Use of Matching Layers in the Design of Broadband High Efficiency High Frequency Transducers Capable of Being Operated at Depth

H Koyman, B K Gazey and B V Smith
University of Birmingham

The design of a new range of broadband high frequency transducers operating in the frequency range 250 kHz to 1 MHz is presented. These have typical electroacoustic conversion efficiencies in excess of 60% and are capable of operating in deep water. High efficiency operation is obtained through the use of a low acoustic impedance backing synthesised using a three-layer composite solid structure. A suitable matching layer between the transducer and its water load is developed to maximise the operational bandwidth. Measurements of frequency response, efficiency and power handling capacity are included to illustrate the superiority of the new designs over existing conventional high frequency transducers.

A 75 kHz Transducer Array Using Transverse Drive

J R Dunn
University of Birmingham

This array consists of a drive of five elements, and the particular requirements were that

each section should be half a wavelength square and that there should be the lowest possible cross-talk between them. Conventional composite 'sandwich' transducers had to be rejected, and the solution lay in the use of narrow piezoelectric bars radiating from one end. They are poled and driven in thickness, but resonant in length; three bars are used in each section, which is surrounded by pressure-release plastic foam. The performance is satisfactory, except that the beamwidth is narrower than expected due to radiation from an area rather greater than the active face of each section.

Quarter-Wavelength Matching of Air-Backed Piezoelectric Discs to a Water Load

N G Pace and P D Thorne*
School of Physics, University of Bath

***Now at IOS Taunton**

The possibility of calculating efficiency of simple disc transducers, broad-banded by use of face plates, from input electrical admittance measurements is explored. It was found for an air-backed ceramic disc with a perspex face plate, that provided the uniformity of face plate thickness is better than about 0.3%, that the electrical losses for use in efficiency calculations may be obtained from air-loaded electrical input conductance measurements.

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BRANCH AND GROUP NEWS

North East Branch

Diploma Projects from last year's course at Newcastle Polytechnic formed the topic of the meeting which opened the session in October. Four varied and interesting short papers were given to an audience which included students from this year's course. Tegryn Jones (Gateshead MBC) talked on *Predicting Traffic Noise*; his colleague from the same authority, Ian Broughton, explained his investigation of *Intrusion of Traffic Noise into Buildings*; Mike Sullivan (British Gas) revealed the secrets of *Calibrating Sound Level Meters*, and Dave Jarema (AAF) spoke on the art of *Enclosure Design*.

These short papers were very well received and it is hoped to make this form of meeting a regular feature in future programmes.

In November, more than 50 members and guests crammed into the Polytech-

nic Board Room to listen to Bob Ackrill (HSE) talk on *Work Place Noise*. He pitched his lecture just right; the mix of theory and practical experience gave the audience a clear understanding of this problem area. A small exhibition of noise measuring and analysing equipment supported many of the points made in the lecture.

David Tozer from Newcastle University Physics Department is the speaker at the joint meeting with the IoP in December. Based on his interests in both music and physics he will be guiding us along those uncertain borders between art and science in his lecture *Musical Acoustics*.

Arrangements for Acoustics '81 are well in hand; the New Year will see a rapid increase in these preparations. More details of this event appear in other parts of Acoustics Bulletin. Other events in the North East Branch

programme for the early part of 1981 include a talk on *Microcomputer Applications in Acoustics* by I S Diggory and D J Oldham at British Gas ERS, at 2 pm on 14 January; AGM and Bar Sports at Newcastle Polytechnic on the evening of 18 February; and a visit to the Audiology Laboratory at North Riding Infirmary, Middlesbrough, starting at 2 pm on 12 March. New members and guests are welcome to attend all meetings.

Musical Acoustics Group Visits

On 22 October a group of members visited the laboratory of Professor Charles Taylor at University College Cardiff. After an excellent buffet lunch we were welcomed by Professor Taylor who gave a short talk on the history and current interests of his research group. His colleagues then took us on a tour of the laboratory. The work on the perception of the pitch of complex tones has produced some significant results enabling some further insight into the pitch-extraction mechanism to be achieved.

THE UNIVERSITY OF AUCKLAND New Zealand

ACOUSTICS — The BRANZ Senior Research Fellowship in Acoustics (School of Architecture)

CLOSING DATE: 6 FEBRUARY 1981

The position is funded by the Building Research Association of New Zealand, and its primary function is the provision of an Acoustics Advisory Service to the New Zealand building industry. Applicants should have a first degree in science or engineering and a higher degree which includes a substantial acoustics component. Professional experience in engineering, noise control, architectural acoustics or community noise is essential. Familiarity with real time data acquisition and control systems and their application in acoustics laboratory measurements would be advantageous. Commencing salary will be established within the scale for Senior Lecturers, at present NZ\$19,846 — \$22,710 per annum. Conditions of Appointment and Method of Application are available from the **Assistant Registrar (Academic Appointments)**, University of Auckland, or from the **Association of Commonwealth Universities (Appts.)**, 36 Gordon Square, London WC1H 0PF.

Applications in accordance with 'Method of Application' should be forwarded as soon as possible but not later than 6 February 1981.

THE OPEN UNIVERSITY
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To work on a study of the extent to which airborne sound penetrates porous ground surfaces. A strong background in physics, mathematics or engineering is preferred. Some postgraduate experience of acoustics is desirable and essential for appointment as Fellow. Salary at an appropriate point on scale 1B £4795-6985 or 1A £5505-9595 (under review).

Further details and application forms are available from Sheila McBrearty, Faculty of Technology, The Open University, Milton Keynes, MK7 6AA; informal enquiries to Dr. K. Attenborough, Tel. 0908 653945.

Curious pitch shifts on altering the composition of the complex have invalidated certain earlier theories.

The control of an electronic synthesiser by means of a minicomputer was of singular interest. As an example of computer composition, the computer was programmed to construct a melody of certain notes with a certain tone-quality. This melody was then combined in counterpoint with itself in various ways. (Was there here an echo of the Associated Board theory papers?)

To emphasise that every self-respecting laboratory nowadays has a laser, we were shown the current work on laser-Doppler interferometry with guitars and hand-bells. The front plate of a guitar showed an intriguing complexity of vibration while a hand-bell demonstrated some agreement with the results of finite-element analysis.

As a final delight in a most interesting visit we were privileged to see and try the Cardiff-based set of "violin" instruments made by Carleen Hutchins of the Catgut Acoustical Society. Professor Taylor and his colleagues demonstrated that it *was* possible to play the large bass without a step-ladder and that the tenor (viola range, but approaching cello size) *could* (just) be played under the chin! We thank Professor Taylor and his group for arranging this extremely interesting visit.

On 18 November some seventeen members of the Institute paid a visit to the Edgware factory of Boosey & Hawkes at the invitation of Dr Richard Smith. We were shown in detail the manufacture of brass and woodwind instruments and the engineering problems of quantity production were highlighted. We were able to see the progress of an instrument from pattern-shop through the convolutions of tube bending and wood boring to final assembly and examination. Richard and his colleagues were a vast store of information on subjects ranging from wave physics through metallurgy and welding technology to production engineering and musical aesthetics. Our visit was a memorable reminder of the know-how behind every bit of practical music-making. We thank Dr Smith and Boosey's for once more allowing us to visit their factory. □

A E Brown

Institute of Acoustics Diploma Examination 1980

A total of 163 registrants sat for the Diploma Examination in June 1980; 98 gained the Diploma and in addition four of the successful examination candidates for 1979 who have since submitted acceptable project reports also qualify for the Diploma.

The percentage of passes in the General Module Paper was 84, which is comparable with the 93 and 85 of years 1978 and 1979 respectively. As in previous years the Law and Administration Module attracted most entries in the Specialist Modules—40.8%—

whereas the Transportation Noise and Architectural Acoustics Modules had percentages of 13.2 and 15.4 respectively. In the present session 1980-81, an additional module is offered, that of Vibration Control. The number of colleges participating in the Diploma continues to grow and candidates from eight colleges took the 1980 Examination, the newcomers being Bristol Polytechnic, Derby Lonsdale College of Further Education and Tottenham College of Technology. Of their aggregate entry of 39 only 3, i.e. 7%, failed to pass the General Module.

