Vol 31 No 5 SEPTEMBER/OCTOBER 2006

ACOUSTICS BULLETIN

in this issue...

Amplified music from licensed premises

plus... **IOA Membership Survey**

Perceived environmental noise from aircraft

Hand-arm vibration measurements: why bother?

Hand-arm vibration: filling the gap

Institute of Acoustics

Hamilton & McGregor

ACOUSTICS DIVISION

A unique opportunity to join a dynamic consultancy working at the forefront of noise management and control

Hamilton & McGregor is a fast growing, dynamic acoustic and GIS consultancy based in Scotland. We have recently been appointed to undertake the first round of END noise mapping for Scotland.

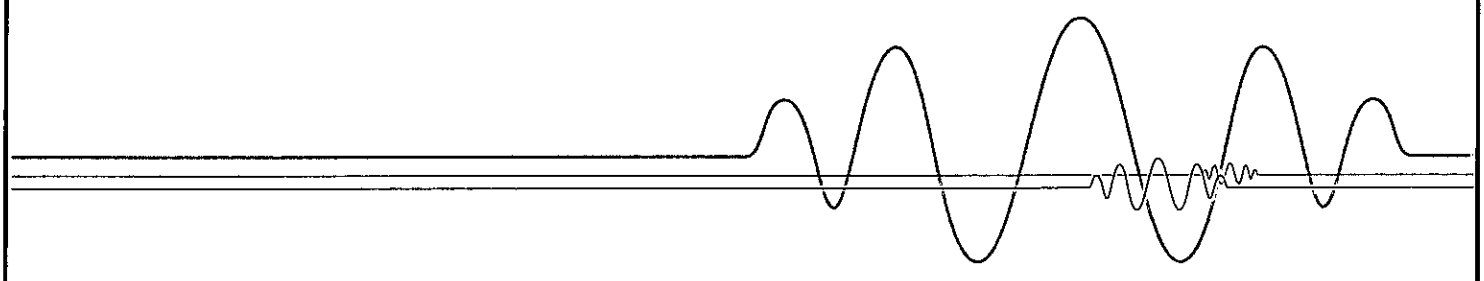
Due to our increasing workload we wish to recruit staff with approximately 2 years post-qualification experience (IOA Diploma or MSc).

Our current workload is varied and includes major transportation schemes (road and rail), high profile building projects, research projects, and numerous noise mapping projects. The work will involve environmental noise assessments (PAN 56, BS 4142 etc), building acoustics evaluation and testing.

The successful candidate/candidates will hold a valid driving licence, be prepared to travel, and be capable of working under their own initiative. The posts offer the opportunity for considerable professional development for young graduates with some experience. It is a marvellous opportunity to get involved in a wide variety of large and small projects.

The salary package will be commensurate with experience. Benefits include a generous car allowance, private health care, and a commitment to CPD. The office is centrally located in Glasgow close to Charing Cross Station and the M8.

Contact: Ms Spark, Administrator, with CV and letter of interest.
Hamilton & McGregor,
16 Sandyford Place
Glasgow,
G3 7NB
Tel 0141 248 2992
Email j.spark@hammac.co.uk



Career Opportunity

Vibration Isolation & Sound Insulation Specialists

CDM-UK

CDM-UK is the UK franchise of CDM; the Belgian vibration isolation and sound insulation specialists. Our head office is located in Leicestershire with a satellite office in London.

During the last five years CDM-UK has worked on many of the landmark buildings in the United Kingdom and Ireland and we are looking for someone to help with the design and project management of many of the new projects we will be working on in the future.

In addition there will be significant increase in our activities in railway isolation; the majority of work being in embedded rail systems for trains; and therefore major involvement in this area will also be a requirement.

We are seeking a candidate with the following attributes:

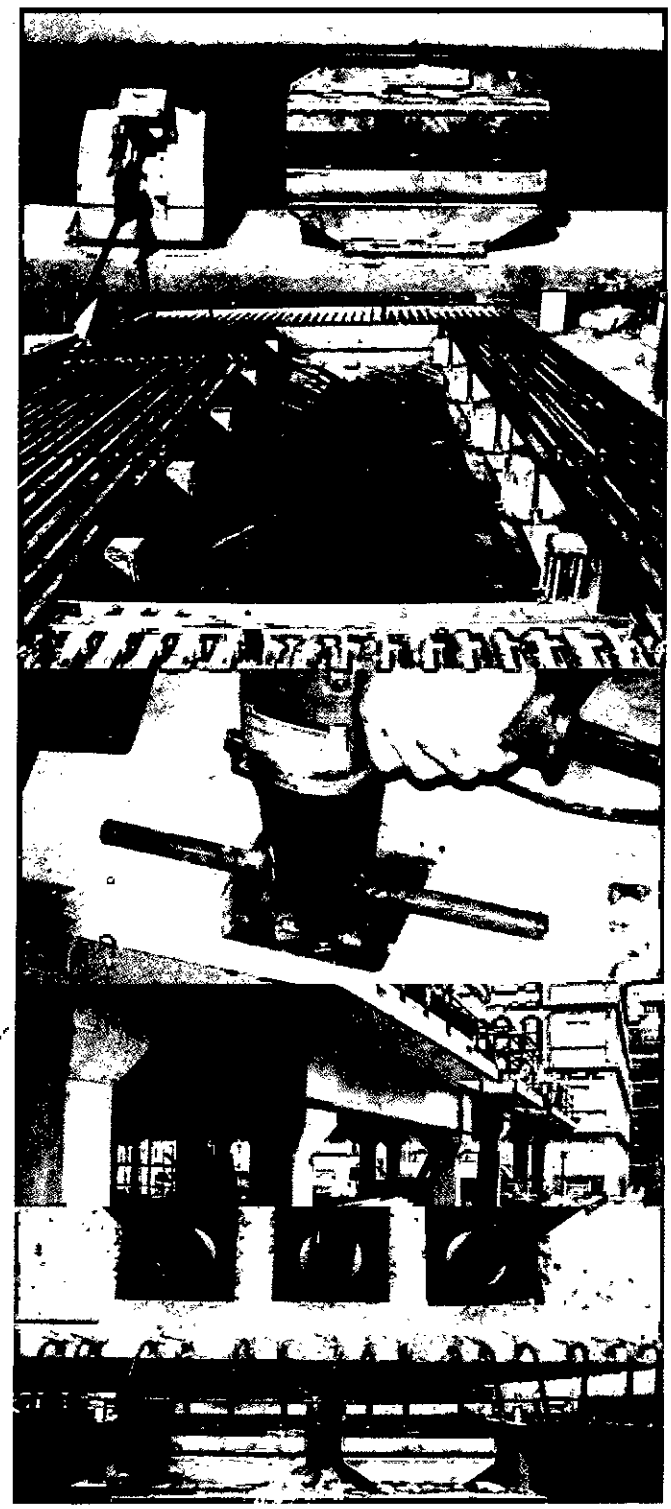
- knowledge and understanding of noise and vibration
- a practical, confident, and competent approach to work
- the ability to work to deadlines under pressure
- ideally London based

The successful candidate will have the opportunity to work on many prestigious projects, liaising with acoustic consultants and design teams at the highest level. With time there may be the opportunity of an equity share in the business.

Salary and benefits are negotiable and will be related to experience.

Please forward your CV to Roger Kelly

roger.kelly@cdm-uk.co.uk



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www.cdm-uk.co.uk

Thinking of a change?

RBA Acoustics Limited is a forward-looking acoustic consultancy practice based in central London. Due to our continued success, we currently have vacancies at all levels for candidates considering a career within a dynamic consultancy.

Working as part of our highly-qualified and motivated team, you will be involved in the wide range of projects on which we are currently working, including:

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- **Environmental Impact Assessments for large, mixed use developments**
- **Design and commissioning of residential developments**
- **Planning and licensing of pubs, restaurants and nightclubs**
- **Assessment of noise and vibration issues arising from transport schemes**
- **Design and analysis of educational buildings**

Candidates will be expected to hold a relevant degree or diploma supplemented by excellent written and verbal communication skills. Experience in the work areas in which the company is currently involved is also of importance, although our commitment to furthering the education of our employees will provide support for continued professional development and exploring new business opportunities. Successful applicants will display a strong work ethic along with a desire to further their own career and the success of the company.

A very competitive benefits package, including profit-related bonus, is offered for successful candidates showing the necessary drive and ambition. Candidates will also benefit from an open-minded and flexible management approach and will be given the opportunity to make a real contribution to the development of the business in the knowledge that they will reap the benefits of their hard work.

For more information on the company, please visit our website www.rbaacoustics.co.uk

Prospective candidates should forward their details to:

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65 Glasshill Street
London SE1 0QR
or email Torben.Andersen@rbaacoustics.co.uk

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ACOUSTICS BULLETIN

Vol 31 No 5 September/October 2006

Contents

Your New *Audio Analyzer*

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PULSE™ Electroacoustics is a versatile platform for the evaluation of electro-acoustic transducers. It includes a wide range of analysis capabilities allowing you to determine the important features of an electroacoustic device.

Features

- Frequency responses, distortion, directivity and more
- Pre-selected measurement accuracy
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PULSE *Electroacoustics*

Brüel & Kjær

Dear Members

To the casual observer, the Institute may appear dormant during the summer, with fewer meetings being held, but behind the scenes the work of the Institute continues as intensively as ever, planning events for the forthcoming months. In particular, the analysis of the on-line membership survey has been completed and a detailed report on the responses can be found in this issue of the Bulletin. It was reassuring to find that the majority of the respondents thought that we were doing a good job, but one of the main reasons for conducting the survey was to find out where we could improve on what we provide for our membership. I am pleased to see that there were many good suggestions made and we are already in the process of implementing some of them.

The ideas put forward ranged from the aspirational desire to see the Institute with more influence in the wider world, to the purely practical, such as paying membership fees in instalments. With just over half of the respondents being responsible for paying their own fees, we recognise that an annual payment in January can cause some members problems and we are looking at ways to spread the cost throughout the year.

There was a feeling expressed that we should be more influential with government and an important way we can do this is by providing detailed responses to draft documents issued by government departments. We have been providing responses to these documents for many years and, as a result, we are regularly invited to comment on issues. With such a diverse membership it is, of course, often difficult for us to have a single 'Institute view'. What we seek to do is provide a balanced view of all of our members. Often there is little time for us to prepare these responses and the appropriate committee undertakes the task, but if time allows we arrange meetings to ensure that the response reflects the widest possible range of views of our members. We have been asked to comment on Defra's draft guidance on the Noise Act and are planning a one-day meeting in early September. This Act is relevant to very many of our members and I urge you to let us have your views. If you cannot attend a consultation meeting we are still interested to hear from you, so please write to us with your comments before the meeting so that they can be included in the discussion.

Finally, I am delighted to welcome Joan Smith to the Head Office staff in the new role of Membership Manager. She joins us with a wealth of experience gained at other institutes and will be responsible for increasing the membership. I mentioned in my last letter that we have introduced a PI insurance scheme and Joan is working on a raft of new benefits for members that I hope to announce soon.*

Colin English

PRESIDENT

*As we went to press one of these had already been introduced:
a 15% discount is available for members at 20 BCP airport parking sites throughout the UK - Ed.

Institute of Acoustics Membership Survey

Analysis of replies

Background

The purpose of the Membership Survey was to obtain members' views on the type and quality of service they expected from the Institute of Acoustics. These views will be taken into account in deciding the future strategy of the Institute.

With regard to the written suggestions, these will be sent to the Chairmen of the relevant Specialist Groups and Committees for discussion within the group. They will be asked to suggest the main points for action which will then be presented to Executive.

Summary

The Institute now has some 2600 members. Eighty percent of those members have e-mail addresses and access to the internet. Therefore it can be assumed that the e-mail sent to all members regarding the membership survey was received by approximately 2080 members.

Of these 2080 members, 165 replied: this means that only about 8% of members responded. The written replies received, however, were very constructive.

Key messages from the written replies would appear to be:

- More information and guidance (standards, employment possibilities) on the IOA web site (including consultation documents) and more online facilities;
- The IOA should be the primary source for keeping up to date with developments;
- Better accreditation (CEnv, pre-completion testing, etc);
- The need for more media exposure (exhibitions/careers fairs/articles);
- Closer involvement with schools and universities, and more involvement with young people (careers page on web site and information for students).

Below is an analysis based on the different sections.

Section I

In questions 1, 2, 3, 5 and 6 of this section, members were asked to answer a couple of questions about themselves and comment on which benefits and services they considered most important. Question 4 sought suggestions on benefits or services not currently offered.

Q1 How long have you been a member?

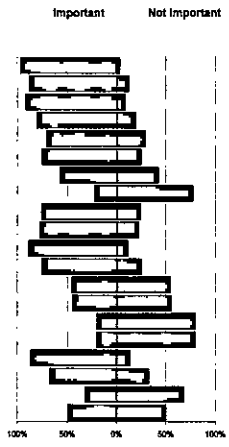
Less than a year:	1
1-5 years:	9
6-10 years:	31
11-20 years:	69
More than 20 years:	55

Q2 Which grade of membership do you hold?

Honorary Fellow	4
Fellow	20
Member	123
Associate Member	17
Technician	0
Affiliate	1
Student	0

Q3 How important to you personally are the benefits of Institute Membership?

	Very important	Fairly important	Not very important	Not important
Membership of an active Institute	67%	30%	3%	0%
A recognised qualification	67%	21%	9%	3%
Acoustics Bulletin	48%	44%	8%	1%
Conferences/meetings/workshops	35%	45%	18%	2%
Special Interest Groups	24%	47%	27%	2%
Website	33%	42%	23%	2%
Regional Branch meetings	22%	36%	36%	6%
Regional Branch social events	7%	15%	48%	30%
Professional Development	35%	41%	16%	8%
Opportunities for networking with other professionals	35%	43%	18%	4%
Technical reports/Codes of Practice/Publications	53%	36%	8%	3%
Proceedings of meetings	37%	38%	21%	4%
Job vacancies	22%	23%	35%	20%
Route to achieving CEng and IEng status	29%	16%	29%	26%
Reduced subscription for JSV/Applied Acoustics	7%	13%	32%	48%
EAA reduced rates for Acta Acustica	6%	15%	30%	49%
Register of Members	44%	42%	10%	3%
Buyers' Guide	29%	38%	26%	7%
PI Insurance at reduced rates	18%	14%	27%	41%
Access to IOA Library facilities	26%	24%	33%	17%



Q4 Which benefits which are not currently offered should be provided?

The main suggestions were as follows:

- More online services (proceedings/technical papers/standards, access to journals Acoustic Bulletin, information, discussion groups etc, access to past Diploma papers)
- Accreditation (CEnv, Building Regulations Part E pre-completion testing, recognised calibration service for sound level meters owned by IOA members)
- DVD/CD containing all conference proceedings of the year
- Newsletter
- Diary of meetings to members with relevant IOA dates
- Membership fees (payment online, by monthly direct debit, or quarterly or half yearly, early bird discount)
- Education (Certificate of Competence in Sound Insulation Measurement, resource pack for schools)
- IOA ID card
- Guidance (on standards, employment possibilities, for consultants doing noise surveys).

Q5 Would you prefer to receive proceedings of meetings as a hard copy?

Hard copy:	41%
CD:	59%

Q6 Would you prefer to receive the Register of Members as a hard copy or via the website?

Hard copy:	60%
Website:	40%

Section II

In this section questions 7-14 asked members to comment on the Institute's events and meetings and its Professional Development Programme.

Q7 Meetings attended?

Meeting type	*none*	*1 or 2*	*3 or more*
Residential conferences	75%	25%	-
One-day meetings	62%	35%	3%
Regional branch meetings	64%	24%	12%

Q8 Reasons for non-attendance:

Work commitments:	41%
Cost:	20%
Topic not of interest:	17%
Location:	15%
Other:	7%

Q9 Regular attendance at regional branch meetings?

Regular attendance	21%
Do not regularly attend	79%

Q10 Reasons for not regularly attending:

Work commitments:	35%
Too far to travel:	25%
Topic not of interest	19%
Wrong time of day	9%
Other reasons	12%

Q11 Are you registered with any of the following?

Engineering Council	38%
Society for the Environment	4%
Science Council	5%

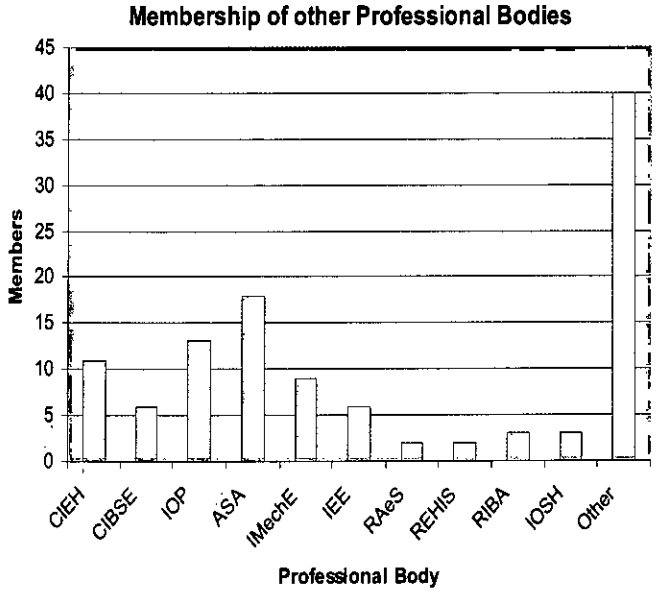
Q12 Interest in the Institute providing a route to Chartered Scientist (CSci) or Chartered Environmentalist (CEnv)

Chartered Scientist	36% interested
Chartered Environmentalist	39% interested

Q13 Membership of other professional bodies:

Yes: 59% No: 41%

Breakdown:



Q14 Do you pay your own membership fees?

Yes:	51%
No:	36%
Self-employed:	13%

Section III

This section was designed to obtain comments on the quality of services provided by the Institute and suggestions on ways to improve the service.

Q15 Publications in which the IOA should feature more prominently?

There were 52 replies. The publications will be taken into account for publicity and advertising purposes. A list can be obtained from the Institute (Annex 1).

Q16 How do you rate the overall quality of service you receive from the Institute office?

Very good:	46%
Good:	45%
Satisfactory:	8%
Unsatisfactory:	1%

Q17 How well are you kept informed of forthcoming events and given other information?

Well informed:	74%
Adequately informed:	25%
Not well informed:	1%

Q18 Would you prefer to receive information on forthcoming events by e-mail or by post?

E-mail:	81%
Post:	19%

Q19 Suggestions for meeting venues?

There were replies from 45 members. A list can be obtained from the Institute (Annex 2).

Q20 Suggestions for meeting topics?

There were replies from 50 members. A list can be obtained from the Institute (Annex 3)

Q21 How do you rate the image projected by the Institute to the following groups?

group	*very important*	*fairly important*	*very important*	*not important*
academia	56%	41%	3%	-
employers	58%	33%	8%	1%
central government	63%	25%	11%	1%
local government	57%	30%	12%	1%
general public	36%	27%	25%	12%

Q22 Ways in which the Institute can improve its profile?

There were 56 replies, and the main suggestions are outlined below. Many of the suggestions are already being implemented.