Congratulations to the following candidates who were successful in the IOA Diploma Examinations.

N E Surrey College of Technology

R A F Barnes	Miss R J Green	T J Pashen
A E Barton	M C Gregory	R P Robinson
D R Bayliss	A K Griffiths	J D Rolfs
P R Blewden	R J Grinstead	P J Smith
D R Bower	Miss W V Hallam	M A Tracy
G T Crowhurst	S D P Hewitt	C L Trapmore
N F Divers	N F S Ho	P A Trew
P O'Dwyer	K M Lo	C A White
J P Emerson	S F Lo	W K Wu
A W Franklin	G N Osborne	M J Young
A J Garton	R K Parsons	

Liverpool Polytechnic

W A Baines	S D Johnson	J D Lyon
K Bentley	J Hickinbottom	J P Moylan
A Blinston	K G Kaufman	J B Simpson
Mrs R E Chadwick	M Kehayas	D N Sutcliffe
P Cox	M A Kennedy	B Whittaker
R T Davenport	D A Logan	
T J Gould	A Lowe	

Newcastle upon Tyne Polytechnic

R Bainbridge	P Hepworth	D W Robinson
J R Broughton	T Jones	J Thurlaway
D R Dier	F G McQueen	J Watson
J A Duffield	A A Miller	

Cornwall Technical College

A J Kirk

Leeds Polytechnic

B J Anderson	D K Evans	G Smith
S G Carden	P S Loker	
S P Davidson	D W Purchon	

During the ensuing session Slough College, Colchester Institute and Heriot-Watt University have also been validated to run courses for the Diploma.

Two aspects of the examination deserve mention: firstly the continued high standard of the Project Reports and secondly the pleasing increase in the number of candidates who are utilising the opportunity to increase their technical knowledge by qualifying in additional specialist modules.

The winner of the Institute Merit Award this year was S F Lo (Hong Kong) who follows in the path of N F S Ho and K M Lo who were presented with their Diplomas at Hong Kong in July during a visit by one of

us (RWBS) to the University. Congratulations to Mr S F Lo and to R Bainbridge who obtained the Prize of the Association of Noise Consultants for his project report *Noise and Hearing Protection from Pneumatic Caulking on a Ship under construction*.

During the coming year the General Module paper will be taken at the end of the Easter Vacation, thus avoiding clashing with other intensive duties of University and College examiners during the June-July period. This and other minor changes will expedite the final assessment of examination results. □

B J Smith
R W B Stephens

Candidates successful in the IOA Diploma Examinations (continued)

Bristol Polytechnic

R G Enticott	K S Horton	A Taylor
G Evans	J A Jefferies	
T E Gorman	H R Nowell	

Tottenham College of Technology

M Crisp	S A Monk	M J Thraves
R J Davies	J F Priest	H R Vaughan
R C Dorney	M J Roberts	R N Wade
J L Goswell	P R Russell	N P Walker
S P Hawes	R A Simpson	M J Westwood
R N Lovett	R J Swaby	

Derby Lonsdale College of Higher Education

R D Armitage	P C Cooper	N S Straw
C R Atkins	W K Smith	R C Webster
H Batteson	J W Storer	

The following holders of the Diploma passed additional specialist modules.

N E Surrey College of Technology

M R Bailey (1)	C W G Pennington (1)	M S Sugiura (1)
M C Gunton (1)	A R Sharp (2)	

Liverpool Polytechnic

Mrs R E Chadwick (2)	C Fudge (2)
J Dinsdale (2)	J Hickinbottom (1)

Newcastle upon Tyne Polytechnic

D Jarema (1)	J F Perkins (1)
P J Nutt (1)	P N Wright (1)

Cornwall Technical College

A J Kirk (1)	R F Phin (2)
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Professor E J Richards



News of the award of Honorary Membership of the Acoustical Society of America to Elfynd Richards will have been greeted with pleasure by IOA members. An Honorary Fellow of the IOA since 1978, Professor Richards joins a very select roll of eminent scientists chosen to be so honoured:

Thomas A Edison (1929)
Harvey Fletcher (1949)
Vern O Knudsen (1954)
Paul E Sabine (1954)
Floyd R Watson (1954)
Harvey C Hayes (1960)
Walter G Cady (1971)

Honorary Membership is awarded to Professor Richards 'for his eminent contribution to combating noise pollution through his leadership in research, management, administration, consultation and education.'

The full ASA citation to Professor Richards appears in *JASA Supplement 1, Volume 68, Fall 1980*. □

The 10th International Congress on Acoustics

Sydney: July 9th-16th, 1980

Very few members of the IOA were able to attend the 10th ICA in Sydney in July. We give here a report on the conference from the host country, kindly prepared by Professor Anita Lawrence, convenor for the Technical Programme.

THIS was the first occasion for the International Congress on Acoustics to be held in the Southern Hemisphere. For many residents in the Northern Hemisphere it was also the first time that they had contemplated an air journey of such duration, or an instant change of season from 'summer' to 'winter'. (Those Australians, of course, who participate in International conferences know only too well the problems involved!) It was with very great pleasure, therefore, that over 900 delegates, accompanying persons and students were welcomed to the Sydney meeting. Of these, approximately 436 were delegates who came from 37 overseas countries, and 309 were delegates from Australia.

Organisation of the Technical Programme

The venue for the Technical Programme (and for some of the social events) was the University of New South Wales. The programme was organised into three different types of session: Plenary Sessions in which distinguished acousticians from various fields were invited to present their views on *Acoustics in the '80s*; Structured Sessions, which attempted to bring together groups of specialists in nominated fields to present papers and to take part in discussions at more length than is possible in normal sessions; and Contributed Paper Sessions, in which, as is customary with ICA meetings, anyone is free to present a short paper on any topic in acoustics.

Plenary Sessions

Nine plenary sessions were programmed as follows:

Recent developments in auditorium acoustics, with specific reference to the Sydney Opera House, V L Jordan (Denmark). (The paper was actually presented by P Hall, the architect associated with the building, and dealt specifically with the Sydney Opera House.)

Comparative aspects of auditory mechanisms, Y Katsuki (Japan).

Current trends in musical acoustics, J Sundberg (Sweden).

Predicting sound propagation near the earth's surface, C I Chessell (Australia).

Modèles auditifs et modèles de production de parole, R Carré (France).

Acoustics and audiology, a changing relation, I Hirsh (USA).

Opto-acoustical sources of sound, L Liamshev (USSR). (Unfortunately, Professor Liamshev was unable to present his paper verbally.)

Recent progress in understanding basic flow acoustics, E-A Muller (FRG).

Community noise — a field for further research, H Myncke (Belgium).

These papers attracted wide interest from the delegates and are published in full in Volume 1 of the Congress Proceedings.

Structured Sessions

Six topics were programmed in nine special sessions. The Structured Sessions were innovative as far as ICA is concerned, although they were inspired by the successful ICA-Scope Workshop sessions held during the 9th ICA in Madrid. Convenors were invited to organise sessions covering the following topics:

Acoustics in the developing countries, Convenor: B S Ramakrishna, India. (25 contributors in two sessions.)

Acoustical aspects of Australasian music, Convenor: M Kassler, Australia. (This was jointly sponsored by the Musicological Society of Australia and there were 3 contributors.)

Nonlinear acoustics, Convenor: D T Blackstock, USA. (11 contributors in two sessions.)

Underwater sound, Convenor: J D Penrose, Australia. (3 contributors in two sessions.)

Acoustic emission, Convenor: A Pollock, USA. (6 contributors.)

Acoustical imaging and medical ultrasonics, Convenor: G Kossoff, Australia. (3 contributors.)