- More articles (press/popular science, institute journals, professional publications, business papers, non-technical articles in newspapers)

continued on page 8

IOA Membership Survey - *continued from page 7*

- More press releases (on relevant news items, acoustics/noise issues and events of public interest)
- More media/press exposure (people available to comment about technical issues behind new regulations, become main source of expert advice, TV shows, BBC science programmes, appointment of a spokesperson for the media)
- Publications (IOA Journal, commissioned/sponsored reference books, reviews, IOA's own standards, technical guidance/codes of practice, information on acoustical topics)
- Better promotion (good acoustic practice, promote to 'business' rather than 'science', more involvement in public issues, develop publicity pack, promote benefits of IOA to industry (HR departments), more links with industry, promotional goods, material and updated logo)
- Better profile with general public ('FAQ' pages on web)
- More exhibitions/public events
- Closer involvement (schools/universities, government committees and local government)
- Better links with young people
- Better collaboration/links with other Institutes
- Meetings (organise/participate in national/international conferences, host annual awards ceremony, bigger international conferences, smaller specialist discussion forums)
- Membership (chartered IOA status, implement professional registration board and/or professional competency system for persons evaluating noise complaints, accredited MSc and MEng degrees to show direct link into CSci, CEng etc).

Q23 Suggestions for encouraging students and young people to get involved?

There were 53 replies. Some of the main suggestions were:

- More contact with employers to encourage them to get young staff members more involved
- Promotional talks to educational establishments
- Free first year membership or low-cost membership
- Attendance at careers fairs
- More media involvement in encouraging young people to think about noise issues
- Annual conference for young people (similar to CIEH)
- More information for young people either through dedicated pages on our website (including careers and professional development) or through seminars/social gatherings (perhaps 'fun' regional branch meetings).
- Work experience (either summer placements or longer with consultancies).

Q24 Did you use the Institute's professional development support services during 2005?

Yes:	8%
No:	92%

Q25 Ways in which the professional development service could be improved?

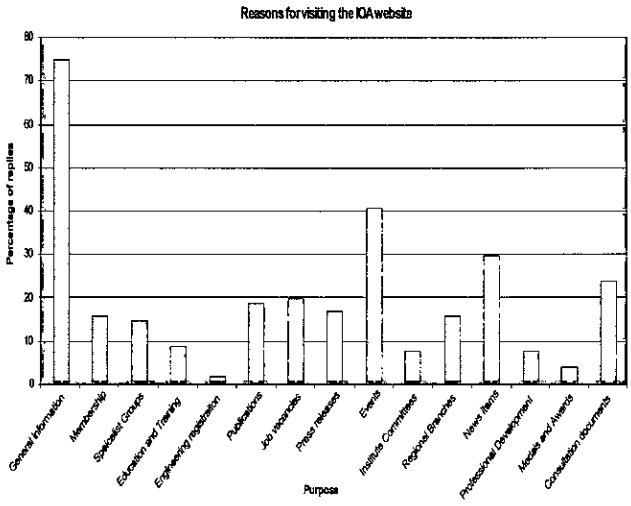
A selection from the 32 suggestions received is shown below.

- More information/awareness and guidance (information available online)
- Better publicity on what CPD is, both within the IOA and to employers
- Mentoring/coaching
- More structured training scheme
- Condition of continuing membership.

Q26 How often do you visit the Institute's website www.ioa.org.uk?

Monthly: 72% Not at all: 16% Weekly: 8% Daily: 4%

Q27 For what purpose?



Q28 Improvements to the IOA web site?

There were 42 replies. Comments varied from those who liked it and thought there was enough information to those who felt there should be more information. Below is a selection of the comments.

- Much improved
- Keep it updated and attractive
- Documents/proceedings available online
- More consultation documents
- Easier log-in and password facility (some found it difficult)
- More information (technical, product, past meetings procedures and links, acoustics information, standards, research reports etc)
- Better search facility for online papers/presentations from conferences and meetings
- More information from groups/branches
- Needs improved news service on acoustic related items
- More consultation documents, guidance developments and new documents
- IOA primary source for keeping up to date with developments.

Q29 Do you read Acoustics Bulletin?

Yes:	93%
No:	1%
Occasionally:	6%

Q30 How do you rate the content of Acoustics Bulletin?

Very good:	57%
Good:	36%
Satisfactory:	7%

Q31 Suggestions for improving Acoustics Bulletin

There were 50 replies. On the whole members seemed to like the new format. There were many suggestions with regard to content and presentation. A complete list can be obtained from the Institute (Annex 4). Below are the main suggestions:

- More technical papers, some peer reviewed (large number of replies)

- Better balance between technical/academic papers and practical papers
- More product news and general news items
- More articles on policy
- Some felt the Bulletin needed to be more of professional journal than a magazine with better presentation and shorter articles
- 93% thought it was 'good' or 'very good'.

Q32 Would you be prepared to volunteer to participate in Institute committee work?

Forty-one percent ***of those who replied indicated that they would be prepared to participate in Institute Committee work. A list of names will be sent to the relevant Specialist Groups or Committees.***

Q33 Would you be prepared to volunteer for raising awareness of acoustics at school and university level and for mentoring?

Yes:	37%
No:	63%

There were 37% positive responses, which was very encouraging. A more detailed analysis will be undertaken by area and subject (school visits, undergraduate mentor and member mentor) and those who have expressed an interest will be contacted.

Q34 Additional comments

There was a wide variety of comments ranging from members feeling that the IOA was providing a good service, to those expressing concern (for example) that standards, particularly in meetings and quality of papers, were slipping. A few members also expressed concern that the IOA does not provide accreditation for AD-E sound insulation testing. There was a feeling that the IOA should press ODPM for authorisation to give accreditation to any of its members that it considers adequately qualified to meet the required standard of AD-E testing.

One or two overseas members expressed the fact that they felt the IOA service was perhaps not relevant to them, even though they had a lot to offer.

Several members expressed a desire to be more actively involved with IOA activities but were restricted by work or family commitments.

Nominations invited for the Tyndall Medal 2008

Latest news

The Tyndall Medal, which is made of silver gilt, is awarded biannually to a citizen of the UK, preferably under the age of 40, for achievement and services in the field of acoustics. It was first awarded in 1975 with the aim of recognising early career attainments in acoustics.

John Tyndall (1820-1893) preceded Rayleigh as Professor of Natural Philosophy at the Royal Institute. He investigated the acoustic properties of the atmosphere, and although a distinguished experimental physicist he is remembered primarily as one of the world's most brilliant scientific lecturers.

The recipient of the 2006 medal was Professor Kirill Horoshenkov, a leading acoustics researcher at the University of Bradford. He was awarded the medal for his achievements and proven record in developing efficient and novel solutions to noise problems and in general sound propagation work.

Previous recipients have been successful in fields such as speech research and technology, the development and implementation of numerical methods for the modelling of sound propagation, the assessment of noise impact from aviation and rail transport, the control of entertainment noise, and research into communication and teaching in acoustics.

The nomination form can be downloaded from the Institute of Acoustics' web site at http://www.ioa.org.uk/medals.asp and should be addressed to The President, Institute of Acoustics, 77A St Peter's Street, St Albans, Hertfordshire, AL1 3BN. **The deadline for receipt of nominations is 31 January 2007.**

The Tyndall Medal, awarded for achievement and services in the field of acoustics

Revision of BS 5228

Latest news

The sub-committee reviewing and revising BS 5228 has started examining in detail the various parts. The sub-committee is considering inclusion of comments from a number of sources, is looking to update legislative and advisory references and include recent data and is considering enhancing the section on criteria for setting noise and vibration control targets to provide further guidance on possible assessment criteria.

Currently the major proposals include the merging of Parts 1 and 2, and a significant update of the noise source data based upon the recent Defra funded, Hepworth Acoustics work establishing sound pressure and power levels from construction equipment.

Extensive work is also being carried out to update the Parts to include legislative and other advisory documentation changes since the last revision.

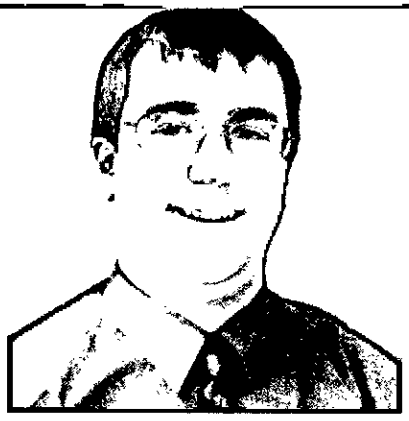
Please let me know if you have any comment on the Standard which I will pass on for consideration by the sub-committee.

Nick Antonio - Arup Acoustics

8th Floor, St James Buildings
Manchester M1 6EL

nick.antonio@arup.com

Editor's notes



Ian F Bennett CEng MIOA.

I know that acousticians have an advanced appreciation of 'green' issues, not least because of our regular involvement with 'environmental' disciplines such as landscape architecture and ecology. I'm therefore especially grateful to Peter Rogers, whose article appears in this issue, for enlightening me about 'sustainability' and what it means for acoustical engineering. I'm still not entirely convinced, I must admit, that sustainable design is much more than good, considerate design, but then there's always a risk that useful neologisms will be hijacked by politicians and rendered imprecise by over-use.

The article by Mike Swanwick on commercial aircraft noise I found particularly interesting, not least because it offers an explanation to the non-scientifically minded of how a turbofan engine works (useful for settling those pub arguments...). On a related subject, as a dedicated provider of professional services to the brewing industry (no, not just consuming the product) I hope that the review by Jim Griffiths and John Seller, concerning how noise levels from licensed premises are best measured, will help stimulate discussion and debate on the subject. I have come across several of the methods and metrics in my consultancy dealings with various licensing authorities, and I'd say that a consistent and workable approach is well overdue.

Space is at a premium this issue, so there is only the briefest preview of the Autumn Conference, but members will have had a 'flyer' from Head Office by now. The Conference will cover WHO Guidelines, Codes of Practice and noise mapping, and the event is on 16 and 17 October 2006. There is an interesting and varied programme of papers in prospect, including a keynote speech on the World Health Organisation's noise guidelines by Birgitta Berglund. The Institute web site has full details of this and other future conferences. The site at www.ioa.org.uk is fully operational with its updated, clean and easy-to-navigate layout, so if you haven't visited lately, go and have a look. The sound reproducers also have their own site at www.reproducedsound.co.uk which gives details of the forthcoming RS22 conference on 3 and 4 November 2006: as happened last year, Reproduced Sound is being run entirely separately from the Autumn Conference, instead of running straight on.

Copy for the November/December issue (yes, already!) should reach me by Friday 13 October, please. If you can't meet that particular deadline, feel free to offer a contribution for next year, as we will shortly be deciding on the themes for each 2007 issue.

Ian Bennett

The Institute of Acoustics appoints Membership Manager

Joan Smith joins the IOA

The Institute of Acoustics is pleased to announce the appointment of Joan Smith to the newly created position of Membership Manager. Joan will be responsible for managing and implementing a membership development plan and setting priorities in order to maximise growth.

Joan brings to the Institute many years of experience in membership management. Her last position was at the Institution of Electrical Engineers where she successfully managed several large-scale projects and implemented a series of new initiatives designed to maintain and increase membership.

This new post will provide an exciting opportunity to recruit new members to all grades of membership, maintain contact with sponsoring organisations and develop and maintain links with regional branches.

"Joan's appointment is part of the Institute's strategy to raise the profile of the Institute" said Kevin Macan-Lind, Chief Executive of the Institute of Acoustics. *"Her experience will be invaluable in improving our services to our current members and recruiting new members. I look forward to working in close cooperation with her."*

For her part, Joan said, *"I look forward to the challenges of increasing IOA membership and adding some tangible benefits for the whole membership to enjoy".*

Meeting Announcement - Autumn Conference 2006

Monday 16 - Tuesday 17 October 2006.
The Oxford Hotel, Oxford, UK

This year's Autumn Conference, organised by the Environmental Noise Group, will cover issues associated with WHO Guidelines, Codes of Practice and noise mapping.

The WHO published guidelines for community noise in 1999. These have been interpreted and used in a number of ways in the UK, sometimes leading to disagreements in the way guidelines are used in planning new developments and dealing with complaints from existing noise sources.

The Conference this year will devote a day to examining the "use and mis-use" of the guidelines and has invited Birgitta Berglund, one of the principle authors of the guidelines, to present the keynote paper. This will be followed by the perspectives from both the local authority and consultants points of view, and will culminate in a workshop/discussion enabling all attendees to air their views.

The latest emerging UK Codes of Practice and Gudelines will also be reported upon. The IEMA/IOA Noise Assessment Guidelines, BS 9142 and PPS 24 have all made significant progress, and are due to be issued in the near future. Other documents will be addressed and their relevance and need for updating examined.

Following the first major round of UK noise mapping, there will also be feedback on how this worked in practice, and how issues such as tranquil areas should be dealt with.

The meeting will be of interest to Enviromental Health Officers, Environmental Noise Consultants, Local Authority planners, developers, consulting engineers, architects and planning consultants

For more information or to register visit **www.ioa.org.uk/viewupcoming.asp** or phone Linda Canty on **01727 848195**.

Ideas needed please!

Women in acoustics

International Women's Day will fall on 8 March 2007. To mark the occasion the Institute is thinking of holding a 'celebratory' event or meeting concerning women in acoustics. The powers that be would very much like to know what you, the members, think of this idea. Any specific suggestions for possible meeting topics or, indeed, suitable venues would be very welcome.

Please send any views and suggestions as soon as possible to **judy.edrich@ioa.org.uk** or telephone **01727 848195**.

Many thanks

Examination results

Certificate Name: Environmental Noise Assessment
Exam Date: 19 May 2006 - Pass Candidates

Bell College
Mr P Brennan
Mr P D Graham
Miss M J Hayes
Miss K Heggie
Mr P G John
Ms S K Lerner
Mr T MacIver
Miss V Maley
Mr C Mason
Mr P McFarland
Mr A Morton
Mr S Patrick
Mrs L B Richardson
Mr M S Saleem
Miss I F Small
Miss G Thomson
Mr R D Valentine
Mrs A Willding
Mr A Wrens

University of Birmingham
Mr E Armstrong
Mr P Bowden
Mr M Brownjohn
Miss J Green
Miss M Reed
Mr B D Symons
Mr G C Waldron

University of the West of England
Miss R Athay
Mr C Ball
Ms S F Brown
Mr T W Burns
Miss E R Cole
Mr C G Conway
Mr S P Dart
Mr D H Evans
Mr M J Flannigan
Mr B D Freight
Mr A P Harding
Mr S P Horsler
Mr P J Sanders
Mr T R Thayre

Colchester Institute
Mr A G Beebe
Mr C Camilleri
Mr M S Chapman
Mr B Forrest
Mrs C Guiney-Walsh
Mr B T Keenan
Mr C Kitts
Mr R J Lewis
Mr M N Richmond
Miss D D M Romaine
Mr A N Stacey
Miss A J Stafford
Mr R J Watkins

University of Derby
Miss J A Clent
Miss M J Dawson
Mrs M J Dennis
Mrs C Martin
Mr D Penny
Mr C Richardson
Mr B S Sarton
Mrs E J Ulyett
Mr R Wright

EEF Sheffield
Mr M E Bolland
Miss S E Cayless
Mr M C Dale
Mr D C W Davies
Miss J Gascoigne
Mr M Masterson

Liverpool University
Miss H C Beswick
Mr T Clayton
Mr M J Curry
Mr D V Cuthbert
Mr I J Ferguson
Mr R J Green
Mr J M Howell
Mr J E Mape
Mr S M Parrott
Ms N Roche
Miss C Rooney
Miss A J Smith
Mr M H R B Warren

NESCOT
Mrs S C Dandy
Ms L S Hayward
Mr G J Madigan
Mr S E McEntee
Mr R J Miller
Ms A J Nicholls
Mr R F Reed
Miss R L Roberts
Miss N J Slade
Miss M Speed
Miss V G Thwaites
Mr R Wade
Mr M Witcher

University of Strathclyde
Mr C R Aitken
Miss C Allen
Mr S J Blaikie
Mr B Campbell
Mr B Gallacher
Miss J S Hadden
Mr B G Inglis
Mr B Kemp
Mr S J Miller
Mr D Wilson
Mr P A Young
Mr I R Zycinski

Intelligible measurements!

How accurate are speech intelligibility measurements in practice?

A joint one-day meeting on the quantification of speech intelligibility, organised by the Electroacoustics Group and the Measurement and Instrumentation Group will take place on Tuesday 26 September 2006 at the Kohn Centre, Royal Society, 6-9 Carlton House Terrace, London, UK.

The meeting is an opportunity for those who need to measure speech intelligibility accurately to review current advances in intelligibility measurement, discuss ways to ensure accurate measurements, and share experiences of problems encountered.

The need to comprehend the spoken word reliably is key to understanding: in the management of crisis situations it is critical. Basically we are dealing with a subjective reaction and there are many complex factors at play in this process with variables in the source, transmission path and receiver. At the end of the day it is only the transmission path that is under control of the acoustics professional and this is where we have to apply our expertise.

In research and detailed design studies the many variables, which include reverberation and background noise, can be analysed and predicted in many complex ways to achieve the quantification necessary to project the results required. But in everyday evaluation and enforcement activities we have to have a liberal application of the KISS principle to keep it short and simple. It is only by this method that the control and thus improvement in speech intelligibility will gain popular acceptance thereby allowing unsatisfactory situations in our schools and other public places to reach reasonable levels. The standardisation community has been working on these methods and we now have the STIPA criteria that replace the now defunct RASTI systems, and new regulations, such as the Building Bulletin BB93 dealing with the Acoustic Design of Schools, are starting to appear using these methods of quantification.

These regulatory drivers have prompted various government agencies and acoustic consultants to require these measurements to be made both in terms of the acceptance testing of new build and for the quantification and ranking of schemes to improve areas where there have been complaints about the intelligibility levels. These considerations seem to apply equally to spaces where both natural and reinforced speech is used. This has resulted in the sound and communication engineering branch of the profession and the more traditional architectural consultancies who are more concerned with natural speech approaching these quantifications. In turn this has prompted the equipment suppliers to produce systems for making the measurements and it seems here to the approaches are coming from two directions. The public address equipment suppliers are producing equipment for testing the performance of their sound reinforcement systems, and in parallel the sound level meter manufacturers are adding options that allow existing precision sound level meters to be used for the direct measurement of speech interference alongside the traditional functions of reverberation time and real time frequency spectra.

There is obviously a lot for the profession to assimilate as the quantification of acoustic environments advances, and to facilitate this the Instrumentation and Measurement and Electro-Acoustic Groups of the Institute are jointly promoting a meeting that will explore the basic methods involved and hear reports back from those who have had experience in the field with the quantification of speech intelligibility. There is a full programme of 11 papers drawn almost equally from research and applied areas. A meeting 'flyer' can be downloaded from **www.ioa.org.uk**

Everyday measurement and enforcement

Examination results

Certificate Name: Workplace Noise Assessment
Exam Date: 7 April 2006 - Pass Candidates Only

University of the West of England
Miss L A Aston
Mrs T E Barratt
Mr S G T Brown
Mr A Dorr
Lord S J Edward
Mr M J Fullalove
Mr M B Griffiths
Mr A Jenkins
Mr E King
Mr K D Millward
Mr D F J Osborn
Mr T J Roberts

Colchester Institute
Mrs D Colquhoun
Mr R V Groborz
Mr W A McCallum
Mr J C McRoberts
Mr M A Pereir
Mr M E Ranson
Mr M E Thornewill

University of Derby
Mr I Boyle
Mr P A Brown
Mr D C Grainger
Mr C Jenkinson
Mr G I Powell
Mr M J Squires

EEF Sheffield
Mr W A Clarkson
Mr S J Granger
Mr J Hewitt
Mr M J Jordan
Mr A R Payling
Mr R Pearson
Mr G T Peel
Ms D J Rose
Mr J Ross
Mr P Slater
Mr P Smith
Mr R A Smith

EEF East Midlands & Mid Anglia
Mr J H Alderson
Mr C E Armstrong
Mr P Crudeineton
Mr M Cutts
Mr G R Hanmore
Mr D Penny

Institute of Occupational Medicine
Mr L J Appleby
Mr C Chisholm
Mr D McAra
Mr M McGhie
Mr G Millen
Mr R H Monk-Steel
Mr E S M Saunders
Mr B Warner
Mr A Wylie

Leeds Metropolitan University
Ms M H Aitchison
Mr A J Bergus
Mr I Boland
Mr T J Coyne
Miss E Keon
Mr M Leatherbarrow
Mr A D Olney
Mrs L J Pearson
Mr W Taylor
Mr P Thompson

NESCOT
Mr J S Dhesi

Rapid Results College
Mr R G Thompson

IOA new members

At Council on 22 June 2006 the following were elected to the membership grades shown:

Fellow
Hinton, J F

Member
Aazem, J
Chilton, R A
Churchill, C E
Clouston, J S R
Cockram, P B
Coussios, C C
Drewery, C
Evans, M R
Finn, A
Fowler, S J
Francis, P
Garcia Senchermes, A
Gaston, R H
Goodhand, C D
Harte, J M
Hetherington, S
Kennett, J L
Kim, S M
King, S A
Kuyser, M J
Meister, A
Morris, A J
Morrow, M J
Richardson, M L
Tizianel, J
Umnova, O
Vivian, R M
Wong, C C C
Wong, C W S

Associate Member
Barber, N J
Burton, R F L
Cand, M M
Chatzipanagiotis, T
Dodgson, T G
French, I R
Gibb, A
Gil, J
Kierek-Bell, A
Lewis, P J
Makin, T J
Miller, R J
Newman, J
O'Neill, C
Poole, E A
Pratley, D S
Ryan, A
Saint Martin, P
Sherwood, R D
Whelan, R S
Williams, F

Afiliate
Spowage, G D F

Technican
Akhurst, P J M
Brough, S G
Dandy, S C
Lofting, R
Mallen, F R
Monk-Steel, R H
Scott, M S
Tan, J

Student
Carter, A
Davidson, J L
Garner, D
Mackinnon, G R
Roberts, S J
Robertson, L A
Stigwood, D M
Williams, R D G
Zepidou, G

Sponsor Members
Saint-Gobain Ecophon Ltd
Thales Underwater Systems Ltd
Falkirk Council

Young Persons' Award for Innovation in Acoustical Engineering enters second year

Entries are now being invited

Entries are now being invited for the Young Person's Award for Innovation in Acoustical Engineering, now running for the second time. The Award, offered by the Institute of Acoustics, is sponsored by IAC Ltd, a global leader in noise control and employer of many of the UK's best acoustical engineers.

The biennial prize was first awarded in October 2005. Colin English, President of the Institute of Acoustics says that the presentation of this award was one of the highlights of the 2005 industry calendar and the Institute was looking forward to receiving entries for this second round. Recognising the enormous contribution that young acoustical engineers bring to the industry in terms of their enthusiasm and inventiveness across such a wide spectrum of applications, acknowledging and celebrating their input in this way was a great pleasure.

Entries are welcomed from now until the closing date of 30 March 2007, when the distinguished panel of judges drawn from academia and industry will select a winner and two runners-up. The judging panel consists of: **Dr Bernadette McKell** BSc MSc PhD CEng MIOA partner, Hamilton & McGregor Acoustics Division and chairman, Engineering Division, Institute of Acoustics; **Dr Ian Flindell** BSc MSc PGCertEd PhD MIOA part-time lecturer, Institute of Sound and Vibration Research at the University of Southampton and independent acoustical consultant; **Dr Frederick Brenchley** MDes (RCA) MIOA technical and development manager & acoustic specialist, Armstrong Building Specialists; and **Geoff Crowhurst** MIOA MIOD director, IAC UK Acoustics Division.

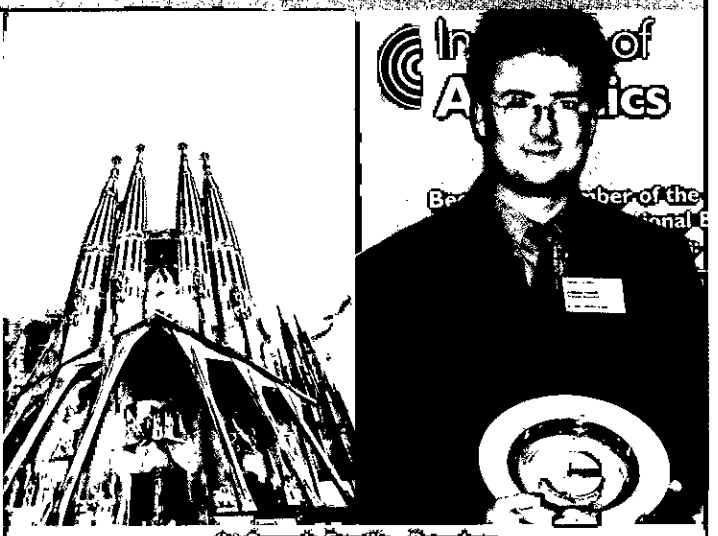
Judges will be looking for entries that are innovative and inventive, feasible and practicable, money-saving, green, end-user friendly, and time-saving, or that are improvements to existing processes.

Colin English speaks from experience when he says that a career in acoustics gives great opportunities for making a difference to people's lives - the variety of applications is growing constantly and modern electronic technology is opening more and more opportunities in a noisy world. Acoustics undergraduate courses tend to attract high calibre students who, once they enter industry, are often full of ideas for innovation. A high standard of entries is again anticipated.

The winner of the Award will have his or her name engraved on the prestigious solid silver trophy designed by British silversmith Alfred Pain of Leathermarket, London, and will receive a solid silver replica to keep. In addition, the prize provided by sponsors IAC will include a luxury weekend break for two in Barcelona with £500 to spend; tickets for a show of their choice at any one of the city's theatres; and either a lunch with Dr Higini Arau, Spain's leading performance space acoustician and Master of Barcelona University, or a visit to IDIADA, one of Spain's state-of-the-art acoustic testing laboratories.

The first runner-up will receive a cheque for £200 and a commendation goblet, and the second runner-up a commendation goblet. The prizes will be presented at the IOA's Autumn Conference in Oxford on Monday 15 October 2007.

Brian Quarendon, chief executive officer and president of IAC said that the company was delighted again to be celebrating the achievements of young acousticians in industry in this way and to be supporting the Institute in promoting the sector. The standard of entries in 2005 was impressive, and showed just how varied the applications of acoustical engineering are. In the sectors in which IAC operates, innovation certainly gives a competitive edge and they were pleased to reward good ideas and hard work.



(L) Sagrada Familia - Barcelona
(R) Andrew Hurrell - recipient of the first award in 2005

Palau de la Musica Catalana

Entry forms can be downloaded from the dedicated Award page on **www.industrialacoustics.com/uk** and from the Institute's website at **www.ioa.org.uk**. To receive an entry form by post contact telephone **01727 848195**, fax **01727 850553** or e-mail **ioa@ioa.org.uk**

Examination results

Certificate Name: Hand Arm Vibration

Exam Date: 12 May 2006 - Pass Candidates

EEF SheffieldMedicine

Mr R S B Agnew
Mr D M Jennett
Mr R D Shard
Mrs E Houldridge
Mr P J D Lee
Mr G A Stace
Mr A Parris

Institute of Naval Medicine

Mr M G Cantley
Mr G L Jenkins
Mr M M Pasalk
Mr S Cocks
Miss J W Maina
Mr S D Robertson

How does sustainability sound?

Peter Rogers. It is time to encourage acousticians fully to enter the debate on sustainability

The Building Acoustics Group has been watching the gathering momentum of this topic with interest, and feels that the membership should be brought up to speed with the story so far. It is time to encourage acousticians fully to enter the debate on sustainability. The first hurdle, naturally enough, is understanding what sustainability means, and how acoustics fits in. This article aims to set out relevant information to assist the acoustic specialist with an understanding of sustainability, and to aid clear debate on the subject.

Is living in a home that is closer to your neighbours, built on a brown-field site in a noisy area of town, nearer to public transportation such as roads and railways, going to turn us off the idea of 'sustainability'?

The answer is likely to be 'yes' unless there is provision for the safeguarding of 'acoustic comfort' for those living in the sustainable homes of the future. The Code for Sustainable Homes was released by the government as a consultation document in December 2005, and it was concluded by the IOA that the provisions proposed were inadequate to protect acoustic comfort, and therefore quality of life. The IOA's response can be found in full on the Institute's website **http://www.ioa.org.uk/condocuments.asp**

Getting to grips with how acoustics fits into the challenge of delivering sustainability is considered here as a prelude to the most focused debate yet for the industry at the Spring Conference 2007, planned to take place in Cambridge next April. The call for papers has gone out, and those with something to say on the matter should please step forward before the closing date of 1 September 2006.

What came of the consultation response?

In May 2006 the ODPM was reinvented as the Department for Communities and Local Government (DCLG). The department now claims a 'powerful new remit to promote community cohesion and equality, as well as responsibility for housing, urban regeneration, planning and local government'. There has been some indirect reaction from the government on the consultation. In March 2006 the Minister for Housing and Planning, Yvette Cooper MP responded to criticism from the Environmental Audit Committee report on sustainable housing. She said the government was strengthening the Code for Sustainable Homes, in response to consultation. The recent report by the government of 13 July 2006 states that the code will be the basis of the next wave of improvements to the Building Regulations. She also says that they are currently considering over 2000 responses received during the consultation before publishing the revised code, which they are considering making mandatory. It is unclear whether the IOA's comments have been taken on board at this stage, but it is at the very least encouraging. No timescale has been given.

What are 'sustainable communities'?

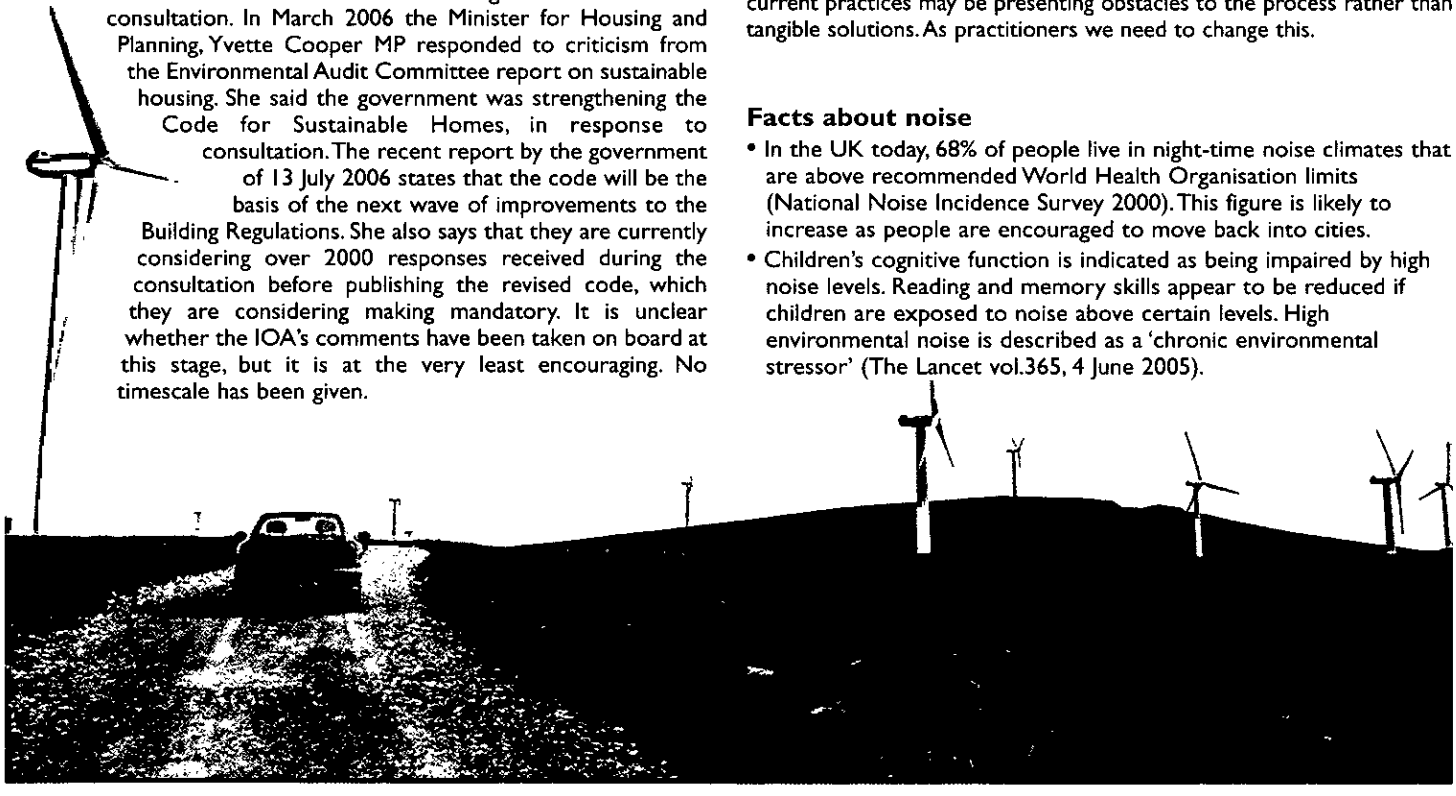
The short definition, according to the government, is: 'places where people want to live and work, now and in the future'. The longer version set out on DCLG's web site includes references to places being well designed and built, well served, thriving and environmentally sensitive, among other headings. The environmental objectives are defined as 'enabling a lifestyle that minimises negative environmental impacts and enhances positive impacts'. Noise falls explicitly within this section, but is also a factor for consideration in many of the other sections that focus on social well-being, which are 'softer' issues. It is perceived by the IOA that further work to translate these definitions into a clear vision for what constitutes a 'sustainable building' remains a key challenge ahead of delivering the solutions in practice. The subject has been re-branded by some as eco-architecture, which perhaps is no bad thing as it alters the angle of emphasis to one of delivery rather than just one of principle.

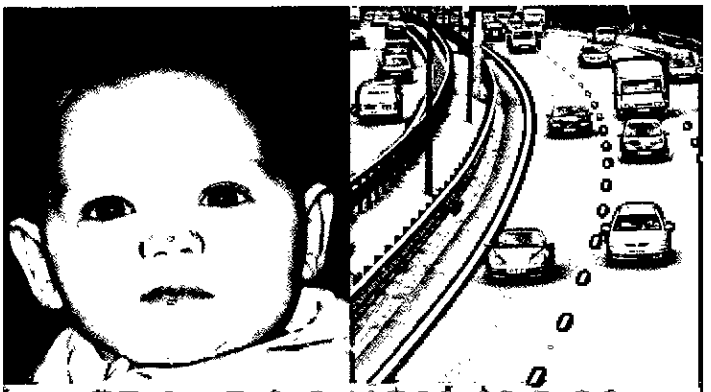
Despite pressure the government insists that progress is being made, and in the two Sustainability Summits held in 2004 and 2005 a number of new sustainable communities were honoured with awards. These included the regeneration of Attwood Green, Birmingham, Gravesend town centre, and 'a new deal for Braunston' in Leicester. The Thames Gateway was also identified as a project of magnitude and vision that is planned to deliver a low carbon community, with the aim of progressing toward the ultimate goal of being 'carbon neutral'. The project team is paying close attention to the benefits and examples set by the 2012 Olympic Games, billed as the Green Olympics. There is no shortage of examples, but are the acoustic problems associated with making the sustainable solution work leading to compromises that could water down the end result? How sustainable do they actually end up being once they have been through the mangle of design to become a commercially viable project? This is for the members to address directly through their own experience of sustainable projects.

If sustainable communities are to flourish in these built environments, then a number of specialist areas need to work together in order to remove technical obstacles and enable the delivery of sustainable living. Acoustics is just one of these specialist areas, and at the moment the reality is that current practices may be presenting obstacles to the process rather than tangible solutions. As practitioners we need to change this.

Facts about noise

- In the UK today, 68% of people live in night-time noise climates that are above recommended World Health Organisation limits (National Noise Incidence Survey 2000). This figure is likely to increase as people are encouraged to move back into cities.
- Children's cognitive function is indicated as being impaired by high noise levels. Reading and memory skills appear to be reduced if children are exposed to noise above certain levels. High environmental noise is described as a 'chronic environmental stressor' (The Lancet vol.365, 4 June 2005).





Children's cognitive function is indicated as being impaired by high noise levels

- Health effects are not yet categorically proven to have links with noise exposure, but there is a body of evidence building up, and some agreement between experts that noise is directly related to our overall health through sleep deprivation, ischemic heart disease, and children's development (review by British Government Panel on Sustainable Development 1999).

Making homes acceptable

The most recent studies on the effects of noise on people in buildings include the Noise Incidence Survey 2000, Neighbour Noise 2003, English House Condition Survey 2001, Merseyside Study of 2004, and the World Health Organisation Guidelines on Community Noise 2000. These studies show that both neighbour noise and transportation noise are highly relevant to people's 'quality of life', 'liveability' and the issue of 'comfort'. These are the key lifestyle categories when assessing how 'sustainable' a solution is acoustically.

'Acoustic comfort' is a term covering these categories that has evolved through the consultation process. It is intended to be a subjective, holistic term to describe an acceptable internal or external acoustic environment for human habitation in or around the built environment. An objective assessment would be based on achieving the targets currently set by British Standards or statute (such as BS.8233 or the 2003 Approved Document E). This article takes a look at some of the technical issues facing the acoustician whose job it is to make sustainability work in practice, by asking following questions.

- Should we improve on existing building standards?
- How we should tackle the placement of homes in noisy environments?
- How can we do this and still make the best contribution towards a sustainable solution?
- Should there be a radical review of the materials specified by acousticians: 'low embodied energy'?
- How can we encourage new solutions and innovation to emerge?
- How can we expedite the swift delivery of sustainability?

This article cannot of course provide definitive answers to these questions, but is designed to provide food for thought. The delivery of sustainability reaches across the UK planning system and Building Regulations, and deep into the global political arena. The acoustic viewpoint is relatively novel in this arena, but should be very much a part of what will make the sustainable homes of the future fully acceptable to people. Acousticians need to begin the process of resolving the challenges of delivering sustainable living practically. The protection of people's quality of life through enhanced acoustic comfort is a valuable part of making sustainability work.

The reality is that we need to balance the function of the buildings with the environments in which they are placed, and the overall global environmental impact, in terms of CO2 emission and energy usage, of their construction and occupation. However, the challenge to the field of acoustics is to provide clear guidance on how to create truly sustainable communities without compromising the comfort of people living within them. What exactly is required is set out helpfully at:

http://www.wwf.org.uk/sustainablehomes/about.asp and **http://www.communities.gov.uk/index.asp?id=1139866**

There is a real need for Government to guide the construction industry on how to begin to do this, while protecting the environment for future generations.