These sessions were generally very successful. Contributors to the Structured Sessions were invited to prepare 4-page summaries for publication in Volume 1 of the Proceedings, although many were content to provide only a 1-page abstract.

Contributed Paper Sessions

Over 600 abstracts of contributed papers were published in Volumes 2 and 3 of the Proceedings. Table 1 shows the distribution of papers by topic and it is interesting to note the large proportion in the general area of 'Noise'.

Table 1

Distribution of Contributed Papers

A: Speech Communication	74
B: Physiological and Psychological Acoustics	69
C: Noise: Its Effects and Control	140
D: Shock and Vibration	32
E: Architectural and Building Acoustics	60
F: Bioacoustics	22
G: Ultrasonics: Quantum Acoustics and Physical Effects of Sound	58
H: Underwater Sound	38
I: Physical Acoustics	38
J: Aeroacoustics, Atmospheric Sound	18
K: Musical Acoustics	28
L: Transduction: Acoustical Devices for the Generation and Reproduction of Sound	34
M: Acoustical Measurements and Instrumentation, Signal Processing, Statistical Methods in Acoustics	40

Eventually, 634 papers were programmed in up to 13 parallel sessions. Although every effort was made to avoid 'gaps' due to authors not being present, they did still occur, and it is estimated that about 560 of the contributed papers were actually presented. The withdrawal of papers listed in the programme seems to be a perennial problem for ICA organisers and there is no easy solution. One innovation, which was intended to reduce the wastage of delegates' time when authors failed to appear, was to print all parallel sessions occurring at any

one time slot on the same page of the programme (Volume 5 of the Proceedings); thus it was possible for delegates to switch to another session at the last moment, if they wished.

Authors of contributed papers were invited to prepare full written versions and to lodge them with the Secretariat for photocopying; delegates were then able to order them for home delivery, at cost. At least 50% of the authors provided written papers for this purpose and over 900 copies of some 200 separate papers were ordered. This obviously was a worthwhile exercise, although it is suggested that there should be a page limit (say, 10 pp) for any future organisations using this system.

Other Activities

The Opening Session of the Congress was held in the Concert Hall of the Sydney Opera House, the ceremony being performed by the Governor-General of Australia, Sir Zelman Cowen, with Professor R Beyer, Chairman of the International Commission on Acoustics in the Chair. On this occasion there was an opportunity for the acoustics of the Concert Hall to be 'heard' — during a recital by the

Leonine Consort of singers and a short recital on the recently completed pipe organ. Another opportunity to sample the room's acoustics was available to those attending a concert featuring the Australian classical guitarist, John Williams, in a new work by Peter Sculthorpe.

A number of technical visits were arranged and proved popular, including a week-end tour to the optical telescope at Siding Springs and the radio telescope at Parkes, giving those taking part a brief glimpse of the Australian Outback as well. A comprehensive Technical Exhibition was set up in a building adjacent to the Congress Office.

Various social functions also furthered old and new friendships in a traditional 'Australian' manner, and the fears of Europeans and North Americans about visiting Sydney in winter were mitigated when they discovered that the maximum daily temperatures were the same as those occurring concurrently in their home countries!

Satellite Symposia and Associated Meeting

Two Satellite Symposia were held, in Adelaide, South Australia on July 7th

and 8th on Engineering for Noise Control and in Perth, Western Australia on July 18th and 19th on Basic Causes of Noise Deafness. 138 delegates registered for the Adelaide symposium, including 68 from overseas. Two invited and twelve contributed papers were presented. The Perth symposium attracted only 48 registrants, including 12 from overseas, and three invited and ten contributed papers were presented. Unless overseas visitors were able to include the Sydney-Perth leg in their international air fare, the additional cost of the internal flight would have been a significant deterrent. In addition, an Associated Meeting was organised at the same time in Auckland by the New Zealand Acoustical Society, which was well attended. This meeting had two themes: Acoustics of Educational Buildings and Ambient Noise in the Sea.

In spite of the considerable difficulties in liaising between Symposia and Congress committees, separated by as much as 3300 km, those delegates who managed to attend the Satellites or the Associated Meeting found them to be very successful. □

Anita Lawrence

International Conference and Exhibition on Ultrasonics

New Delhi, 18-20 July 1980

This meeting performed the function of a satellite meeting to the 10th ICA for those foreign visitors mainly interested in ultrasonics. At the same time it served to bring together the large number of ultrasonic research units scattered throughout the vast continent, and Dr Bindal and his young colleagues at the National Physical Laboratory, the venue of the meeting, are to be congratulated on their effort. Nearly 300 delegates attended the meeting and about 80 selected contributed papers were presented, about 30 per cent being concerned with the physics of ultrasound and 10 per cent with medical and biological ultrasound; other topics included underwater acoustics, transducer materials, etc. Invited papers were given by Prof J Malecki (Poland) on *Physical Acoustics in Poland: Research Trends and its Applications*, Prof A Aleppi (Italy) on *Acousto-optics and Surface Waves*, H Shimiga

(Japan) on *Power Spectrum Analysis of Ultrasonics due to Liquid Leak from Pipe-Lines* and R W B Stephens on *Photoacoustic Spectrometry and its Applications*.

A seminar was arranged on the last day of the meeting on *Growth of Ultrasonics in Industries in India* which provided a useful complement to the exhibition of products on show of some ten or so Indian manufacturers. It is hoped that the success of their effort will prompt the organisers to inaugurate further such conferences in the future, but the individual available lecture times should be increased to give greater opportunity for discussion. At a general meeting of the Ultrasonics Society held on 21 July Dr M Pancholy, former head of the Acoustics Division at NPL India and the writer were elected first Honorary Fellows of the Society. □

R W B S

Delegate's View . . .

Professor Stephens did manage to make the trip to the Southern Hemisphere, and adds the following comments.

Despite the great distance of Sydney from most of the active centres of acoustics, the 10th ICA attracted about 750 delegates. Unfortunately a number of contributors who found themselves unable to attend did not give warning to the organisers so that in the initial days some sections of the programme showed unavoidable gaps.

The opening ceremony was appropriately held in the Concert Hall of the Sydney Opera House, the Congress being opened by the Governor-General of the Commonwealth of Australia. The musical entertainment giving unique Australian contributions to music permitted the audience to evaluate the acoustic properties of the Hall, being some compensation for the many who were unable to obtain tickets for the concert given later in the week.

The plenary invited lectures are published in full in Volume I of the Proceedings while Volumes II and III

contain over 600 one-page abstracts of the contributed papers. Volume IV gives details of the Exhibition. The full version of the papers given at the Satellite Symposia at Adelaide and at Perth are published in separate volumes.

The venue of the meeting was the University of New South Wales which was pleasantly situated on the outskirts of Sydney, a convenient bus journey from the city centre, and in close proximity to a race-course and within walking distance of Sydney cricket ground. The lecture facilities at the University were very suitable for a large conference and movement between lecture halls during lecture intervals was comparatively easy. □

R W B S

NEW ELECTIONS

At its meeting on 23 October 1980, Council approved the following elections.