How does noise specifically fit in?

Acoustics uniquely straddles the social and environmental aspects of how people interact with their internal and external environments. As noise is generally a term to describe unwanted sound, and the response of people is largely subjective, it presents a unique and difficult challenge to decide what is acceptable. The World Health Organisation has set objective targets that provide an idealistic benchmark, but these are not definitive limits, as people react differently to noise and to some extent can adapt to the noise to which they are exposed. Because an easily quantifiable dose-response relationship does not exist at the typical levels found in the environment, adequately protecting people's comfort, quality of life and well-being remains difficult. The search must go on for more suitable objective criteria.

The need to take a more strategic approach to manage the noise climate is under way, but we will continue to face the challenge of placing people in noisy environments as part of making sustainability work. The revision of PPG24 to the anticipated PPS24 really ought take this into account. Is it sustainable, for example, for noise guidance to promote the development of new residences on quiet sites?

Sheep's wool - a highly sustainable solution for acoustic insulation

Acoustical issues often conflict with sustainable solutions. A good example would be building a sustainable community (which could include schools as well as homes) close to public transport links, on a brown-field site close to existing MEL (Major Employment Land). In order to balance the amenity needs of the residents with the inevitable noise around them, we need to develop acoustical evaluation strategies and building design solutions that support the underlying sustainable principles of resolving two potentially conflicting requirements.

There are also less obvious concerns, such as the nature of the materials that are used to provide acoustic insulation and linings in buildings. The sustainable solution is one which requires the least energy over its lifecycle. For example, sheep's wool is a much more sustainable solution for absorption than the highly energy-intensive alternative of mineral fibre (spun glass or rock). Mineral fibre is currently the industry standard, and some incentive is necessary if this is to change. Recycled materials could also be considered for ceiling tiles and cavity fillings.

continued on page 16

How does sustainability sound? - *continued from page 15*

For sound insulation the alternatives to the cheapest solutions in the UK (brick, concrete block, plasterboard) are less obvious. Straw rendered with mud is one option, but perhaps for the less earthy and more practically inclined an 'FSC' (Forestry Stewardship Council) timber framed building, with dense particle board linings, is both viable and considerably more sustainable than the alternatives. These are not materials currently used regularly on building sites across the UK (except possibly in Scotland).

Where people live in and around the built environment we are learning that their interaction with the environment is important to their well-being. 'Next generation solutions' must be developed to tackle the above challenges, especially those listed in Table 1.

Table 1: Key relationships where noise and vibration associate with sustainable issues

- Sustainable power sources are noisy (eg wind turbines, water turbines). Note that solar power is essentially silent, but currently has the highest price-tag. This could be considered relative to coal fired power stations.
- Bringing communities to existing public transportation links. This would require developing brownfield sites, thereby balancing the acoustic pollutants against the environmental benefits. This is a significant change of approach, no longer driven by the 'public interest' to develop in quiet locations, and reversing the assumption that placing building in noisy areas is not acceptable.
- Providing good acoustical separation between adjoining living areas, without increasing the energy footprint against an agreed target.
- Allowing natural or mechanical ventilation without degrading the acoustic environment internally.
- Protection and improvement of external public or amenity spaces that are currently polluted by noise (noise maps and action plans could be useful here).
- Reverberation control in enclosed areas: where the exposure of thermal mass of the building may be part of the sustainable cooling solution, should a minimum level of absorption be provided?
- Use of recycled materials to provide absorption in cavities, or provide options, shredded newspaper being one example.
- Social aspects of making an area a desirable place to live, bringing up children and allowing communities to thrive.
- How might a building provide flexible living space that can evolve with the requirements of the occupants and those surrounding them in order to minimise waste. This is about extending the lifecycle of the buildings: starting by enabling to meet the needs of a young couple, but then evolving to adapt to growing family living without compromising the overall function of the building. The ultimate challenge is then to cater for a growing elderly population too. The requirement for enhanced sound insulation is most likely to be an additional factor to be considered.

The relationships listed in Table 1 are not exhaustive, but are intended to promote thought and debate on how to move each one forward. Standards have been proposed to the ODPM/DCLG in the Institute of Acoustics' response to the consultation draft of the Code for Sustainable Homes, which could form the basis of an 'enhanced acoustic comfort' standard. The objective targets proposed by the IOA are summarised in Table 2, with a Code based on scoring points to achieve one of five rating levels. Ten points would be available for acoustics as a whole.

The sound insulation performances would be based on pre-completion testing results for an agreed percentage (10% at present, but up to 30% may need testing to be in line with the current qualification criterion for additional EcoHomes points).

Table 2:
Objective targets for enhanced acoustic comfort

Sound insulation

The following code points shall be awarded:

$D_{ntw} + C_{tr}$	
48 dB	1 point
51 dB	2 points
54 dB	3 points
>54 dB	4 points

Reverberation time in living areas: T_{mf} <0.8 second (further discussion required: an optional 1 point extra to create a benchmark for a standard that could be achieved easily by the occupier using carpet or standard furnishings).

The 5 points would make up half of those available for acoustics.

External noise

We suggest a form similar to achieving the ideal standards of design set by BS.8233, such as:

	L_{Aeq}	L_{Amax}	
bedrooms (23.00 to 07.00)	35 dB	-	
and other living spaces (07.00 to 23.00)	40 dB	-	1 point
bedrooms (23.00 to 07.00)	30 dB	<45 dB	
and other living spaces (07.00 to 23.00)	30 dB		4 points*
balconies or gardens (07.00 to 23.00)	<55dB	-	1 point

** A system for awarding the points weighted towards challenging sites is considered appropriate. The full four points would be awarded if a site has external levels that exceed an objective threshold, based on the new PPS24. A relaxation of 5dB would then apply to the limits stated above. For sites with ambient noise levels below the threshold would only be awarded up to 3 points only.*

The environmental break-in noise values could be demonstrated by calculation, based on an ambient noise survey of the area. Such methodology is considered acceptable under Building Bulletin 93: Acoustics Design of Schools, and computer modelling may be included.

The enforcer of such a scheme would then be able to assess the acoustic merits of the scheme against the other factors. By sharing the acoustic points equally across the categories identified as part of the code, the resulting solution would better reflect a balanced consideration of the issues affecting acoustic comfort. High density living environments located in challenging noise climates would then be catered for within the whole sustainable design process.

Government leadership is needed for the construction industry to start embracing the detail of the challenge set by sustainability. The 2012 Olympic Games to be held in London offer Britain the perfect showcase for 'Green Olympics'. Ahead of this the UK Government has decided not to stage the third Sustainability Summit planned for February 2007. However it is claiming to remain fully committed to sustainability and is extending the opportunity to the private sector to host events for the next three years. It remains to be seen whether this is a good start for the DCLG on the issue of sustainability, but irrespective of the outcome it is hoped that the Olympics will provide an excellent forum for focused debate and the combination of ideas across related sectors.

The Institute of Acoustics has proposed a number of objective targets to provide enhanced standards for protection from external and internal noise in and around the built environment. Acoustics is of course only part of the solution, but it is a crucial step towards building

a more complete picture of what sustainable building and living actually means in practice.

The way forward

It seems that it does little good to attempt to consider 'sustainable building' without 'sustainable living' as an integral part. This raises significant challenges. If the concept of sustainability is to be converted to viable building designs and industry standards, we need to work together with the government and private sector leaders to provide meaningful guidance.

Such guidance should be focused on providing holistic solutions for the construction industry to build, together with incentives to encourage the standards to be adopted within the time scales set by global warming, and interpreted by the Kyoto protocol which has set targets and limits on greenhouse gas emissions. Providing input to the DEFRA-led Sustainability Buildings Task Group and the newly formed Academy for Sustainable Communities may be routes for acousticians to follow.

The Institute of Acoustics intends to continue its proactive stance on this topic, encouraging its members who are involved in the construction industry to introduce the concepts into projects without delay. There will be a particular focus on sustainability at the Spring Conference in April 2007, when there will be plenty of opportunity for debate on the issues raised in this article. It will also be a chance to help the Institute meaningfully to translate and communicate the concept of acoustics within sustainability. The subject is certainly not going away. The July 2006 heat wave may be a literal sign of things to come, with scorching hot weather perhaps the most obvious reminder that we must all help move sustainability forward.

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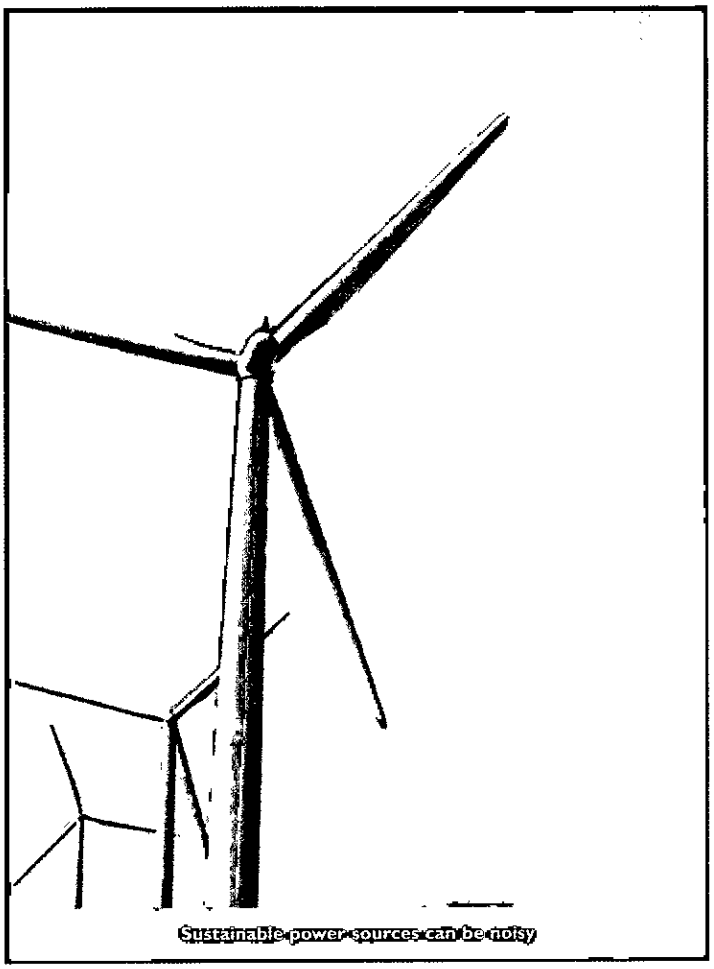


Amplified music from licensed premises

Jim Griffiths & John Seller. Developing the New Night-time Noise Offence

Background to the study

It is intended to bring licensed premises within the scope of the Noise Act 1996 to complement and add to existing powers. It will provide a mechanism that is relatively easy to use and can be fully implemented in response to a complaint on the night that any problem arises. The aim is to fill any gap in existing legislation and reduce the time to provide effective enforcement. Such a measure is required to help counter the potential for increased noise disturbance owing to the liberalisation of the licensing regime brought about by implementation of the Licensing Act 2003 in late 2005. Existing legislation is generally adequate to cope with most noise problems from licensed premises, however, the new powers are intended to provide a rapid reaction to problems when they first arise, with the penalties aimed at discouraging recurrence of the problem.

Currently the Noise Act 1996 only applies to noise from dwellings and there are concerns that the existing noise level measurement protocol and criteria might not be well suited to entertainment noise from licensed premises. Consequently, DEFRA commissioned Capita Symonds Ltd and the Building Research Establishment jointly to study methods and criteria for assessment of entertainment noise from licensed premises. This was Phase II of the project 'Noise from pubs and clubs: NANR 163' and the final report was published in May 2006 [1].

Phase I

Phase I of the project [2] had been completed in 2005, and can be summarised as a detailed literature review of research into noise from pubs and clubs and current custom and practice in assessing such noise across England and Wales. Phase I of the project made recommendations as to further 'validation' of various methods and criteria for assessing noise from pubs and clubs.

One outcome was the development of a table of candidate methodologies and criteria for assessment of noise from pubs and clubs, so that further testing and comparative assessments to determine their effectiveness could proceed. This table is reproduced as Table 1.

Table 1: Methodologies and criteria from Phase 1

name	parameter	type
IOA working group annex	L_{Aeq} vs. L_{A90} plus L_{10} vs. L_{90} in 40-160 Hz third-octave bands	relative
BS 4142/Noise Act 1996	L_{Aeq} vs. background (L_{A90}, L_{A99} *etc*)	relative
Noise Rating curve	third-octave (L_{eq}, L_{10} or L_{max}) vs. NR curve	absolute
absolute L_{Aeq}	L_{Aeq}	absolute
DIN 45680/Moorhouse	10-160 Hz third-octave L_{eq} vs. reference curve	absolute
inaudibility	subjective	relative

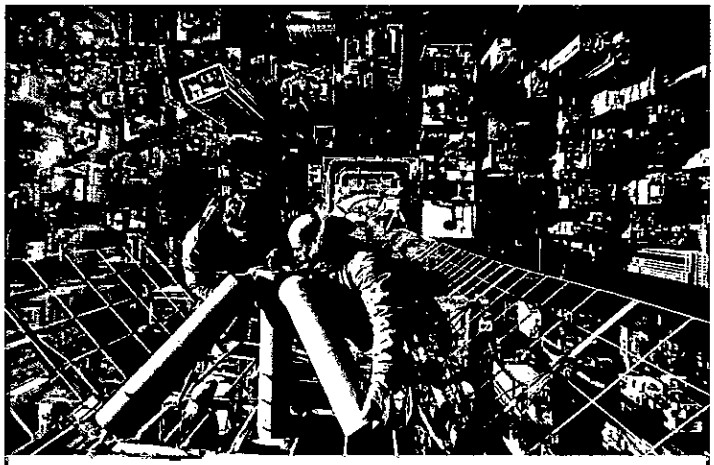
Phase I of the project also concluded that 'laboratory testing produces more reliable judgements from subjects and gives more control over the sound fields being heard'. Consequently, Phase II of the study was primarily based on laboratory testing, with field trials to determine the practicality of using various noise metrics.

Phase II Scope of study and specification

The original purpose of this project was to scrutinise the different methods for assessing the impact of entertainment noise from pubs and clubs at night, and to develop an appropriate rating method to complement the application of the provisions of the Noise Act 1996 to licensed premises. In the course of the study the number of variations of different assessment methods increased to 18.

Other important parameters that defined the scope of the study included:

- The study only related to entertainment noise, including amplified music, singing, speech and sports TV broadcasts sourced from inside and within the curtilage of pub and club type licensed premises.
- The project focused on the assessment of noise from infrequent and one-off entertainment activities operating between 23:00h and 07:00h, with a view to determining which methods were best suited to gauging the impact of such noise on persons trying to sleep.
- The methodology developed will be mindful of the alternative legislation already available for use by Environmental Health Practitioners (EHPs) eg the Licensing Act 2003, Anti-social Behaviour Act 1998 as amended, and the statutory nuisance provisions of the Environmental Protection Act 1990.
- The preferred outcome was a single methodology and criterion, although it was identified that this might not be practicable in all situations and a matrix of methodologies may be a better approach.
- It must be practicable for EHPs to use the methodologies and enforce criteria, which in order to allow licensees to comply must fair and reasonable.



It must be practicable for EHPs to use the methodologies

Laboratory tests

BRE Test Facilities

Laboratory tests were carried out at the Building Research Establishment during January 2006. The decision was made to use houses rather than listening rooms, partly because it enabled testing of noise sources from within the building and from outside the building, but also because it created a more realistic environment for subjects. Two identical houses were used, each of which had three upstairs bedrooms. One test subject was in each bedroom.

The microphone for each noise analyser was positioned in the centre of the room away from the window and at least 1m from any reflecting surface. Noise measurements were taken in each room of all noise indices, including the background L_{A90} both with and without the entertainment noise.

Types of music and sound system

The sound system was chosen to be representative of a typical high performance system that might be installed in a club. Four different noise types were used for the laboratory testing:

(A) Guitar-oriented rock. This style of music typically operates with peak low frequency noise levels in the 63Hz and 125Hz octave bands, and a developed and extended frequency spectrum with additional peaks at mid to high frequency

(B) Modern dance music. 'House' and 'Drum 'n' bass' and other modern dance music types have a reputation for persistent virtually non-stop low frequency bass thump, often peaking in the 63Hz octave band, sometimes

with significant energy in the 40Hz and 50Hz third-octave bands, and then a pronounced and steep drop-off in levels at mid to high frequency in the spectrum.

(C) Non-music entertainment noise. Sport noise is not uncommon in pubs and bars, an example being a football match being shown on a large TV or video screen. The spectrum of this type of noise typically has a fairly flat profile with modest peaks in lower frequency octave bands.

(D) Karaoke. The vocal content (of varying subjective quality) is often emphasised over the backing music compared with other music types and this sort of entertainment can be played at relatively high levels. The vocal element is significant and the frequency spectrum typically has peaks in the 63Hz or 125Hz octave bands and also in the mid frequency range of 500Hz to 2kHz.

Each noise type was presented to the test subjects at five different levels. These were subjectively described as:

1. inaudible to an average listener
2. just audible to an average listener
3. plainly audible ie the content of the noise is communicated to the test subject so they can recognise its type (music or speech etc) but the content is not intelligible
4. clearly audible ie the noise is communicated so that the content is intelligible to an average person and subjects can make out words and recognise songs and tracks
5. 'loud' to an average listener.

Five of the tests (total of 30 subjects) had the source of the noise in the ground floor of the test houses to simulate structure-borne transmission from a noise source within the same building. In another five tests, the noise sources were outside the test houses, to simulate airborne transmission from a noise source outside the building.

Recruitment of test subjects and experimental protocol

There was a total of 60 experimental subjects. Subjects were selected according to a number of criteria, in order to cover a broad mixture of the population. The pre-selection questionnaire was designed to obtain information on the age and sex of volunteers, any level of hearing impairment, and a confirmation of their ability to hear and understand instructions, and to read and complete questionnaires. The average age of the subjects was just under 45 years.

Two questionnaires were used during the testing. The first was Questionnaire A used at the end of each noise segment, ie 20 times during the testing (four types of entertainment at five noise levels). The questionnaire included a series of questions regarding environmental comfort, and then more specifically relating to the noise and the overall acceptability: this was used as the primary target variable for the analysis. The second questionnaire was presented after the noise segments were finished, and asked for some background information about the subjects, including their general attitudes to noise and entertainment noise, and some information about their normal exposure to entertainment noise.

Testing took place in the late evening. This was to make the tests as psychologically and physiologically realistic as possible. Previous work has shown differences in responses between daytime and evening testing, and as the main research questions in this project relate to the impact of entertainment noise at home during the evening and night, moving the testing into the evening seemed an obvious and necessary decision.

Results (noise measurements)

During each laboratory test the noise levels were recorded continuously in each test room. This allowed checks for any anomalies in noise levels. The noise analysers continuously recorded a large range of noise indicators, including L_{Aeq}, L_{Ceq} and third-octave L_{eq} spectra every 125ms. These short time intervals allowed various noise indicators, including statistical indicators, to be calculated for each noise condition.

Two further test runs were carried out, one for airborne and one for structure-borne transmission, with no subjects in the test rooms. Data from

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Amplified music from licensed premises - *continued from page 19*

these tests were used to calculate a number of different noise indicators.

Each noise indicator was calculated separately for each room and each noise condition (combination of airborne/structure-borne transmission, noise type and level). This gave a total of 40 noise conditions for each of the six rooms.

Noise metrics

The following noise indicators were calculated for each noise condition and room:

Institute of Acoustics Draft Good Practice Guide on the Control of Noise from Pubs and Clubs – Annex 1: Criteria and Measurement Guides

'A' weighted: difference between L_{Aeq} of entertainment noise (logarithmic subtraction of L_{Aeq} with entertainment noise and L_{Aeq} without entertainment noise) and L_{A90} without entertainment noise

Third-octave: difference between L_{A10} of entertainment noise (assumed to be logarithmic subtraction of L_{A10} with entertainment noise and L_{A10} without entertainment noise) and L_{A90} without entertainment noise in third-octave bands between 40Hz and 160Hz.

The maximum value in any of these bands was then used for the analysis

Maximum value of each of the above

Noise Act / BS.4142

Noise Act methodology: L_{Aeq} minus $L_{A99.8}$ with entertainment noise present for both.

BS.4142 methodology: L_{Aeq} minus L_{A90} with entertainment noise not present for L_{A90} measurement

Noise Rating (NR) curves

NR based on octave band L_{eq} measurements
NR based on octave band L_{10} measurements
NR based on octave band L_{90} measurements
NR based on octave band L_{max} measurements

Absolute L_{Aeq}

The Moorhouse modification of the DIN 45680 methodology for investigating low frequency noise

Maximum exceedance of third-octave band L_{eq} measurements over reference curve in the range 12.5Hz to 160Hz

'C' weighted

Absolute L_{Ceq}
L_{Ceq} minus $L_{C99.8}$ with entertainment noise present for both
L_{Ceq} minus L_{C90} with entertainment noise not present for L_{C90} measurement

Comparative L_{90}

L_{A90} (with entertainment noise) minus L_{A90} (without entertainment noise)
L_{C90} (with entertainment noise) minus L_{C90} (without entertainment noise)
Short temporal averaging (using $L_{eq,125ms}$ measurements to assess the quietest period with entertainment noise on, the quietest 125ms being the $L_{99.95}$ for a five-minute measurement)
L_{Aeq} minus $L_{A99.95}$
L_{Ceq} minus $L_{C99.95}$

Inaudibility (assessed directly from responses to questionnaires)

Analysis of laboratory tests

Figures 1 and 2 show L_{Aeq} and L_{Ceq} noise indicators for each noise condition (respectively for the structure-borne and airborne transmission arrangements). It can be seen that the C-weighted indicator is less sensitive to noise types C and D (sports event and karaoke), where there is less low-frequency noise.

The distribution of responses was examined, and extreme and outlier responses were identified. Box plots are available for all the subjective responses and noise metrics. As an example, Figure 3 shows the box plots for responses on acceptability (1: clearly acceptable, 5: just acceptable, 6: just unacceptable, 10: clearly unacceptable), for each noise type and level. As a brief key to the box plots, the boxes themselves indicate the bounds of the upper and lower quartiles of the responses, and the bold line in the middle is the median response. The circle points are outliers, and the star points are extreme values. Outliers and extreme values were removed from further

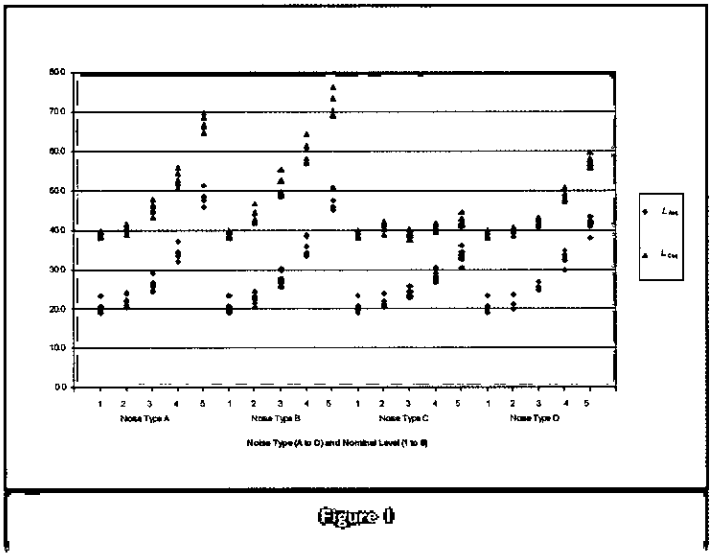

Figure 1

L_{Aeq} and L_{Ceq} indicators for tests with structure-borne transmission

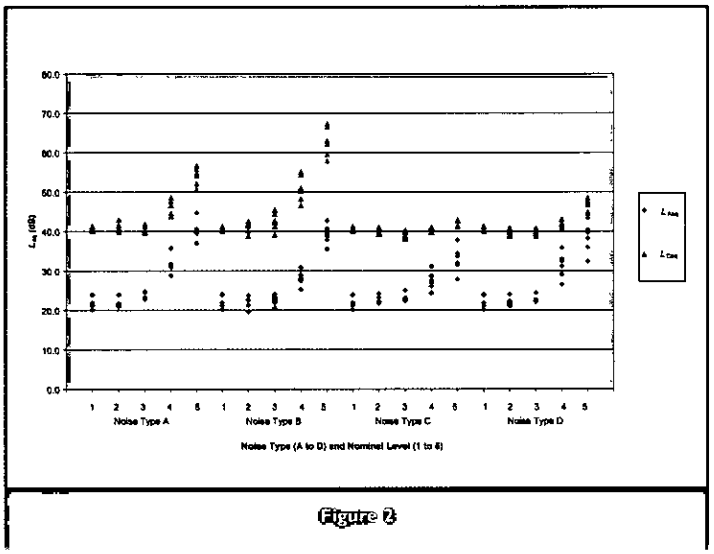

Figure 2

L_{Aeq} and L_{Ceq} indicators for tests with airborne transmission

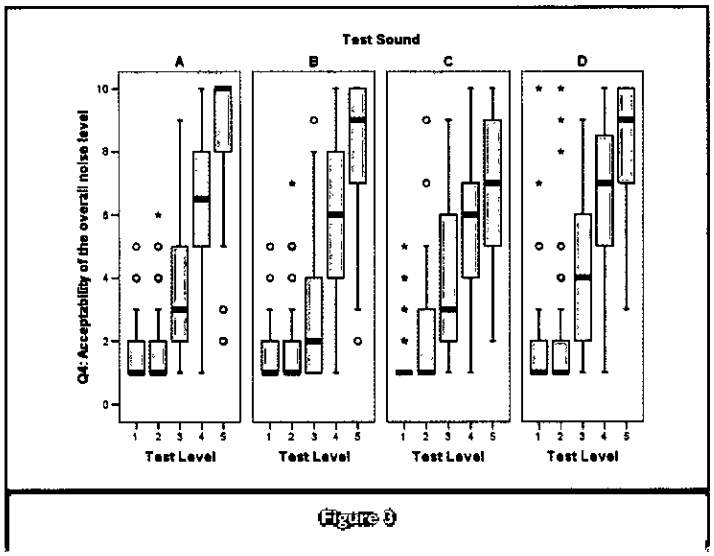

Figure 3

Responses on acceptability of the overall noise level by test condition

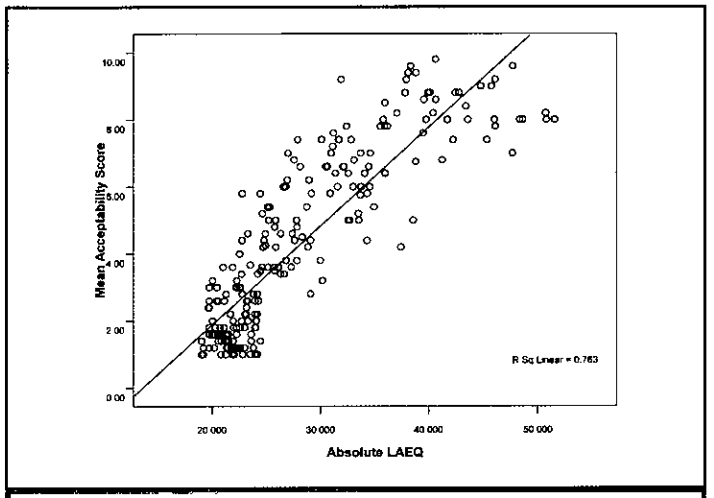

Figure 4

Acceptability ratings in the laboratory for Absolute L_{Aeq}

Table 2: Spearman's rho coefficients for acceptability of level of sound and noise metrics

	Spearman's Rho				
metric	all sounds	sound A (rock)	sound B (dance)	sound C (sport)	sound D (karaoke)
IOA A-weighted	0.765 (3)	0.801	0.779 (3)	0.698	0.769 (3)
IOA max third-octave exceedance	0.598	0.724	0.728	0.550	0.657
IOA max exceedance	0.621	0.724	0.728	0.632	0.680
Noise Act L_{Aeq}-$L_{A99.8}$	0.732	0.763	0.757	0.682	0.741
BS.4142 L_{Aeq}-L_{A90}(no music)	0.756	0.800	0.762	0.697	0.750
NR L_{eq}	0.735	0.800	0.752	0.648	0.724
NR L_{10}	0.776 (2)	0.811 (3)	0.804 (1)	0.698	0.775 (2)
NR L_{90}	0.529	0.769	0.397	0.468	0.469
NR L_{max}	0.576	0.633	0.623	0.280	0.739
absolute L_{Aeq}	0.781 (1)	0.828 (1)	0.784 (2)	0.720 (1)	0.781 (1)
Moorhouse max exceedance	0.499	0.717	0.761	0.107	0.540
L_{Ceq}	0.571	0.762	0.774	0.264	0.687
L_{Ceq}-$L_{C99.8}$	0.399	0.660	0.766	-0.213	0.493
L_{Ceq}-L_{C90}(no music)	0.534	0.739	0.766	0.148	0.582
L_{A90}-L_{A90}(no music)	0.761	0.815 (2)	0.778	0.702 (2)	0.754
L_{C90}-L_{C90}(no music)	0.610	0.777	0.734	0.430	0.587
L_{Aeq}-$L_{A99.95}$	0.745	0.776	0.756	0.699 (3)	0.753
L_{Ceq}-$L_{C99.95}$	0.397	0.655	0.771	-0.250	0.493

Key for correlation tables:
(1) most significant correlation
(2) 2nd most significant correlation
(3) 3rd most significant correlation

analysis. In the case of sound D, one respondent told us that she had completed the first few iterations of the questionnaire using the scale in reverse, and that explains most of the very high extreme values for the lowest sound levels.

If subjects indicated that they had heard entertainment noise, they were asked what impact the noise would have on their daily activities. It is clear from these charts that entertainment noise at levels 1, 2 and 3 would not be considered a major disruption by most subjects, but at level 4, the disturbance is becoming more obvious.

Tests were carried out on potentially confounding variables to determine if they had an effect on the level of acceptability of entertainment noise. These included age, sex, test house, sources of sound, types of sound, types of location, locations, types of property, whether or not entertainment noise can be heard indoors at home, level of annoyance with entertainment noise heard at home and the level of hearing impairment. Differences were observed with the various sound level groups (four distinct groups were identified) and one of the test rooms although this was only just significant and likely to be a spurious result rather than a meaningful one.

The data for noise metrics versus acceptability for the four different sound types are shown in Table 2. The results indicate that the best across-the-board metric was the absolute L_{Aeq}. This metric had the strongest two correlations for all four noise types. No other metric had such a consistent predictive performance with subjective response. For the other noise metrics, different ones were strong for different noise types: for example. the C-weighted metrics only made a showing for the dance music, and the IOA A-weighted (L_{Aeq} with entertainment noise minus L_{A90} without entertainment noise) was only strong for the sports and karaoke.

All of the correlations are significant, and almost all are positive, indicating a strong positive linear relationship between the level of noise measured (as indicated per metric) and acceptability of the level of noise. The correlations were repeated controlling for overall comfort. While the correlations did become a little stronger when overall comfort was controlled for, there was not a large difference and the order of correlations remained pretty much the same.

Figure 4 shows a plot of the mean acceptability score for each absolute LAeq value experienced. The linear regression line through the data explains around 76% of the variance in the data. This graph can be used to determine appropriate noise targets.

The second best predictive performer in the laboratory testing was L_{A90} minus L_{A90} (no music). Figure 5 shows the scatter plot of acceptability for these metrics. The variance explained by this regression is much lower than with absolute L_{Aeq}, and it is clear by inspection that the regression line is a poorer predictor of the acceptability rating.

Inaudibility

One of the suggested noise metrics tested was inaudibility, which is an assessment that assumes acceptability to be linked with inaudibility. Figure 6 shows the frequencies at each acceptability rating, split according to whether or not the subject reported hearing the entertainment noise. It is clear that in many cases, subjects who were able to hear the entertainment noise nevertheless considered it acceptable. This indicates that an assessment method based on inaudibility would significantly underestimate the acceptability ratings of the people experiencing the noise.

Semantic descriptor and L_{Aeq} from the laboratory tests

According to the regression between subjective acceptability rating and noise level in absolute L_{Aeq}, Table 3 shows the L_{Aeq} levels associated with each value of acceptability. For example, if the objective of the new criterion is to reflect the level at which householders feel the noise is 'just unacceptable', the target absolute L_{Aeq},5min should be 34dB, or somewhere between 34 and 37 dB, being the range of the first two scores for unacceptability.

Field trials

The primary objective of the field trials was to assess the practicability of

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Amplified music from licensed premises - *continued from page 21*

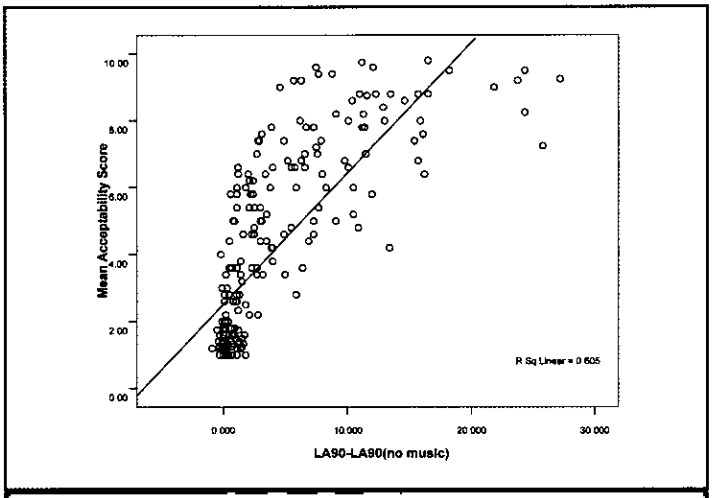

Figure 5

Acceptability ratings in the laboratory by L_{A90} minus L_{A90} (no music)

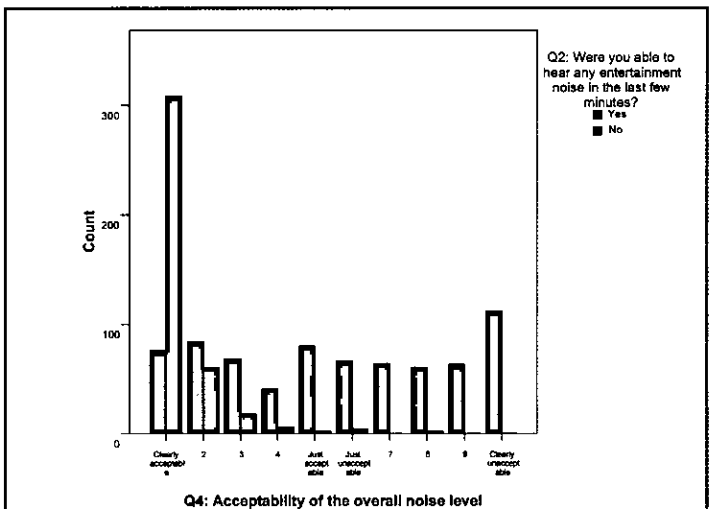

Figure 6

Frequency at each acceptability rating by whether or not the subject could hear the noise

using the assessment methods found under laboratory conditions to have the best correlation with subjective response to entertainment noise in real world conditions. The field trials aimed to cover variables such as urban and rural environments, geographical spread within the UK, and significantly different background noise climates. Furthermore, the venues were selected so that they included those:

- with a recognised noise problem;
- with an acceptable noise climate;
- on the 'borderline'.

Field trials were undertaken at ten venues around the UK across a good range of venues (pubs, clubs and town halls), locations (urban, towns and rural) and types of music. For consistency, the equipment used for the field trials was the same as that used for the laboratory tests. Questionnaire B was developed for the use of EHPs and was similar to that used in the laboratory testing.

At each venue there were at least two, and in most cases three, EHPs who

Table 3: Semantic descriptor and associated value of acceptability

semantic descriptor	score	absolute $L_{Aeq,5\ minutes}$
Clearly acceptable	1	17.0
	2	20.4
	3	23.8
	4	27.2
Just acceptable	5	30.6
Just unacceptable	6	34.0
	7	37.4
	8	40.8
	9	44.2
Clearly unacceptable	10	47.5

completed the questionnaires regarding their perception of the noise both inside, and immediately outside, each selected residential location. Where possible, EHPs from neighbouring local authorities also took part, in case existing noise issues at the venue affected the opinions of the local officers.

Background noise measurements were generally taken immediately before the music was played at 'normal' operational levels within the pub or club. The measurements were taken directly outside the residential property and in the worst affected habitable room.

Where possible, the noise measurements with the music noise being assessed were taken after 23:00h. However, this was not always possible as some of the pubs closed at 23:00h. In some cases it was practical to undertake the noise assessment soon after completion of the background noise measurements. In these circumstances the EHPs were instructed to assess the music noise as if the event was after 23:00h.

Method

To ensure consistency at each of the ten field trials the following methodology was adopted. At most of the noise measurement locations a five-minute background noise measurement was made inside and outside the selected residential property before the start of the music event at the venue. The external levels were taken 1m from the façade of the residential property behind which was the room where the internal measurements were taken. The internal background noise measurements followed the same

Test houses at BRE

Internal view of (L) a test room and (R) a source room

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Amplified music from licensed premises - *continued from page 22*

methodology as the laboratory tests: the windows were closed and the microphone was located close to the centre of the room at least 1m away from any reflecting surfaces. These measurements were taken as close as possible to the time of the music events. The measurements with entertainment noise present followed the same procedure and were measured at the same locations.

Briefing documents were provided to the residents and licensees for each field trial. These documents detailed the project objectives and provided information about the laboratory and field trials. A further document was given to the participating EHPs which requested the existing entertainment noise assessment criterion and enforcement methods used by the participating local authorities.

On completion of the assessments the tests were repeated if either (a) the source noise levels could be significantly varied, or (b) there was another habitable room where the assessment could be repeated. The latter was a useful exercise when there was direct sound transmission via a party wall or floor from the venue to the residential receptor, as it was usually relatively easy to move to a room in the dwelling less affected by the noise from the licensed premises.

The completed questionnaires and the associated five-minute noise measurements were then analysed as before for the laboratory tests. Where possible, 15-minute samples were also taken of noise levels in the test dwelling, although this was difficult to achieve in practice as it required co-operation from the residents in the late evening. A total of 14 EHPs were involved in the assessments, making a total of 75 assessments for 10 venues. Between one and four assessments were made at each venue at different locations.