Fellow

W A Ainsworth J M Hovem
C A Hill

Member

D R Baylis	B P Lender
K Bentley	P A Mapp
J-P A Berhault	D B H Montgomery
S J Burge	P A Northfield
M S Butler	B Quartermain
P J Chapman	S W Turner
A E Charles	C Xydeas
K-K Kan	

Associate

A Blinstone	W McTaggart
S G Carden	F J Marlow
Y H Chang	K E Marriott
P-C Ching	A Murphy
D J Connolly	B Newington
S P Davison	W L Parkinson
D F Edge	P J Patrick
K Egtesadi	S Roberts
A W Franklin	R Thornton
J French	H R Vaughn
I Jones	A E Watson

Student

J R Runchman

Project Titles submitted for 1980 Diploma Exam

N E Surrey College of Technology

Investigation into Acoustic Conditions in the Salvation Army Citadel at Reading

The Investigation of a Noise Nuisance and the Preparation of a Report for the Local Authority

A Study of the Acoustics of the Salvation Army Hall, Reading

A Study of the Effects of Tunnels on Road Traffic Kerbside Noise Levels

Noise Control and the Construction of the River Mole Flood Alleviation Scheme

Determination of the Sound Power Level of a Domestic Food Liquidiser

An Investigation into Noise Exposure of Persons Employed in a Small Manufacturing Dairy

Airborne Sound Transmission Test on a Party Wall

Noise from Lynx Ground Support Equipment — Part 1, Initial Survey

An Acoustic Survey of a Machine Shop

Domestic Noise — A Survey and Assessment

The Design and Construction of an Acoustic Enclosure

Kensington New Town Hall Boiler House Noise Survey

Investigation into the Acoustics of a Gas Valve Pit

A Noise Nuisance caused to a Flat above a Hot Bread Shop and the Local Authority's Involvement in such a Problem — Field Test on the ALS Acoustic Louvre and the SME Sound Reducing Enclosure

Assessment of Acoustic Efficiency of Sound Insulation installed under the Gatwick Airport — London Noise Insulation Grants Scheme 1973

A Study on Airborne Sound Insulation Properties of Single & Double Plywood Panels

Noise Abatement Zones — Some Administration and Acoustic Problems

The Routine Noise Testing of Racing Motor Vehicles, An Assessment of the Royal Automobile Club Motor Sports Association Regulation AA7

Investigation into Acoustic Problems at the Recording Studio of Free Tape Recorded Library for the Blind, 26 Laggan Road, Maidenhead

An Investigation into the Acoustics of a Swimming Pool Enclosure with particular reference to the Problems of Communication and Health and Safety

An Acoustic Investigation of an Indoor Swimming Pool

Noise and Vibration from Heavy Vehicles

An Investigation into the Effectiveness of Earth Mounds in attenuating Aircraft Ground Noise

A Study on the Measurement of Structural Frequency Response

An Investigation into the Acoustic Characteristics of the Salvation Army Hall, Reading

Industrial Audiometry — with special reference to the equipment in use at North East Surrey Technical College

A Study of Some Acoustic Properties of Emmanuel Church Hall, Surbiton

A Study of Noise from Refrigeration Plant.

Liverpool Polytechnic

Noise Nuisance — A Case Study

Investigation of the Statistical Characteristics of Traffic Noise

An Investigation of the Nature and Extent of the Noise Within a Motor Vehicle Field Measurements of Airborne Sound Insulation of Dual Glazed Facades

Sound Insulation of Internal Partition Walls

Possible Errors in the Measurement of Kart Engine Noise as Specified by the RAC Method

Analysis of Noise Emitted by a Domestic Hair Dryer

Assessment & Rating of Airborne Sound Insulation of Walls Between Dwellings

An Investigation into Vibration and Sound Pressure Levels in Lecture Rooms, Induced by Underground Trains

The Masking Effect of Noise from Domestic Appliances on the Audibility of a Ringing Telephone

Practical Measurements of Noise Levels from a Motorway and their Relationship to Road Traffic Noise Predictions

An Investigation into the Behaviour of a Large Radiating Plane Source with respect to Distance Attenuation and Directivity
 Exhaust Silencing of a Go-Kart Engine
 Construction Site Noise and a Comparison of Prediction and Measurement Methods
 A Method for the Prediction and Assessment of Total Noise Emanating from a Selected Section of Railway Line

Newcastle upon Tyne Polytechnic

Noise and hearing protection from pneumatic caulking on a ship under construction
 Assessment of the noise climate within the Claude Gibb Louvaine Halls of Residence
 An acoustic assessment of the Dunboyne Hall, Whitehaven
 Methods of control available to LAs for noise from construction and demolition sites
 Effects of noise on man with particular reference to wood working machines
 A comparison between the frequency response of a telephone system and that of an intercom system
 Prediction of effect of construction of new bridge on weekday L_{eq} levels at nearby residential sites
 Assessment of the suitability of an open-plan office for use of field workers and clerical staff
 Acoustical conditions at the halls of residence attached to Newcastle upon Tyne Polytechnic
 A rural dual carriageway — Detailed study of sound attenuation by natural barriers
 Complete calibration of a precision sound level meter
 The inclusion of a computer terminal into an existing office situation
 Methods of control available to LAs for noise from construction and demolition sites
 Noise on the move

Leeds Polytechnic

Measurement of noise exposure to employees operating a 4-ton hammer
 The use of earth mound noise barriers on open-cast coal mining sites
 Noise from Agricultural Grain Dryer
 An investigation into a typical community noise nuisance problem
 The Determination of Sound Power Levels and Loudness of Hand-Held Electrical Power Tools and Methods of Control
 An Assessment of the Potential Risk to the Hearing of those persons employed in Doncaster Abattoir
 High frequency noise from a gas transfer station in a residential area
 The determination at the planning stage of the suitability of land adjacent to a motorway for residential development
 Noise from printing machinery at Leeds Civic Hall
 Investigation of noise from coin-operated launderette
 The accuracy of visual estimation of sound pressure levels as measured by a sound level meter
 Investigation of an alleged noise nuisance arising from operations carried out at an engineering factory

Tottenham College of Technology

An investigation into the reverberation times of the gymnasium, Highlands School, Hadleigh, Suffolk
 The use of instrumentation in the evaluation of noise nuisance with special reference to the work of a Local Authority
 An investigation into Acoustic problems in a small church
 An investigation of night-time noise levels
 Planning and Noise
 L_{90} Background Noise levels carried out in rural South Cambridge
 Noise Abatement Zones — a case study
 The Investigation and Silencing of a low frequency noise
 Investigation of the effect of extending the London Transport Bus Garage at Hornchurch, Essex

Continued overleaf

Appreciation

Professor Auguste C Raes



One of the early Belgian workers in Acoustics, Professor Auguste C Raes, passed away in September of last year in his eightieth year. A native of Ghent, Prof Raes studied at the University of Liège and at the Montefiore Institute of Electrotechniques, from where he obtained a Civil Engineering Degree. He set up his own independent laboratory in 1925 as a bureau of consultancy and here he constructed the apparatus required in the many projects that he undertook. In particular he was a pioneer of room acoustics in Belgium and was involved acoustically with the Palais des Congrès at Liège and with the transformation of its ancient church of St-André into a music-hall.

At Brussels besides the 'Conservatoire Royal de Musique' and various cultural centres he was also concerned in other types of acoustical problems such as with the Nord-Midi tunnel junction etc. He served on the Architectural Acoustics Committee of the American Acoustical Society and also on the materials committee of the ASTM. An author of over forty papers and of three books, the merit of his scientific work was recognised by the awards of the Chevalier de l'Ordre de Léopold and of l'Ordre National des Palmes Académiques de France. □

RWBS

An investigation into the nature of Hearing in Relation to Workplace Noise
 An Acoustic investigation of Harlow Town Hall Council Chamber
 Construction Site Noise
 Practical Noise complaint investigation — a case history
 One Man's Music is another Man's Nuisance
 Vibration in a Building produced by the passing of an Underground train
 Project to consider certain installations designed to reduce the effects of increased road traffic noise on Residential Properties
 Project to consider some Noise aspects of widening the A13 in Newham
 To examine the noise emission from a small saw-mill and timber yard both subjectively and objectively with a view to establish whether or not a noise nuisance exists to local inhabitants
 Traffic Noise Contour
 Entertainment Licensing in London
 Measurement of the attenuation of broad band airborne sound (insertion loss) of silencing elements for ducted ventilating and air conditioning systems
 The approaches and opinion to the Control of noise from Audible Alarm Systems
 A comparison of the efficacy of the use of BS4142 and ISO 1996 in the assessment of Industrial Noise
 To examine the masking and intruding effect of road traffic noise on constant speech level