Analysis

Acceptability is rated by the EHPs on a ten point scale, where 1 is clearly acceptable, 5 is just acceptable, 6 is just unacceptable and 10 is clearly unacceptable. Table 4 shows the mean scores for acceptability of the entertainment noise heard, when judged as a one-off or infrequent event, and when judged as a regular event. As might be expected, noise levels were more likely to be considered acceptable when judged as one-off events than when judged as regular events.

Table 5 shows the correlation coefficients between the responses on acceptability made by EHPs to entertainment noise, when considered as a one-off event. The range of coefficients was greater than for the laboratory testing data, with some metrics giving very weak correlations. Absolute L_{Aeq} was the strongest predictor of householder response in the laboratory testing, and it provides a fair but not strong prediction of EHP response in the field. The strongest predictor of EHP response across all assessments in the field was L_{A90} minus L_{A90} (no music). The equivalent table for entertainment noise judged as a regular event is shown in Table 6.

In general, the correlation coefficients between EHP rating of acceptability and noise metrics were fairly weak. This is probably because the individual variation in response between the EHPs had a greater influence on the outcome of the statistical analysis, partly because of the lower sample size of EHPs (14) in the field tests compared with the sample of members of the public (60) used in the laboratory tests. Extraneous noise such as road traffic and people in the street had a much greater confounding impact on the measured noise levels at some of the field test sites in comparison with the laboratory tests, where the influence of extraneous noise on the measurements was minimal.

It should be noted that L_{A90} minus L_{A90} (no music) requires a second measurement, as the metric requires measurement both with and without the entertainment noise. This makes it a less practical tool for environmental noise assessment, particularly when dealing with enforcement for one-off events on the night in question. Values missing because the L_{A90} (no music) measurement could not be arranged may also affect the results for this measure.

Assessment of laboratory and field testing

The performance of each of the proposed noise metrics is summarised in Table 7. This includes the correlation coefficients with acceptability ratings of test subjects in the laboratory testing, and with the ratings of EHPs in the field testing, as well as judgements on practicality, ease of comprehension and use.

Table 4: Acceptability ratings of entertainment noise by EHPs judged as one-off and regular events.

venue	How would you rate the current level of entertainment noise overall...	
	...for a one-off event? (Q5)	...for a regular event? (Q11)
1. London club	4.25	5.75
2. Bristol pub	4.83	6.00
3. Bristol club	2.75	4.75
4. Milton Keynes club	2.50	3.38
5. Milton Keynes pub	5.63	6.25
6. North Hertfordshire Town Hall	9.50	10.00
7. Sheffield club	7.38	8.75
8. Nottinghamshire miners' club	3.25	3.88
9. Skipton, North Yorkshire pub (town)	4.67	6.67
10. Skipton, North Yorkshire pub (rural)	7.33	9.33

Table 5: Spearman's rho coefficients for acceptability of level of sound and measures of sound, for entertainment noise judged as a one-off event

metric	How would you rate the current level of entertainment noise overall, for a one-off event?		
	all measures	inside measures	outside measures
IOA A-weighted	0.511	0.375	**0.651 (2)**
IOA max third-octave exceedance	0.676	**0.813 (2)**	0.309
IOA max exceedance	0.676	**0.813 (2)**	0.309
Noise Act L_{Aeq}-$L_{A99.8}$	0.110	0.261	-0.195
BS.4142 L_{Aeq}-L_{A90}(no music)	0.518	0.526	0.578
NR L_{eq}	0.403	0.304	0.322
NR L_{10}	0.531	0.602	0.435
NR L_{90}	0.434	0.425	0.365
NR L_{max}	0.245	-0.057	0.532
absolute L_{Aeq}	0.507	0.508	0.491
Moorhouse max exceedance	0.547	0.552	0.472
L_{Ceq}	0.545	0.628	0.520
L_{Ceq}-$L_{C99.8}$	0.260	0.166	-0.112
L_{Ceq}-L_{C90}(no music)	**0.732 (2)**	**0.798 (3)**	0.564
L_{A90}-L_{A90}(no music)	**0.757 (1)**	**0.833 (1)**	**0.713 (1)**
L_{C90}-L_{C90}(no music)	**0.714 (3)**	0.714	**0.621 (3)**
L_{Aeq}-$L_{A99.95}$	0.128	0.302	-0.195
L_{Ceq}-$L_{C99.95}$	0.303	0.290	-0.028

Basis for assessment of noise metrics

The primary aim of the research is to test which noise metrics best represents the ratings of householders, and it is important that the noise metrics recommended in this project are firmly supported by the controlled laboratory testing, rather than trying to find the closest to what EHPs are currently doing. The metrics are therefore assessed on their correlation with subjective response to entertainment noise, and on their practicality and ease of comprehension in the field.

Conclusions

In this study the majority of members of the public recruited as laboratory test subjects reported the ability to tolerate a modest degree of audibly intrusive entertainment noise and that the threshold of audibility did not equate to a measure of acceptability. The noise metric that provided the best overall prediction of subjective ratings was the absolute L_{Aeq}.

Field testing was carried out to test the practicability of the different noise metrics, and to record the assessments made by EHPs to the entertainment noise being measured. The best performing metrics in the laboratory testing have potential drawbacks in the field, so there is no clear recommendation. The following options are considered the best available for assessing noise from one-off events after 23:00h.

Absolute L_{Aeq} with an additional subjective judgement, at a single action level, would be less relevant in the context where the ambient noise level is at or close to the action level even without the entertainment noise. An action level in terms of absolute L_{Aeq} is recommended, with the proviso that the entertainment noise itself is a clearly audible contributor to the overall noise. The action level can be that at which subjects felt the noise was 'just unacceptable' in the context of a one-off event in a habitable room with windows closed: 34dB $L_{Aeq,5min}$.

Table 6: Spearman's rho coefficients for acceptability of level of sound and measures of sound , for entertainment noise judged as a *regular event*

metric	How would you rate the current level of entertainment noise overall, for a regular event? all measures	inside measures	outside measures
IOA A-weighted	0.461	0.330	0.561
IOA max third-octave exceedance	**0.604 (3)**	**0.766 (2)**	0.260
IOA max exceedance	**0.604 (3)**	**0.766 (2)**	0.260
Noise Act L_{Aeq}-$L_{A99.8}$	0.079	0.225	-0.225
BS.4142 L_{Aeq}-L_{A90}(no music)	0.446	0.470	0.460
NR L_{eq}	0.399	0.255	0.451
NR L_{10}	0.529	0.572	0.530
NR L_{90}	0.442	0.422	0.441
NR L_{max}	0.231	-0.093	**0.574 (2)**
absolute L_{Aeq}	0.498	0.461	**0.562 (3)**
Moorhouse max exceedance	0.523	0.483	0.543
L_{Ceq}	0.549	0.628	**0.588 (1)**
L_{Ceq}-$L_{C99.8}$	0.274	0.207	-0.109
L_{Ceq}-L_{C90}(no music)	**0.665 (2)**	**0.739 (3)**	0.477
L_{A90}-L_{A90}(no music)	**0.679 (1)**	**0.786 (1)**	0.622
L_{C90}-L_{C90}(no music)	0.599	0.639	0.467
L_{Aeq}-$L_{A99.95}$	0.092	0.259	-0.225
L_{Ceq}-$L_{C99.95}$	0.324	0.329	-0.004

Table 7: Summary of performance of each noise metric, laboratory and field tests

Metric	laboratory: Correlation with acceptability ratings of subjects in laboratory testing	field: Practicality for use in the field	field: Ease of understanding and use
IOA A-weighted	**0.765**	medium	high
IOA max third-octave exceedance	0.598	low	low
IOA max exceedance	0.621	low	low
Noise Act L_{Aeq}-$L_{A99.8}$	0.732	medium	medium
BS4142 L_{Aeq}-L_{A90}(no music)	0.756	medium	medium
NR L_{eq}	0.735	low	medium
NR L_{10}	**0.776**	low	medium
NR L_{90}	0.529	low	medium
NR L_{max}	0.576	low	medium
absolute L_{Aeq}	**0.781**	high	high
Moorhouse max exceedance	0.499	low	low
L_{Ceq}	0.571	high	medium
L_{Ceq}-$L_{C99.8}$	0.399	medium	low
L_{Ceq}-L_{C90}(no music)	0.534	low	low
L_{A90}-L_{A90}(no music)	0.761	low	medium
L_{C90}-L_{C90}(no music)	0.610	low	low
L_{Aeq}-$L_{A99.95}$	0.745	medium	medium
L_{Ceq}-$L_{C99.95}$	0.397	medium	low

L_{A90} minus L_{A90} (no music) allows the background level to be considered, but requires a measurement without noise, which may not be possible. In practice the metric may be unusable for one-off events.

L_{Aeq} minus $L_{A99.98}$ or 'Noise Act' metrics include some consideration of the underlying noise level, without requiring a separate measurement without the music. The former is slightly better at predicting subjective response than the latter, but not substantially so, and the Noise Act method has logistical advantages. The performance of both metrics was weaker than the options above, but they avoid the practical disadvantages.

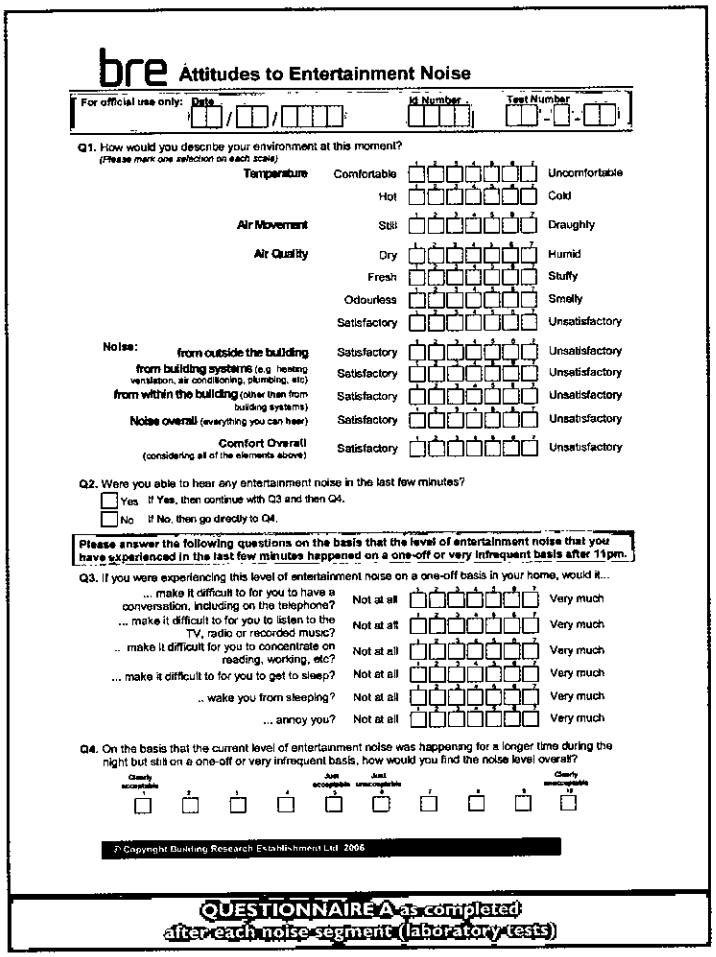
Jim Griffiths FIOA, formerly with Capita Symonds, is now with Vanguardia Consulting

John Seller MIOA is with the Building Research Establishment

References

[1] Noise from Pubs and clubs (Phase II), Final Report: DEFRA contract NANR 163, Capita Symonds and Building Research Establishment (BRE), May 2006

[2] Noise from Pubs and Clubs, Final Report – Phase 1: DEFRA contract NANR 92, University of Salford and Hepworth Acoustics, March 2005



bre **Attitudes to Entertainment Noise**

For official use only: Date / / Id Number Test Number - -

Q1. How would you describe your environment at this moment?
(Please mark one selection on each scale)

Temperature	Comfortable	Uncomfortable
	Hot	Cold
Air Movement	Still	Draughty
Air Quality	Dry	Humid
	Fresh	Stuffy
	Odourless	Smelly
	Satisfactory	Unsatisfactory
Noise: from outside the building	Satisfactory	Unsatisfactory
from building systems (e.g. heating ventilation, air conditioning, plumbing, etc)	Satisfactory	Unsatisfactory
from within the building (other than from building systems)	Satisfactory	Unsatisfactory
Noise overall (everything you can hear)	Satisfactory	Unsatisfactory
Comfort Overall (considering all of the elements above)	Satisfactory	Unsatisfactory

Q2. Were you able to hear any entertainment noise in the last few minutes?
☐ Yes If Yes, then continue with Q3 and then Q4.
☐ No If No, then go directly to Q4.

Please answer the following questions on the basis that the level of entertainment noise that you have experienced in the last few minutes happened on a one-off or very infrequent basis after 11pm.

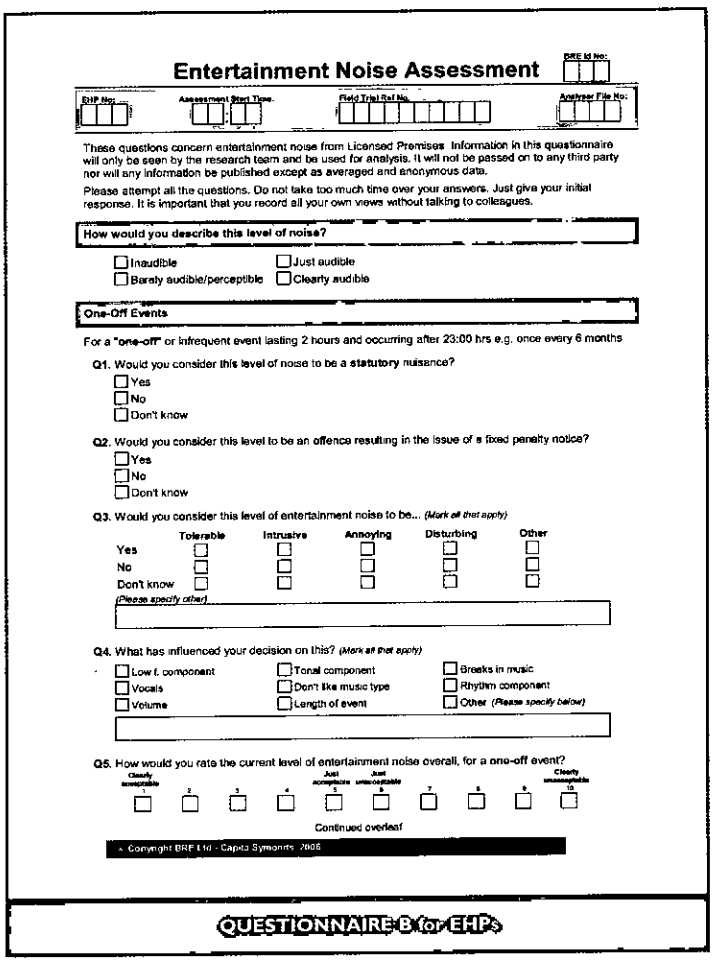
Q3. If you were experiencing this level of entertainment noise on a one-off basis in your home, would it...

... make it difficult to for you to have a conversation, including on the telephone?	Not at all	Very much
... make it difficult to for you to listen to the TV, radio or recorded music?	Not at all	Very much
... make it difficult for you to concentrate on reading, working, etc?	Not at all	Very much
... make it difficult to for you to get to sleep?	Not at all	Very much
... wake you from sleeping?	Not at all	Very much
... annoy you?	Not at all	Very much

Q4. On the basis that the current level of entertainment noise was happening for a longer time during the night but still on a one-off or very infrequent basis, how would you find the noise level overall?

Clearly acceptable 1 2 3 4 Just acceptable 5 Just unacceptable 6 7 8 9 Clearly unacceptable 10

QUESTIONNAIRE A as completed after each noise segment (laboratory tests)



Entertainment Noise Assessment

BRE Id No:

EHP No: Assessment Start Time: Field Trial Ref No: Analyser File No:

These questions concern entertainment noise from Licensed Premises. Information in this questionnaire will only be seen by the research team and be used for analysis. It will not be passed on to any third party nor will any information be published except as averaged and anonymous data.

Please attempt all the questions. Do not take too much time over your answers. Just give your initial response. It is important that you record all your own views without talking to colleagues.

How would you describe this level of noise?

☐ Inaudible ☐ Just audible
☐ Barely audible/perceptible ☐ Clearly audible

One-Off Events

For a "one-off" or infrequent event lasting 2 hours and occurring after 23:00 hrs e.g. once every 6 months

Q1. Would you consider this level of noise to be a statutory nuisance?
☐ Yes ☐ No ☐ Don't know

Q2. Would you consider this level to be an offence resulting in the issue of a fixed penalty notice?
☐ Yes ☐ No ☐ Don't know

Q3. Would you consider this level of entertainment noise to be... *(Mark all that apply)*

	Tolerable	Intrusive	Annoying	Disturbing	Other
Yes	☐	☐	☐	☐	☐
No	☐	☐	☐	☐	☐
Don't know	☐	☐	☐	☐	☐

(Please specify other)

Q4. What has influenced your decision on this? *(Mark all that apply)*

☐ Low f. component	☐ Tonal component	☐ Breaks in music
☐ Vocals	☐ Don't like music type	☐ Rhythm component
☐ Volume	☐ Length of event	☐ Other *(Please specify below)*

Q5. How would you rate the current level of entertainment noise overall, for a one-off event?

Clearly acceptable 1 2 3 4 Just acceptable 5 Just unacceptable 6 7 8 9 Clearly unacceptable 10

Continued overleaf

QUESTIONNAIRE B for EHPs

Perceived environmental noise from aircraft

Mike Swanwick. and how to halve it!

Introduction

These days more people want to fly, but there is great pressure to reduce the noise around airports. Over the years the aircraft have needed to change to accommodate these factors.

This article outlines the challenges and gives an idea of how industry deals with the individual noise sources that contribute to aircraft noise. Rolls-Royce has the objective of halving aircraft noise by 2020 for aircraft arrivals and departures, compared with noise levels in 2000.

Since 2000, about 4dB EPNL reduction has been achieved already. The objective of achieving a 10dB reduction by 2020 will, however, require the development and application of novel technologies, some of which are still in their infancy. What follows is written predominantly from an engine manufacturer's point of view, but some airframe, installation and operational issues are mentioned for completeness.

Noise is one of many parameters that are built into the aircraft design process. Other parameters include:

- Performance (power)
- Economy (fuel)
- Purchase cost
- Weight
- Emissions (gaseous and particulate)

Aircraft noise as a whole has many sources including:

- Airframe noise, mainly caused by 'spoilt' airflow across control surfaces and undercarriage;
- Engine noise, mainly caused by the turbo machinery;
- Jet noise, caused by the mixing of the hot and fast jet stream with the cold and slow surrounding air.

If these are identified and understood individually, then methods can be developed to reduce each individual source.

Past Progress

The 1960's turbojet has undergone a metamorphosis into the large by-pass ratio turbofan. With this, the thrust is produced in a more efficient way by moving a large amount of air slowly compared with the traditional method of moving a small amount of air quickly.

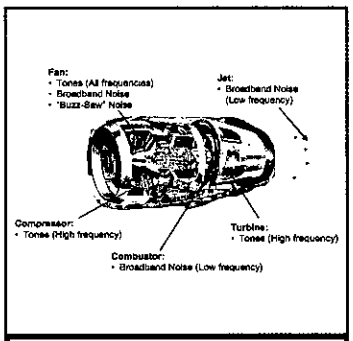
The increased fuel efficiency on this modern engine far outweighs the larger frontal area (causing potential drag) and the extra mass of a large turbofan. In addition to improvement in fuel efficiency, the turbofan has brought dramatic reductions in noise.

Engine Noise Sources

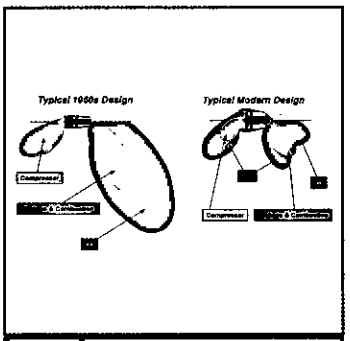
Fan

The fan produces both broadband noise and tones. As the fan speed increases for take-off and climb, the shocks ahead of the fan blade create very significant tones at harmonics of the blade passing frequency. In addition a lower frequency buzz-saw noise can be heard in the cabin forward of the engines, again at take-off and under climb conditions. Sweeping of blade angles can reduce the shock wave generation and optimising the blade and outlet guide vane numbers can reduce rotor/stator interaction tones.

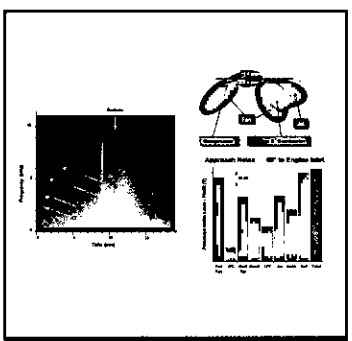
Broadband fan noise is created by the interaction of the blades and vanes with turbulence in the boundary layers and wakes. A good balance between low-noise and aero-efficiency has already been realised, but fan noise is still a dominant noise component.



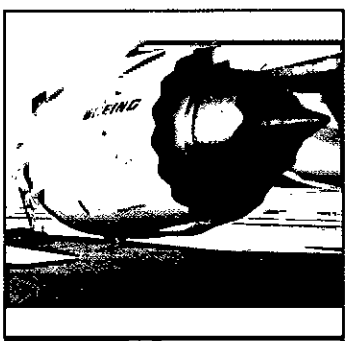
Engine noise identification



Engine noise sources - 1960s versus modern design



Noise sources on a typical modern engine



Nozzle lip treatment

Compressors

The compressors can be thought of as multi-stage fans which create interaction tones at many frequencies. Some compressor noise can be heard outside the engine in the forward direction, but it is not normally very important.

Combustion

The combustion process is generally not a dominant noise source, but it could potentially be important especially with the development of the new low-NOx combustors.

Turbines

The turbine produces noise in much the same way as the compressor. The sound propagates out of the rear of the engine and some of this tonal turbo-machinery noise becomes broader in bandwidth owing to spectral broadening as the tones propagate through the jet shear layers. The choice of numbers of blades and stators is critical for controlling turbine noise.

Jet

The jet produces a large turbulent mixing region to the rear of the aircraft, which creates noise. High frequency noise is created close to the nozzle, with lower frequency noise created further downstream. Shaping the nozzle can encourage mixing in the jet and reduce the low frequency noise, but sometimes the high frequency noise increases as a result. If the air can be slowed down or mixed more efficiently, jet

continued on page 28

Perceived environmental noise from aircraft - *continued from page 27*

noise will decrease. One method would be to move even more air with an 'ultra high by-pass ratio' (UHBR) engine.

Installation

The act of mounting the engine on the aircraft produces an increase in noise due to reflections from the airframe, and aerodynamic interactions between the jet and airframe. Acoustic treatment such as liners within the intake and by-pass ducting is very effective in reducing turbo-machinery noise.

Noise Reduction Technology

Nozzle lip treatment

Mixer nozzles have been used for many years as a way of reducing the noise produced when the fast air from the jet mixes with the relatively slow air of the surrounding atmosphere. However mixers can spoil the flow and cause performance deficits. Serrated nozzles can improve mixing with less of a performance deficit, and if the serrations can be made to retract in cruise (for example using shaped memory alloys) the noise benefit at take-off can be achieved with negligible performance penalties.

Low noise fan design

Small-scale model testing has improved understanding of the acoustic behaviour of the fan. Special techniques such as mode detection have been developed to measure the sound pressure level at the fan and determine the nature of noise propagation down both the intake and the by-pass ducts.

The shape, twist, chord length, angle of attack, number of blades, number of outlet guide vanes, and their interactions are all critical in finding an efficient solution that has less susceptibility to create strong tonal acoustic pressures that can escape the confines of the engine, and hence to optimise the fan for noise and aerodynamics.

Significant progress has been made in modelling the wave propagation using computational fluid dynamics, and this has enabled a computer-aided design to produce a fan blade of an optimum aerodynamic shape for efficient performance and low noise.

Zero-spliced and intake lip liners

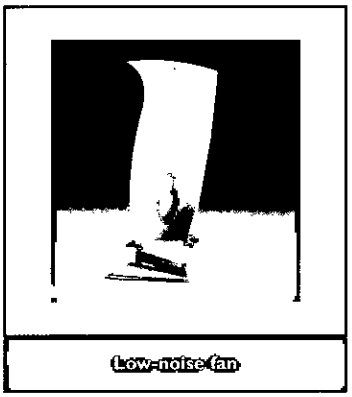
The acoustic treatment forward of the fan has served well in the past to reduce fan noise, and the more area for absorption the better. However the introduction of a continuous liner (without any manufacturing splices) provides an additional benefit in noise reduction. Furthermore the extension of the acoustic liner around the lip of the intake is more effective in reducing fan noise than would be expected from just the increase in liner area.

Negatively scarfed intake

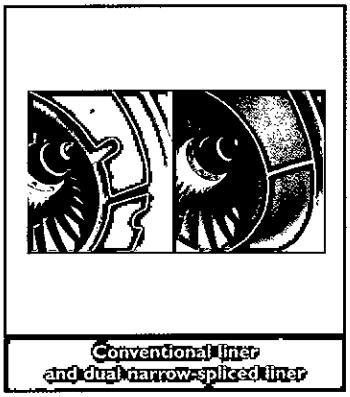
The intake is designed to entrain air onto the fan with equal pressure and a homogeneous flow. Because of the influence of the wing the angle of the front of the inlet is positively scarfed with the top of the intake protruding further forward than the bottom. However this top overhang acts as an acoustic mirror reflecting fan noise downwards during take-off. If the intake were to be angled the opposite way the fan noise would be reflected upwards. This is called a negatively scarfed intake.

Novel aircraft architectures

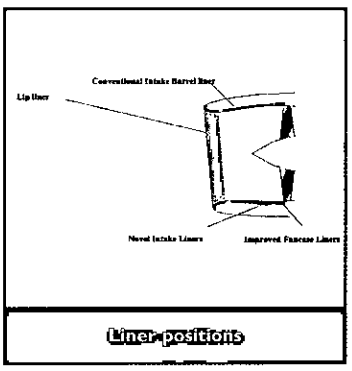
Aircraft designs are being considered that have unusual fuselage shapes and engine configurations. These are designed to minimise aerodynamic noise and mask the engine noise by hiding the engines above the wings as a natural noise barrier.



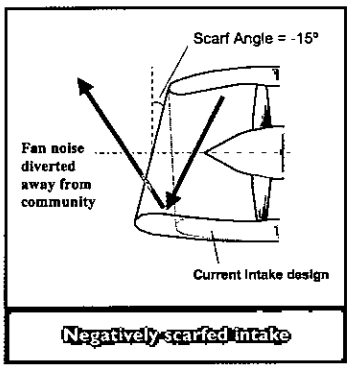
Low-noise fan



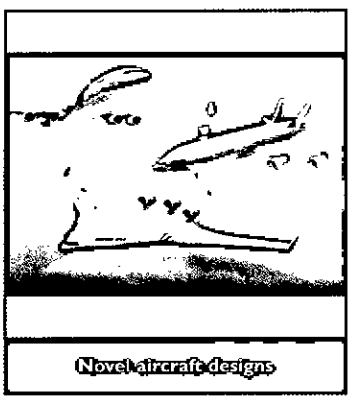
Conventional liner and dual narrow-spliced liner



Liner positions



Negatively scarfed intake



Novel aircraft designs

Alternative approach pattern

Advanced operational procedures

The noise impact upon a community is greatly affected by the position and distance of the aeroplane. If an alternative flight path can be agreed that avoids flying over a residential area then the noise on the community can be reduced. Advanced Continuous Descent Approaches (ACDA) reduce the noise impact, and these approaches are possible with the more sophisticated instrumented landing systems (ILS) on modern aircraft.

Conclusions

The applied technology has delivered some major reductions in overall perceived noise, but further progress is both necessary and possible. This will require sustained investment and substantial progress to reduce the many different complex noise sources that contribute to the aircraft noise signature.

Industry is conducting comprehensive noise research programmes, especially in Europe and the United States, involving many research establishments and Universities.

Many promising concepts for reducing noise are being developed, but further work is required to prove and develop the ideas for application in the very demanding aero-engine environment.

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Hand-arm vibration measurements: why bother?

Steve Wray.

Introduction

This article discusses the difficulties involved in carrying out a hand-arm vibration risk assessment. A sample risk assessment for a typical small engineering workshop is used to illustrate the problem. The Control of Vibration at Work Regulations 2005[1] require employers who carry out work which is liable to expose any of their employees to risk from vibration to carry out a risk assessment. The risk assessment must identify whether any employees are likely to be exposed to vibration at or above any of the exposure action or limit values. In order to do this, the employer needs to know two things: the magnitude of vibration to which his employees are exposed; and the time that his employees are exposed to vibration.

So how can the employer establish these two parameters? To illustrate the process, take the example of a typical small engineering workshop with several employees who regularly use a common 9-inch angle grinder (Figure 1) to grind metal components. The employer needs to know the typical vibration magnitude that the grinder produces, and the time that the employees are exposed to the vibration.

Exposure Time

It might be thought easy to establish the typical exposure time. But if the employer asks his employees how long they use the angle grinders on a typical day, then they are likely to answer 'all day'. After all, the employees do not want to give their employer the impression that they are lazy. However, it is unusual for the operator of an angle grinder actually to use the tool for more than 50% of the time, even for the most productive workers.

What if the exposure varies markedly from day to day, as it often does in a small engineering workshop? The employer could establish the exposure time by direct observation or by video recording the employees (but this is unlikely to go down well with the trade union!). An automatic tool timer could perhaps be fitted to the power supply (for electric or pneumatic tools), or an electronic timer to the trigger, but the measurements may need to be carried out over a prolonged period of time to give realistic results if the exposure does vary markedly. Then what happens if the employees share tools? Once the employer has the results, should he use the mean or the worst-case value?

Perhaps the best approach would be to ask the supervisor, who is probably in the best position to give an accurate estimate of the typical exposure time. For this example, assume that the operators below typically use the grinders for about two hours a day.

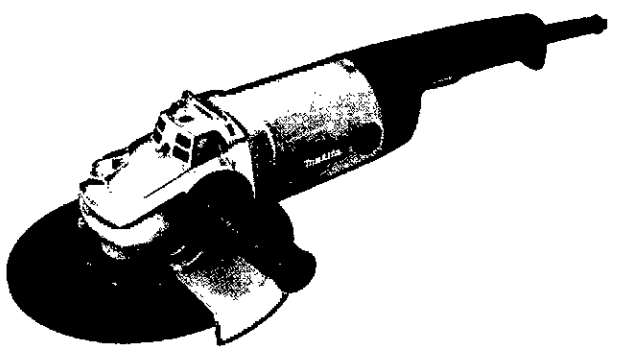

Figure 1 - 9-inch angle grinder

Vibration Magnitude

Once the employer has established the exposure time, he needs to know the vibration magnitude of the tool. He could ask the manufacturer to provide him with this information, but the manufacturer is only obliged[2,3] to provide the declared vibration emission value of the tool, measured according to BS EN ISO 8662[4]. In this case, the 'declared value' of this 9-inch angle grinder is $3ms^{-2}$.

If the employer uses this value in his exposure calculations, then the resultant daily exposure is given by

$$A(8) = a_{hv} \times \sqrt{(T/T_0)} = 3 \times \sqrt{(2/8)} = 1.5ms^{-2}$$

which is below any of the exposure action or limit values.

But the manufacturer's declared value is measured in the laboratory, not under real operating conditions. For angle grinders, the laboratory test is carried out using an artificial unbalance (Figure 2), which is an aluminium disk with a hole drilled in it, in order to get repeatable results. However, as the test standard itself states, *'whilst it is possible that a low declared value will result in a low value in the workplace, it is emphasised that declared values are not adequate for use in risk assessment, which is significantly dependent on workpiece and workstation design, as well as upon daily exposure time'.*

Some manufacturers are starting to provide typical 'field' vibration levels, but this is not common, and generally no other data are available from the manufacturer.

The Health and Safety Executive suggests[5] that the employer can use vibration data from 'trade associations, government bodies, consultants, technical or

continued on page 30

Hand-arm vibration measurements - *continued from page 29*

scientific publications and on-line databases', and quotes two possible web sites:

http://www.las-bb.de/karla/index_.htm

http://vibration.arbetslivsinstitutet.se/eng/havhome.lasso

Unfortunately, despite being one of the most common angle grinders in the UK, neither of these web sites has any data for this particular model.

The HSE also suggests that, *"if you are unable... to obtain representative vibration data for any of your tools or work activities it may be possible to estimate the magnitude from other sources"* and provides examples of vibration magnitudes that have been measured by HSE on tools in real work situations. For large angle grinders, the HSE quotes a vibration magnitude of 4 m/s^2 for modern vibration-reduced designs, and 8 m/s^2 for other types.

If the employer uses these values in his exposure calculations, then the resultant daily exposures are given by

$A(8) = a_{hv} \times \sqrt{(T/T_0)} = 4 \times \sqrt{(2/8)} = 2ms^{-2}$

which is below any of the exposure action or limit values, or

$A(8) = a_{hv} \times \sqrt{(T/T_0)} = 8 \times \sqrt{(2/8)} = 4ms^{-2}$

which is above the lower exposure action value, and approaches the exposure limit value.

The HSE continues 'finally, if you have no available information on the likely in-use vibration magnitude for a hand-held or hand-guided machine, you can make a rough estimate using the tool manufacturer's declared emission value. Because this is likely to be less than the vibration in real use, it is recommended that you apply a scaling factor. Experience has shown that for many tools, doubling the declared value will bring it closer to the vibration magnitude in real use'.

If the employer uses this value in his exposure calculations, then the resultant daily exposure is given by

$A(8) = a_{hv} \times \sqrt{(T/T_0)} = 6 \times \sqrt{(2/8)} = 3ms^{-2}$

which is above the exposure action value, but below the exposure limit value.

The above examples clearly show the wide variation that these different approaches produce, and the employer might be tempted to believe that the only solution is actually to measure the vibration magnitude of his tools in use (Figure 3). He could buy a hand-arm vibration meter and measure the vibration level himself, but this would cost several thousands of pounds, and hand-arm vibration measurements are not easy to perform. A consultant could be engaged to carry out the measurements, but this too could be expensive.

The Industrial Noise and Vibration Centre (INVC) has carried out hand-arm vibration measurements of 25 different examples of this type of angle grinder[6]. The measured vibration levels vary from a minimum of $2.8ms^{-2}$ to a maximum of $19.5ms^{-2}$ with a mean value of $9.9ms^{-2}$ and a standard deviation of $4.2ms^{-2}$.

This illustrates the heart of the problem. With many tools, and especially with angle grinders, the level of vibration produced is only partly due to the tool itself, and is much more dependent on other factors including

- the operator of the tool (grip, force, position, etc);
- the tool accessory (grinding wheel, cutting disk, etc);
- how the tool is used (cutting, grinding, sanding, etc);
- the material being worked on (concrete, metal, stone, etc).

In the above example, of the 25 measurements, only 12 were with the angle grinder grinding metal, and if these results only are used, then the measured vibration levels vary from a minimum of $7.0ms^{-2}$ to a maximum of $15.1ms^{-2}$ with a mean value of $10.8ms^{-2}$ and a standard deviation of $2.5ms^{-2}$. Thus, even after removing two of the above variables there is still a large variation.

If the employer uses the mean value in his exposure calculations, then the resultant daily exposure is given by

$A(8) = a_{hv} \times \sqrt{(T/T_0)} = 10.8 \times \sqrt{(2/8)} = 5.4\ ms^{-2}$

which is above both the exposure action and limit values.

Why Bother?

So what is the poor employer to do? If he uses the HSE's example data for modern vibration-reduced large angle grinders, then he is below any of the exposure action or limit values. If he uses the mean value from the INVC database for this particular angle grinder grinding metal, then he is above both the exposure action and limit values. Which is right?

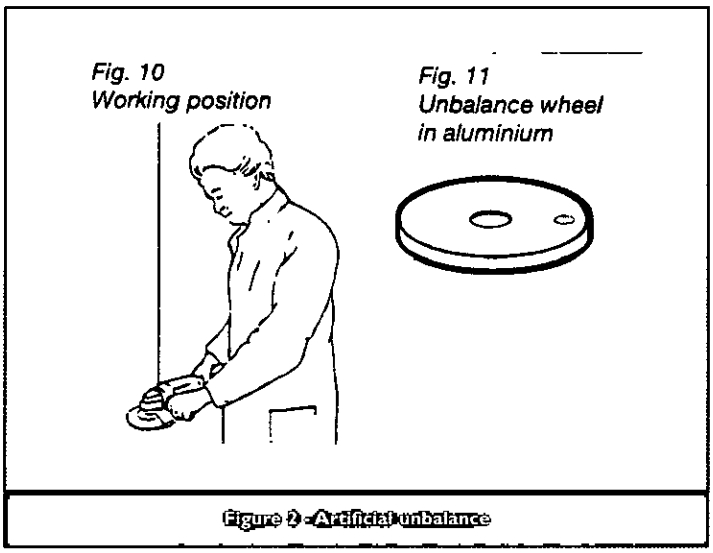

Figure 2 - Artificial unbalance

The answer, of course, is that they probably both are. On some days, some operators carrying out some tasks are probably exposed below any of the exposure action or limit values. On other days with other operators and tasks, there are probably excesses over both the action and limit values.

The HSE also suggests that if the answer to one or more of the following questions is 'yes' then it should be assumed that employees are at risk from vibration.

- Do you use rotary action power tools or machines for more than about an hour per day?
- Do you use hammer action power tools for more than about 15 minutes per day?
- Do you work in an industry where HAVS is known to be a problem?
- Do you work with any of the industrial processes for which HAVS is reportable?
- Do any of your equipment suppliers warn of a vibration risk?
- Do any of your employees have symptoms of HAVS?

If the employer followed this advice, he would deduce without having to carry out any vibration measurements or calculations that his employees were at risk.

So what steps should the employer take to reduce the risk?
The legal duties are:

- To eliminate of reduce the risk as far as reasonably practicable (by introducing other working methods, replacing tools with lower vibration models, providing auxiliary equipment which reduces the risk, introducing appropriate maintenance programmes, reviewing the design and layout of workplaces, work stations and rest facilities, training employees to use the tools properly, reducing the exposure time, introducing appropriate work schedules with adequate rest periods, and providing clothing to protect employees from cold and damp);
- To provide health surveillance for those at risk (by introducing a programme of systematic health checks to identify early signs and symptoms of disease and to allow action to be taken to prevent its progression);
- To provide information, instruction and training about the risk (about the measures taken to comply with the regulations, the exposure action and limit values, the significant findings of the risk assessment, why and how to detect and report signs of injury, entitlement to appropriate health surveillance and its purposes, safe working practices to minimise exposure, and the collective results of any health surveillance undertaken).