Derby Lonsdale College of Higher Education

Planning Criteria for Residential Development adjacent to Railways and Effects of Noise Control Measures on an actual site
 An Investigation to Determine the Degree of Permanent Hearing Threshold Shift in a Member of a 'Pop' Group exposed to Impulsive and Amplified Music over a nine-month period
 Noise Reduction in a Neighbourhood by Voluntary Means — a Practical Example
 The Report of the Staffordshire Noise Study Group and the implementation of their recommendations by South Staffordshire District Council
 Noise Control Considerations in the Area of East Staffordshire District Council Opencast Coal Mining
 Application to local authority by the owners of a small foundry who wish to effect modernisation
 The Control of Noise in relation to the extension of gravel workings at Barrow-on-Trent
 Survey of the changing Traffic Noise Levels incurred by the opening of the Nottingham Road A52 Bypass Extension
 An Investigation into the problem of Noise caused by Stock-Car Racing

Anyone interested in hearing more about any of these projects should contact the Diploma Course Tutor at the appropriate College. □

London Evening Meetings

Somehow this programme of informal meetings in the London area for people interested in acoustics has struggled into its fifth year. To a large extent this longevity is due to the generosity of the Greater London Council who have made the meeting rooms available to the Institute free of charge. Without this accommodation and the stalwart support of a small band of regular attenders this series would have sunk without trace a long time ago. However, there is always plenty of room and the organisers would be delighted to see some new faces. It would be a welcome change if members of the IOA were regularly

in the majority at this Institute activity.

Who's Annoyed by Noise?

Under this title, Ian Griffiths of the University of Surrey gave a talk on 25 September which covered the whole range of the more subjective aspects of acoustics. Why is it necessary to seek to control noise? It certainly cannot be justified on energy conservation grounds. Ian proposed that we are really attempting to control the ill-effects of noise on human beings and sub-divided these effects into three categories of descending severity — health, efficiency and comfort.

It is well known that noise can damage health, affect the efficiency of human task performance and cause annoyance. The problem is to measure the extent of these effects and to relate them to the measured noise levels. In practice this is difficult to do and Ian described, in deceptively simple terms, the range of techniques that are available to the researchers. Add in the problems caused by the wide range of individual responses to the same noise, the inconsistency of the subjects themselves and the difficulties of interpreting the statistical results and it is a wonder that we have made any progress at all.

In the extended discussion period which followed the presentation, it became clear that one of the cherished beliefs of many of the environmental health officers present could not be wholly supported by the research evidence—that the level of noise that is acceptable depends on the background noise level. In fact Ian took this point a stage further and showed from the differences in response to noise levels indoors and outdoors that there was evidence that people reacted not to the actual noise level but to what was expected. A point to be considered by those who advocate noise barriers and sound insulation!

Disco Noise: Can the Problem be Contained?

With hindsight it appears as though on 23 October, Peter Riley of AIRO took up the theme of the discussion at the previous meeting when he talked about his experiences over a ten-year period, in dealing with noise problems associated with Discotheques, Clubs and Pubs. This type of premises frequently gives rise to complaints but in many cases the real complaints stem from the fact that the place is there at all or are objections to the type of person that the premises attract. In these cases noise can act as a suitable proxy for other, more general grievances.

In assessing the problem it is important to isolate the real noise aspects of the complaint from the more general and Peter considered these in two parts, noise from the music and noise from clients in the street. For both types of noise he had found that a modified BS 4142 technique for predicting complaints worked quite well but that complaints from noise in the street tended to arise at lower corrected noise levels than those from the music. It was, however, important to remember that once complaints had

started it was very difficult to reduce the levels sufficiently to stop further complaints — which emphasises the need for a good official design.

The presentation promoted a lot of discussion which also introduced the GLC noise guidelines for Discotheques (not to be confused with the Pop Concert Code of Practice!). Almost everyone seemed to agree that the approaches discussed were the correct ones—the differences of opinion were on the specific noise levels that applied to particular situations.

Railway Noise

Brian Hemsworth of British Rail Research Department, Derby, gave an excellent talk to interested persons at County Hall on 27 November. The talk included detailed discussion on the correct method of predicting train noise, in terms of peak noise level and L_{eq} or L_{ax} . Predictions were made for a reference distance of 25 m and the various empirical and theoretical corrections that need to be made to

predict noise at other reasonable distances were also described. The excellent data base prepared by the British Rail team was demonstrated and certain peculiarities of the interaction between the combination of loco and rolling stock noise were demonstrated. Following from the prediction discussion Brian went on to consider rail/wheel interaction as a source of noise and gave early indications of the latest results from his instrumented coach, in particular on the relationship between acceleration monitoring on a moving wheel and noise. He demonstrated how techniques have been evolved to allow such measurements even at high speeds. These he then compared with laboratory studies on the resonant performance of wheels. Brian's talk gave to those people present a good indication of the state of the art and of the challenging technical problems still to be resolved. The most mysterious one appeared to relate to the way in which the rails change during their life, in terms of surface shape, and the effect

that this has on the possible noise reduction due to better design of vehicles. □

R C Hill
J G Charles

AES Meetings

The following lectures have been provisionally notified by the Audio Engineering Society (British Section) for 1981.

10 February: Acoustics of the violin (Dr J Woodhouse).

10 March: Dolby HX (Ian Hardcastle, Dolby).

14 April: Digital recording (John Watson, IBA).

12 May: Barbican P A system (Re-diffusion and Rank).

9 June: The digital audio disc.

14 July: Listening room acoustics (Professor Peter Lord).

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Standards

Recent British Standards

BS 5817: Specification for audio-visual video and television equipment and systems.

Part 1: 1980 General (IEC 574-1).

BS 5942: High fidelity audio equipment and systems; minimum performance requirements.

Part 1: 1980 Specification for general requirements (IEC 581-1).

Part 3: 1980 Specification for record playing equipment and cartridges (IEC 581-3).

Part 6: 1980 Specification for amplifiers (IEC 581-6).

BS 5966: 1980 Specification for audiometers (IEC 645). Supersedes BS 2980: 1958.

BS Drafts for Comment

80/53667 DC Expression of physical and subjective magnitudes of sound or noise in air (BS 3045) (ISO 131).

80/54568 DC Acoustics — Test code for the measurement of airborne noise emitted by rotating electrical machinery — Engineering method for free-field conditions over a reflecting plane (ISO/DIS 1680/1).

New Work Started

A guide to the selection and use of elastomeric mountings for vibration isolation of structures. Will revise DD 47 clarifying it and expanding it to make it better suited to specifiers and supervisory bodies such as Local Authorities. An appendix will provide examples of design problems and the whole document will be republished as a PD.

Hearing protectors. Will prepare test methods for assessment of all aspects of hearing protector performance excluding acoustic properties and will set out requirements for protectors including acoustic performance.

Recent International Standards

IEC 268: Sound system equipment

IEC 268-5A: 1980 First supplement to IEC 268-5: 1972. Will be dual-numbered with Part 11A of BS 5428.

IEC 268-14: 1980 Circular and elliptical loudspeakers: Outer frame diameters and mounting dimensions. Will be implemented as a dual-numbered part of BS 5428.

ISO 5128: 1980

Acoustics—Measurement of noise inside motor vehicles.

CENELEC Harmonisation Document

HD 399: July 1980 Measurement of transformer and reactor sound level (IEC 551, modified).

Special Issue

PD 6461: 1980 Vocabulary of legal metrology. Fundamental terms. Supersedes PD 6461: 1971.

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New, small, light probe can be used without headband. Ideal for children.

New 1715 Audiometer

The Grason-Stadler 1715 is a manual, two-channel, pure tone and speech audiometer which permits output routing of the test signal via earphones, a bone vibrator, or an optional free-field system. It is designed for the ENT physician or audiologist where a versatile diagnostic audiometer is required at a moderate price.

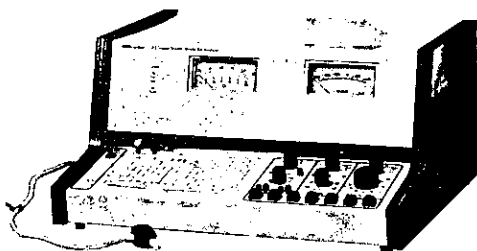
The 1715 provides for most diagnostic audiometric tests including ABLB, SBLB, SISI, Tone Decay, Stenger, Doeffler-Stewart, Lombard and Staggered Spondaic Word (tape). The 1715 oscillator supplies a wide range of fixed frequency pure tones for detailed air bone conduction testing. Each pure tone is available continuous, pulsed, or as an FM signal.

A high-quality test microphone is built into the 1715 for live-voice speech testing, and a stereo tape deck is available as an optional accessory for recorded speech testing.

A calibrated masking signal is automatically available to the non-test ear during testing—narrow band noise at the centre frequency for pure tone testing, and speech spectrum noise for speech testing.

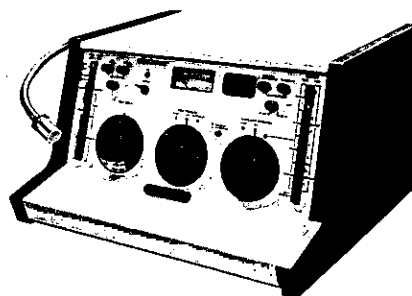
Talk Forward and Talk Back systems link the operator and the individual being tested, and the test signal can be monitored with the VU meter and speaker or optional monitor earphone.

New
low
price



GrayStad (MEDICAL)

GrayStad (MEDICAL) Ltd.,
17 Kildare Terrace,
London W2 5JT
Tel: 01 727 1311



Speech Intelligibility

Speech Group Meeting 24 September 1980

This meeting was organised by the Communication Group, Department of Electrical and Electronic Engineering, University of Aston in Birmingham.

The aim of the meeting was to discuss the general assessment of speech communication efficiency and to review how the effectiveness of speech communication can be determined under practical conditions when communication may be difficult due to a variety of causes. Papers were presented covering the following fields.

(a) Conversation performance of public telephone connections (University of Aston).

(b) Speech impairment and hearing impairment—four papers, entitled:

Intelligibility in the clinical linguistic context, by John H Connelly, School of Speech Pathology, Leicester Polytechnic;

Phonological basis of speech intelligibility, by Richard D Wright, RNID;

The perception of speech by hearing impaired people, by Angela B King, RNID; and

Parameters of spectral shape in speech intelligibility assessment, by Mark P Haggard, MRC Institute of Hearing Research, Nottingham.

(c) Imperfect Synthesis: *Assessment of diphthongs of real and synthetic speech*, Celia Scully, Department of Linguistics and Phonetics, University of Leeds.

(d) Hostile environment: *Analysis and improvement of communications in commercial diving*, Underwater Technology Unit, North East London Polytechnic.

The meeting was attended by 41 members of the Speech Group and visitors,

some of whom came from overseas as well as from various UK research establishments.

Although fairly well-defined methods have now been standardised for assessing telephone connections when used for normal conversation by persons with normal speech and hearing under ordinary ambient conditions, the same methods cannot be extended to cover the wide variety of circumstances revealed at the meeting. Naturally, many diagnostic procedures have to be used for special circumstances and these have to be individually tailored for the job. It seems very unlikely that any formal procedure could be devised for measuring 'intelligibility' in a way that would be acceptable for all, or a large proportion of, possible uses.

Nevertheless it was interesting to hear how others tackled their problems and it is likely that some of the ideas could be extended to other fields than those in which they originated. □

D L Richards

New Products

Submissions for inclusion in this section should be sent direct to J W Sargent, Building Research Establishment, Garston, Watford WD2 7JR.

B & K types 2225 and 2226 Integrating Sound Level Meters

B & K Laboratories Limited have announced the release of two entirely new Integrating Sound Level Meters which are particularly suitable for use by health or police officers and other officials who need not necessarily be experienced themselves in noise measurement.

The Types 2225 and 2226 both fulfil the need for a rugged simple to use instrument which can be confidently operated without apprehension and with only a minimum of practice.

A unique feature of both instruments is the incorporation of a 'Thermometer' type display by means of a vertical column of Light Emitting Diodes providing a 40 dB dynamic scale range with 0.5 dB resolution. Column brightness is automatically controlled in any light enabling it to be easily read

even in direct sunlight. Exceptionally low weight and size are also features of both models, weight being only $\frac{3}{4}$ lb and size less than $7\frac{1}{2} \times 2\frac{1}{2} \times 1$ inches, making single-handed operation easy.

In addition to these advantages both meters also have comprehensive measurement capabilities and can be used to make most of the more complicated noise studies necessitated by current legislation to the relevant BS and IEC standards. These include Community and Industrial noise surveys, measurement of unsteady noise, determination of L_{eq} for the evaluation of annoyance factor or hearing loss risk, determination of Noise Exposure Level SEL (L_{ax}) assessment of impact noise (Type 2225) assessment of impulse noise (Type 2226) and measurement of maximum noise levels (Type 2226).

Technical specifications of both models include a 25 to 140 dB(A) peak measuring range, 'fast' and 'slow' time constants, automatic re-set and switch-off, and DC output for recording.

Model 2225 includes a 'peak hold' function and Model 2226 has an internationally standardised 'impulse detector' with a 'maximum hold' mode on all functions. Both models incorporate pre-polarised condenser microphones and are supplied complete with batteries, windscreen and leather carrying case.

Acoustic Emission Pulse Analyser B & K type 4429

The B & K Acoustic Emission Pulse Analyser type 4429 can be used in conjunction with Acoustic Emission Transducers and other B & K instruments to analyse the small acoustic signals which are generated when materials or structures begin to break down under stress. This can provide early warning information before the failure produces expensive or dangerous consequences.

This analyser can be used with up to 4 separate Acoustic Emission Transducers connected to 4 counting channels in various ways according to the chosen operating mode. There are

three modes of operation, all of which are based on measurements of the time during which the Acoustic Emission signals exceed certain pre-set limits, each mode having its own particular advantage according to the type of investigation involved. In one mode it is possible to actually localise the point of failure with a fair degree of accuracy.

The complete B & K Acoustic Emission detection system basically consists of three Transducers, Types 8312, 8313 and 8314 with an Acoustic Emission Pre-Amplifier Type 2637, a Wide Band Conditioning Amplifier, Type 2638 and the Type 4429 Pulse Analyser already described.

Audio Test Station B & K type 2116

The type 2116 Audio Test Station is a combined signal generator, analyser and chart recorder in one instrument. Primarily it is intended for use in testing hearing aids and small microphones in conjunction with the B & K

range is 100 dB with automatic range switching.

The incorporation of two sine oscillators with a fixed frequency displacement of 1 to 1.4, automatically stepped in 1.8% increments, enables 2nd and 3rd intermodulation distortion records to be made.

The chart recorder uses disposable fibre pens and records on preprinted and punched charts with a writing area of 80 × 105 mm.

Further details of the above instruments can be obtained from B & K Laboratories Ltd, Cross Lances Road, Hounslow TW3 2AE. Tel: 01-570 7774.

Charge Amplifier CA/04

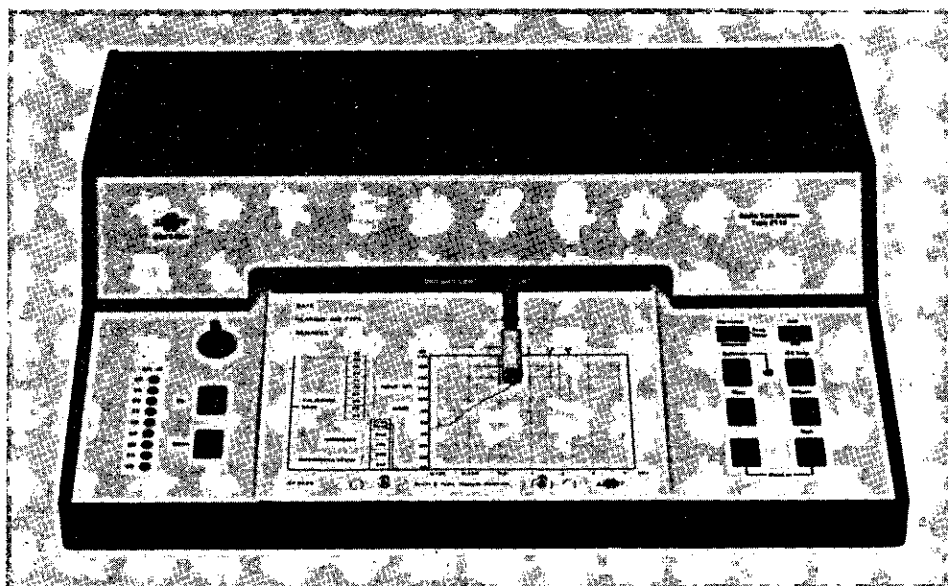
UK Manufacturers D J Birchall Ltd have re-designed their CA/04 Charge Amplifier to extend its frequency response and also reduce the component count. The low noise amplifier is now readily available from stock at the

lengths; overload protected input suitable for accelerometer sensitivities ranging from Number 1 to 100 pC/g (new CA/04/H option caters up to 1000 pC/g);

2 low impedance outputs: 10 mV/g fixed and Number 1 V switched for Number 1 to 300 g scaling; full output swing of ± 12 V, ideal for systems having a 10 V full scale; easy to follow front panel controls; front panel dimensions (8.9 × 3.6 cm) allow 12 CA/04 modules per standard 48 cm (19 inch) rack mounted case.

A stabilised supply of -8, +11 mA @ 15 V dc is required, but a broad range of instrument cases, power supplies and complementary integrator, filter, level alarm modules, etc, are available from the 04 modular vibration system.

For further information please contact: David Purdy, Senior Applications Engineer, D J Birchall Ltd, 102 Bath Road, Cheltenham, Glos GL53 7JX. Tel: Cheltenham (0242) 518588.



Audio Test Station B & K Type 2116

Anechoic Test Chamber but it can also be used for making loudspeaker characteristic measurements and for performing various other acoustic analyses. The instrument is constructed as a desk-top unit and will provide a documented analysis of frequency response, harmonic distortion and intermodulation distortion. A digital memory capable of storing a correction curve, before making measurements, can be used to regulate the test signal at a constant level.

The frequency range of the 2116 is 100 — 10 KHz in 256 logarithmically spaced discrete steps and the dynamic

same competitive price as its predecessor.

The charge amplifier 3 dB bandwidth is now in excess of 50 kHz and the noise level referred to input is typically 0.02 pC.

Primarily intended to condition vibration and shock signals from piezoelectric accelerometers, the CA/04 may be used equally well with piezoelectric force and pressure transducers.

Features include:

Overall sensitivity virtually unaffected by using different transducer cable

Self Cleaning Silencer

The noise arising from process fans discharging to atmosphere often creates environmental problems for nearby residents at night-time.

Such was the problem experienced by a flour mill in Essex. Upon investigation it was found that the original silencers, merely foam-lined ducts, had caked over with product, thus rendering them ineffective.

Cleveland Acoustics have now supplied five purpose designed silencers having a construction which prohibits the build-up and caking of the product carry over. This is achieved by a combination of expanded steel mesh and an acoustically transparent film covering to the mineral fibre within the internal elements. The effect of this is to produce a surface which is continuously shaking free caking particles.

The units were also small piece construction and completely demountable side plates provided access for inspection.

Cleveland Acoustics specialise in purpose design and manufacture of equipment to reduce noise in many differing applications.

Further details from Cleveland Acoustic Co, Unit 10D, Perry Avenue, Teesside Industrial Estate, Thornaby, Cleveland TS17 9NL. Tel: 0642 597598 /782938.

Self Calibrating Sound Level Meter CRL 2.21A

Cirrus Research Ltd announce a new self calibrating sound level meter, the CRL 2.21A. Based on an existing model, the CRL 2.21A has the advantage of established technology in a low cost package and with the new acoustic calibration and extended measuring range, it becomes a totally self-contained acoustic measuring package.

In use, the microphone, which is mounted on a flexible goose-neck, is simply plugged into the output of an acoustic generator, mounted adjacent to the microphone socket. This generator produces a level of 94 dB at 1 kHz and thus the complete sound level meter, from microphone to meter, is simply and quickly calibrated.

The calibrator section of the instrument shares nothing with the sound level meter, except the batteries and case, and thus the combined instrument is less expensive and more practical than two separate units.

The CRL 2.21A which comes complete with its own carrying case, with a pouch to take spare batteries, screw-driver, microphone, etc, is available from stock at £142, while the original CRL 2.21 alone, without self calibration, is £116.

Further details from Dudley Wallis on Scarborough (0723) 71351. Cirrus Research Ltd, 1/2 York Place, Scarborough YO11 2NP.

Sound Survey Meter CEL-224 and Noise Exposure Indicator CEL-210

The CEL-224 Sound Survey Meter is intended for industrial noise control programmes or environmental applications which require a quick noise level guide to an accepted standard of accuracy. The design uses the latest advances in acoustic and ergonomic engineering to provide an instrument that is both accurate and easy to use. It has a measuring range of 40 - 140 dB(A) in three selectable ranges.

The CEL-210 Noise Exposure Indicator is a low cost survey instrument with an 85 - 125 dB(A) scale designed for checking the exposure of workers to industrial noise. The indicated noise level can be compared against an exposure scale on the front of the instrument to obtain a guide to the permitted work period at this level. Particular attention has been paid to simplifying the meter's operation so that it can be

used in as many work areas as possible by as many people as possible.

Both instruments are housed in hard-wearing, painted, pressed aluminium cases and can be supplied either on their own in a leatherette carrying case or as a complete kit. The kits are contained in moulded custom made cases and include a calibrator, coupler, foam windshield and batteries. The calibrator allows the instrument to be checked and any slight variation due to environmental conditions can be adjusted out by means of the CAL control on the front panel.

Digital Memory Adaptor LM-50

Designed to interface with the LR-50 high speed level recorder, the LM-50 is a digital memory adaptor which enables a recording of sound or vibration to be stored or expanded for more detailed analysis.

The unit has a memory capacity of 3000 words which can be used to store one, two or three channels of signal, allowing waveforms of up to 6 kHz for 1, 3 kHz for 2 and 2 kHz for 3 channel operation.

Storage of the data may be initiated manually or automatically by exceedance of a selectable threshold level, or by external signal. Data transfer takes place at the selected rate on manual command or automatically in the repeat mode.

In this fully automatic mode data storage, data transfer and paper start/stop are all controlled by the memory unit, making the combination of both instruments particularly suited to the recording of short duration noise and vibration events, eg mine blasting or demolition work.

The LR-50 embodies a writing system based on the electro discharge of 120 pins onto metalised chart paper. As the input signal varies, so different pins are activated; up to 1 discharge every 20 microseconds is possible. The resultant series of dots are proportional to the amplitude of the signal. In this way no mechanical movement takes place (necessary when a pen or stylus are employed) and therefore an exceptionally good resolution can be obtained at frequencies as high as 10 kHz.

The LM-50 digital memory adaptor further extends the recorder's upper frequency limit to provide a compact

recording and analysis system suitable for both on-site and laboratory applications. It measures $286 \times 100 \times 180$ mm, weighs 2.5 kg and is powered by the LR-50 which contains built-in rechargeable cells.

Further details about the above instruments from Computer Engineering Ltd, 14 Wallace Way, Hitchin, Herts SG4 0SE.

BUMAR Com-call Headset

The Com-call is a practical solution to the age-old problem of two-way communication in a noisy working environment. It combines hearing protection with efficient transmission and reception of conversation by cable link.

BUMAR Com-call headsets are built into Bilsom ear defenders. The electronics are up-to-date with automatic maximum safe level limiting, automatic volume level, automatic on/off switching, side tone and a very low power consumption giving 400 hours life from one easily changed MN 2400 pen cell. Each headset is self-contained and the microphone boom can be pivoted up to park above the headband when the ear defender is used in the passive mode.

By using a unique impedance tube, in place of the conventional microphone, mounted on the end of a boom arm, the Com-call headsets have many advantages. The boom is infinitely flexible, facilitating easy positioning to the best position for clear speech and it can be replaced in just a few seconds if damaged or for hygienic transfer of headset from person to person. The tube diameter is very small, which avoids the usually unpleasant effect of 'sweat back' around the mouth associated with most systems.

The system can be used between two to ten persons and BUMAR offer a customer design and build service for special headsets and harnesses. A version of the Com-call system is available in an executive style briefcase in full kit form — the ideal kit to carry for representatives, engineers etc, who need man-to-man communication in noisy situations.

A Bumar Com-call headset costs £83. For further details please contact: Peter R Bull on 0723 76241. General Acoustics Ltd, PO Box 20, Scarborough, North Yorkshire, YO11 1DE. □

Non-Institute Meetings

1981

20 January	Developments in large outdoor P A systems design, past, present and future (ISCE evening lecture)	North London Polytechnic
2-5 February	Noise and Safety at Work (Course by Loughborough University of Technology)	Loughborough
16-20 March	Condition Monitoring and Fault Diagnosis in Machines and Engines (Course by Loughborough University of Technology)	Loughborough
17-20 March	68th Audio Engineering Society Convention	Hamburg, Germany
30 March -1 April	International Conference on Acoustics Speech and Signal Processing	Atlanta, Georgia USA
21-24 April	4th FASE Symposium on Acoustics and Speech	Venice, Italy
18-22 May	Acoustical Society of America	Ottawa, Canada
8-10 June	Noise Con 81 (US Conference on Noise Control Engineering)	North Carolina, USA
15-18 June	International Symposium on Underwater Acoustics	Tel-Aviv, Israel
22-25 June	Acoustic Remote Sensing of the Atmosphere and Oceans	Calgary, Canada
6-10 July	Ultrasound (20th International Conference on Acoustics by the Czechoslovak Committee for Electrical Engineering)	Prague, Czechoslovakia
20-24 July	9th International Symposium on Non-linear Acoustics	University of Leeds
20-23 September	8th Vibration Conference (American Society of Mechanical Engineers)	Hartford, Connecticut USA
6-8 October	Inter-Noise 81	Amsterdam, Netherlands

Environmental Health Report 1979

The EHA's annual report, published in October 1980, includes figures to indicate that the rate of noise complaints has risen dramatically. Referring to industrial and commercial noise, the report makes the point that developers of new commercial premises are failing to appreciate how much noise ventilation and refrigeration plant can produce. The biggest rise however is in complaints about domestic noise, up by 33 per cent and involving 156 prosecutions compared with 28 last year. This kind of noise in-

cludes 'barking dogs, crowing cocks and a cacophony of other animal sounds'. Commenting on this hazard of domestic life, Roy Emerson, a member of EHA General Council, remarked: 'I could tell you the saga of the Hartlepool goose which a budding Richard Briers kept at the back of his terraced house. The neighbours might well have laughed at it on TV, but believe me, they didn't laugh at the real thing.'

Environmental Health Report 1979 is available from EHA, 19 Grosvenor Place, London SW1X 7HU. Price £2.36 including postage. □

Hand-Arm Vibration Conference

The Third International Occupational Hand-Arm Vibration Conference will be held on 18-20 May 1981 at Ottawa, Canada. The organisers are Dr A J Brammer of the National Research Council, Ottawa, Ontario K1A 0S1; Professor W Taylor, Nether Banks, Watten, Wick, Caithness, Scotland KW1 5XJ, and Mr D E Wasserman, NIOSH, 4676 Columbia Parkway, Cincinnati 45226, USA.

Anyone interested in attending or contributing a paper for this conference should contact Dr Brammer at the NRC, Canada, from whom further details are available. □

'We'll never sleep again'

A new noise film has been produced by the National Building Agency in association with Sound Research Laboratories Ltd. *We'll never sleep again* emphasises the importance of bringing specialist noise consultants into the design process for new factory developments at an early stage.

The film gives an indication of the progress in the technology available to factory management, and in the willingness of those responsible to take precautions against it, since the Control of Pollution Act 1974. It is directed at a wide specialist and non-specialist audience, particularly those involved in industrial management and design and local authority environmental health officers.

A selection of case histories show how noise problems have been resolved or averted in various factories and other industrial processes, including a sawmill, a diesel engine test bed and a sand and gravel plant. The views of the industry are stated by managers and a senior environmental officer speaks for the public authorities. The wide range of hardware now available to industry is described by a noise consultant.

Terry Scott and June Whitfield lend a light-hearted approach in the film, which runs for 27 minutes. 16 mm sound copies in colour are available for hire from: Central Film Library, Bromyard Avenue, Acton, London W3 7JB, telephone 01-743 5555, for £7.50. Catalogue number UK 3438. □



Institute of Acoustics Meetings

1981

16 February	M	Active Control of Noise and Vibration	Birkbeck College London
26 February	LEM	Measuring Sound Insulation	County Hall, London
26 March	LEM	Improved Assessment and Control of Construction Site Noise	County Hall, London
6 April	SG	New Techniques in Speech Audiometry (Joint with British Society of Audiology)	Polytechnic of Central London
22-24 April	M	SPRING CONFERENCE — ACOUSTICS 81 (Including sessions on Speech Research; Musical Acoustics; Structural Vibration and Industrial Noise)	University of Newcastle
23 April	LEM	Trouble Shooting in Moving Air Systems	County Hall, London
15 May	M	Noise Source Location	Portsmouth Polytechnic
21 May	LEM	25 years in a Shaky Business (by L F Moore of Leslie F Moore Associates)	County Hall, London
9 June	M	An Introduction to Microprocessors and Their Use in Acoustics	Open University Milton Keynes
July	M (P)	Non-verbal Auditory Communication	ISVR
21-23 July	M	Acoustic Emission and Photo-Acoustic Spectroscopy	Chelsea College, London
September	M	Generation, Measurement and Effects of Sound Over 140 dB (Joint with the Society of Environmental Engineers)	University of Birmingham
November	M	Industrial Applications of Ultrasound	Birkbeck College, London
December	M (P)	Sound Propagation Outdoors	Open University Milton Keynes

Key:

M=Meetings Committee Programme
SG=Speech Group
LEM=London Evening Meeting
P=Provisional

Further details from:
Institute of Acoustics
25 Chambers Street
Edinburgh EH1 1HU

Planned noise surveys

Maximum safe exposure to noise is expressed as a noise dose and the present recommended limit is set at the energy equivalent of 90dB(A) continuously for 8 hours. Because industrial noise climates fluctuate over wide limits and contain high amplitude transients, conventional sound level meters are of little use for accurately assessing possible auditory hazards. Carefully planned noise surveys are the only way to be sure that employees are not exposed to more than the permitted maximum.

1 Personal Noise Dose Meters are the answer. These compact, self-contained units are worn by the employee throughout a representative shift. They unobtrusively monitor and record his actual exposure and calculate the percentage of permitted noise dose consumed. A full 60dB dynamic range ensures that all noise impulses are 'captured' and included in the measurement.

2 For the Industrial Hygienist, collecting the results is simplicity itself. The instrument is merely retrieved from the subject and the percentage allowable exposure read directly from the digital display. The CEL Noise Dose Meters provide an easy-to-understand result that can't be misinterpreted.

Make sense out of sound with CEL equipment.

For further information contact



COMPUTER ENGINEERING LIMITED
Wallace Way, Hitchin, Herts, SG4 0SJ
Telephone: Hitchin (0462) 52731/3