These should not be thought of as onerous duties, and it should be relatively easy to incorporate them into company policy. Indeed, if the company already

Figure 3 - Hand-arm vibration measurements

has all these steps in place, then it may not be necessary to carry out a risk assessment at all. The most important thing is to ensure that the company takes steps to reduce the risk to the employees, and does not get bogged down with the risk assessment.

This is summarised nicely in the following list of risk factors:

Getting a dose: the risk factors

- daily vibration dose - tool vibration amplitude and total "finger on trigger" time
- tool design - ergonomics, weight
- tool use on any particular job - access, position
- working conditions - temperature, frequency of breaks
- individual susceptibility and habits - genetic factors, general health, smoking

For example, if the company replaces its tools with a more modern ergonomic design which produces the same vibration level, changes the design of the workstations to improve access, increases the temperature in the workshop, and introduces regular compulsory breaks, then the risk to the employees (and the incidence of HAVS) will be significantly reduced. This will not be reflected in the daily vibration dose, which is only dependent on the tool vibration amplitude and the total 'finger on trigger' time, and will remain the same.

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Hand-arm vibration: filling the gap

Neil Mansfield.

The disparity between manufacturers' declared values and hand-arm vibration emission under real working conditions

Introduction

In July 2005, the European Physical Agents (Vibration) Directive was implemented across Europe[1]. In the UK, this was introduced as the Control of Vibration at Work Regulations[2]. The Regulations contain two criteria: the Exposure Action Value (EAV) and the Exposure Limit Value (ELV). Irrespective of the vibration magnitude to which an individual is exposed, vibration risks must be reduced as far as is reasonably practicable. If the EAV is exceeded then vibration exposures must be minimised, and health surveillance or monitoring and worker training is required. The ELV must not be exceeded. If risks are minimised, the incidence of vibration related disorders should reduce.

The regulations apply to whole-body and hand-arm vibration exposures. For whole-body vibration, the population likely to be exposed above the ELV is small. For most relevant agricultural, industrial or earthmoving applications, unless equipment is used inappropriately (eg with unapproved attachments, poorly maintained, poorly matched with task, or deliberately operated aggressively) exposures will lie between the EAV and ELV. Thus, detailed knowledge of the vibration magnitudes might not be necessary in order to conclude that implementation of generic industry 'best practice' advice is the appropriate action.

For hand-arm vibration, there is a large population who could potentially be exposed above the ELV. Power tools emit a wide range of vibration magnitudes depending on the tool type, inserted tool, task, workpiece and operator technique. Furthermore, the operation time of any tool can vary widely depending on the worker's job. In many cases, requirements for tool use can vary dramatically from day to day. Thus, it is important to consider the exposure of each worker at risk carefully in order to ensure safe and legal working, and to tailor risk minimisation strategies. Such consideration requires data by which the competent person performing the risk assessment can perform calculations and make a judgement.

The Machinery Safety Directive[3] requires that risks from machinery vibration are reduced as far as possible by design, and that data are reported on the vibration emissions. If the emission exceeds 2.5ms^{-2} rms, the emission value must be reported; if it is less than 2.5ms^{-2} the instruction book must indicate that the threshold has not been exceeded. If an appropriate test code exists, the tool must be tested according to that code; if no test code exists, the manufacturer must describe the measurement methods and conditions under which the measurements were made. For the majority of tools in use at work, appropriate test codes exist. Therefore, manufacturers must all use the same test code for the same class of tool.

Under the Control of Vibration at Work Regulations, employers have a requirement to assess the exposures and risks to which their workers are exposed. It might seem appropriate to use manufacturers' data as a basis for risk assessments. In many cases, though, vibration data obtained using test codes it not sufficient for a risk assessment and could inadvertently mislead potential users. This article explores the limitations of manufacturers' declared values, the benefits to industry of an independent database (specifically, the OPERC HAVTEC database[4]), and scenarios where use of a database might be inappropriate.

Risk assessments according to the control of vibration at work regulations

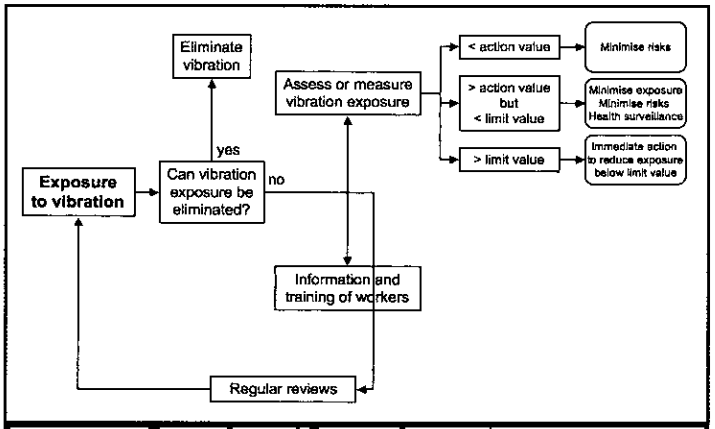
The Control of Vibration at Work Regulations states, in Regulation 5:

"5. Assessment of the risk to health created by vibration at the workplace

(1) An employer who carries out work which is liable to expose any of his employees to risk from vibration shall make a suitable and sufficient assessment of the risk created by that work to the health and safety of those employees and the risk assessment shall identify the measures that need to be taken to meet the requirements of these Regulations.

(2) In conducting the risk assessment, the employer shall assess daily exposure to vibration by means of:

(a) observation of specific working practices;



Physical Agents (Vibration) Directive flowchart (From: Mansfield, Human Response to Vibration, CRC Press, 2005)

(b) reference to relevant information on the probable magnitude of the vibration corresponding to the equipment used in the particular working conditions; and

(c) if necessary, measurement of the magnitude of vibration to which his employees are liable to be exposed,..."

A 'suitable and sufficient' risk assessment should not normally begin with commissioning a consultant; there is much that can usually be done in-house by a suitably trained employee. The purpose of observation is to identify usage and exposure patterns for individual workers on a daily basis. Regulation 5(2)(b) explicitly states that assessments can be based on probable magnitudes of vibration, but data must be specific to the 'particular working conditions'. HSE guidance[5] on the Regulations lists eight sources of vibration data (Table 1). Only one of these methods requires on-site measurements at the user's workplace, and this could include data measured previously. Only in a small minority of cases will new measurements of vibration be required, although these are likely to be the most reliable. Some of these cases are listed later.

Table 1. Possible sources of vibration data in order to obtain information on the probable magnitude of the vibration for equipment used in the particular working conditions, as suggested in HSE guidance on the Control of Vibration at Work Regulations[5].

(a) manufacturers' declared emission values in the equipment handbook
(b) other information from manufacturers
(c) online databases
(d) research organisations
(e) vibration consultancies
(f) HSE website
(g) trade associations
(h) measurements in the user's workplace

Problems with using manufacturers' declared emission data

General approach of tool vibration emission test codes

In order to comply with the Machinery Directive, manufacturers are required to declare an emission value for their machines in the equipment handbook. Even if the handbook is not readily available, most manufacturers are able to provide information for tools, and there are several online sources listing the declared values for tool classes.

Declared values should, in principle, be a rich source of vibration data, as every tool sold must have been tested for vibration emission. Tests are standardised and data are verifiable. Results should be the same irrespective of where the tool was tested as tests are designed to be repeatable. All manufacturers have the same testing requirements and therefore the system can be considered 'fair'. Despite these advantages, there remain serious problems with the use of declared values. These are not the fault of manufacturers but result from

inherent problems in the approaches of test codes.

The introductory paragraphs of ISO 8662-1 (1988)[6] make it clear that although it is one intention of test codes to provide realistic simulated work data, *'a number of test methods have been specified, covering a range from a real work situation to a completely artificial situation, to achieve the desired reproducibility'* and also test codes are *'...not intended for assessment of human exposure to vibrations. The measurement and assessment of human exposure to hand-transmitted vibration in the workplace is given in ISO 5349'*. This means that using test codes as a basis for risk assessment does not heed the warnings given in the test codes themselves.

There are two types of problems with tool test codes. Firstly, there are problems with specific codes in the design of some tests. Secondly, there are inherent problems with test codes in general.

Specific problems with tool vibration emission test codes

There are some specific problems with many of the current test codes which results in most of them producing values that are lower than those obtained when the machine is tested according to ISO 5349 when in use at work. Problems with the codes vary from tool to tool and some are listed in Table 2. Although many current test codes have such problems, the relevant standardisation committees are well aware of the limitations and are in the process of improving the codes such that new and pending procedures will provide values far closer to those experienced at work. As an interim measure, EN/TR 15350[7] has recently been agreed which provides guidance on interpretation of data obtained from the old and current series of test codes including descriptions of how to obtain a 'rough estimate' of the vibration emission at work.

Even though the new series of test codes will solve most of the problems listed in Table 2, naïve end-users are at risk of selecting inappropriate older tools, as the old test codes to which they were tested usually produce lower values than the new test codes. It is therefore vital that purchasers are well informed as to how to interpret emission data of different vintages.

Fundamental problems with tool vibration emission test codes

Even if the problems listed in Table 2 are resolved, there will remain fundamental difficulties with the use of test codes for risk assessment. In most cases, the codes will not provide data as required by the Vibration Regulations, which state that data should be based on *'equipment used in the particular working conditions'*. Declared values will be based on data from new tools only, and will not consider the effects of wear-and-tear on tool vibration emission. Manufacturers have a wide range of expertise in tool testing (and reporting), and some currently reported emission values are doubtful. These problems will not be resolved with improved test codes.

There is a risk that manufacturers could design a tool to the appropriate test code, rather than giving priority to designing a better tool *per se*. For example, a tool could be optimised to perform very well in a subset of its possible configurations at the expense of its performance in other configurations. Conversely, innovation could be discouraged, if it adversely affects the performance under the test code condition.

Test codes themselves have a high degree of inertia. Once agreed, it can take many years for changes to be implemented and many more years for a new generation of tools to be tested according to the new codes. In particular, manufacturers could see commercial advantages in using a particular type of test and would thus be uncooperative during the standardisation process.

When is it appropriate to use manufacturers' declared emission data?

Manufacturers' declared emission values can be very valuable if they are used appropriately. If emission values are corrected to EN/TR 15350 and the test code is broadly representative of the working conditions then manufacturers' data can give a rough estimate of the vibration emission of the tool. This, when combined with the operator's trigger time, might produce a value of A(8) well below the EAV or ELV, and no further vibration data would then be required.

Independent hand-arm vibration emission databases

Advantages of independent hand-arm vibration databases

HSE's guidance on the Vibration Regulations suggests using databases as a source of vibration emission data. One of the advantages of using an independent database is that those hosting the system are not constrained by the requirements of test codes, so measurements can be made according to ISO 5349 (as required by the Physical Agents Directive) and working conditions close to those in real use can be simulated and used to yield source data. For example, a popular hammer drill could be tested with a wide range of drill bits drilling into a variety of materials, giving an indication of the variation in the measurements with operation and configuration. This is an improvement on the requirements of the test code (*eg* ISO 8662-6) where only a single 8mm bit is used for drilling into one material (concrete).

A problem with using genuine field data for a database is that if a database is populated with data from more than one manufacturer's tool, it is difficult to compare results between tools unless they are all tested at the same time. It is likely to be fairer to test under simulated real-work conditions so that results from different tools can be compared. Taking the example of the hammer drill, users could compare results from many work tasks for competing drills to establish if there were consistent trends between them, and would be able to adopt the results which were closest to the working conditions in which the operator will be working. When comparing the vibration emission of tools, it is important to consider the variation in the measurements as well as the emission values themselves, recognising that measurement uncertainty does not equate to measurement error. By reporting standard deviations end-users are able to decide whether differences in reported emissions are likely to translate into differences in workforce exposure. Most manufacturers do not report the measurement uncertainty of their declared emission values for most tools.

Tool users are less likely to consult emission data if source data is distributed across all of their suppliers' websites or in many operation manuals. A central location where most tools are listed is thus attractive, especially to SMEs without full-time health and safety professionals.

Consideration of the EuroNCAP car safety database

It is appropriate to consider the success of the EuroNCAP car safety database over the past 10 years. The European New Car Assessment Programme grew out of the recognition that the single standard car safety test required by European law was unrealistic, and a battery of established tests would be more appropriate. This coincided with resistance to change the required type-tests. Independent consumer organisations commissioned the improved tests and reported relative performance of a range of popular cars. This scheme has now grown to the extent that although cars are required to pass basic safety tests in order to be sold within Europe, purchasers prefer to consult independently generated NCAP results. This gives manufacturers an incentive to improve car safety and as a result advances in secondary safety have been rapid. The tests have evolved continuously, not constrained by the requirements (and inertia) of internationally agreed standards. If new safety technologies are introduced, test methods can be developed, and the effectiveness of the new technologies demonstrated[8].

Key features of the EuroNCAP system have led to its success and these principles can be applied to designing a vibration database (Table 3).

continued on page 34

Table 2. Examples of some of the problems associated with the current version of tool test codes.

Value reported is a single-axis measurement, whereas risk assessments require multi-axis measurements
Tool is tested with only one workpiece type whereas tool is used with a variety of workpieces
Tool is tested with unrealistic workpiece or none
Tool is tested in only one orientation whereas the tool is used in many orientations (*eg* drilling down into floor, horizontally into wall, up into ceiling)
Tool is tested with only one inserted tool (*eg* only one chisel or drill bit) whereas the tool is designed to be operated with many types of inserted tool
Measurements are made at only one hand whilst the tool requires two-handed operation
Only one value is reported despite their being a large variation in possible emission
Measurements are not made at the handle, but on the tool body

Hand-arm vibration: filling the gap - *continued from page 33*

EuroNCAP is not without its critics. The tests themselves do not (and cannot) reflect all crash conditions. Crash test repeatability has been criticised (possibly as a side-effect of testing at realistic high speeds). Not every vehicle has been tested, and only one variant of each is usually tested. Nevertheless, despite these criticisms, consumers are now able to include safety in their consideration of alternative vehicles. A cynic might criticise a vibration database using similar arguments, but the value to the end-user, who needs independent and realistic data in order to comply with the Vibration Regulations today (not after many years of committee work to establish the 'best' test code), is considerable.

OPERC Hand-Arm Vibration Test Centre (HAVTEC)

Ethos of HAVTEC

The Off-highway Plant and Equipment Research Centre (OPERC) is an independent organisation designed to draw together industry practitioners, professionals, and researchers under one umbrella body with the aim of developing and disseminating best practices throughout industry. OPERC members include tool manufacturers, construction companies, health and safety professionals, hire companies, researchers and academics, representing stakeholders on all sides of industry. The Centre is based at Loughborough University, which has a long established and international reputation for excellence in construction research and human vibration research, and many years of consultancy experience. Considering the recommended sources of vibration data listed in Table 1, an online database produced by OPERC would be ideal as it would fit with suggestions (c), (d), (e) and (g).

The OPERC Hand-Arm Vibration Test Centre (HAVTEC) was set up in response to concerns from industry regarding the suitability of manufacturers' data for risk assessment. The Centre is sponsored by Speedy Hire, and funding for the tool tests is primarily sourced from tool manufacturers. Data is available to all, whether or not they are Speedy Hire customers. HAVTEC follows all the principles discussed above:

- Measurements are made according to ISO 5349, thus meeting the requirements of the Physical Agents (Vibration) Directive;
- Each tool is tested under a variety of configurations, as appropriate;
- Data are easily available without any charge, thus meeting the requirements of end-users and particularly supporting SMEs with limited budgets;
- Tests are independently carried out;
- Methods are developed in collaboration with stakeholders as required by tool types and applications, thus meeting the requirements of the Control of Vibration at Work Regulations.

Progress in populating the HAVTEC database

The HAVTEC database went live in early 2006. Measurements have so far been made on over 600 combinations of tool and workpiece, each of which required at least 15 6-axis vibration measurements. So far, the database summarises over 60,000 individual data points. The database expands as new tools are tested. Tests have been completed on many different tool types, including:

- rotary hammer drill (battery)
- rotary hammer drill (electric)
- diamond core drill
- combi-hammer drill
- rock drill
- trolley scabbler
- pole scabbler
- grinder
- reciprocating saw
- circular saw
- power cutter
- floor saw
- chipping hammer
- breaker
- sander
- pick
- wall chaser

Accessing the HAVTEC database

To gain access to the HAVTEC database, all users must first register. This is free of charge and allows the database holders to monitor who is using the information (by industry sector, geographical location, etc). All those completing the free registration must agree with the terms and conditions of use. These include agreement that data must not be re-distributed or sold on without written permission of the OPERC Executive, and a caveat highlighting the inherent constraints with any form of vibration testing in order to generate emission values. The terms also include agreement that if data is used, it is accompanied by the phrase 'This information on vibration readings for plant and equipment was supplied free of charge by OPERC (www.operc.com)'. The terms and conditions point out that vibration emission is only one of many factors that should be considered when selecting tools. Once registration has been confirmed (this usually occurs in less than 24 hours), the user has full and free access to the database.

When the database is accessed, a list of possible tool types is offered. Once a tool type is selected, all data sets for that type are listed, including a list of how many appendages have been tested (ie the number of vibration conditions). A typical page screenshot is shown in Figure 1. Clicking on 'view data' will provide additional data on the tool itself and the test conditions, including the work being done, vibration magnitudes, trigger times to the EAV and ELV and the HSE exposure points accrued per hour of use. In some cases performance data is also appropriate (because a tool might emit less vibration, but take longer to complete the task). As tests are performed according to ISO 5349 (as mandated by the Physical Agents Vibration Directive) vibration results are reported as mean values and standard deviations, in order to comply with the standard.

Table 3. Key features of EuroNCAP and possible parallels for a vibration database.

EuroNCAP	Vibration database
Results are freely and easily accessible by end-users	Vibration data should be freely and easily accessible by end-users
Tests are independent	Tests should be independent
Tests are able to evolve continually, as technologies develop	Methods should be able to evolve without the inertia of standardisation
Tests occur in several realistic simulated real-life scenarios	Tests should occur across many realistic simulated real-life scenarios
Tests occur using well developed methods (*eg* industry-standard Hybrid III and EuroSID-1 dummies)	Tests should occur using well established methods (measurements should be according to ISO 5349)

Residual requirement for measurement

Although the HAVTEC database should help end users perform risk assessments, it is not always appropriate and occasionally new field measurements will be required. Some situations requiring new data to be collected include:

- Development of new tools and evolution of current tools, where tests are required to populate the database;
- Where there are missing data, such as from tools which are out of production;
- Where tools are being used for applications not included in the database;
- Where tools are being used in a 'sensitive' company or industry sector, such as where there is a history of litigation;
- When an employer has implemented a vibration control measure such as a tool or task modification, and the effectiveness of the intervention is to be assessed.

If measurement is required, it is often appropriate to commission experts with experience of human vibration measurement for the job.

Conclusions

Employers have a need to obtain data on vibration emission of tools in order to carry out a suitable and sufficient risk assessment for their employees. Manufacturers are required to provide data obtained using standardised test codes and these codes generate data that are often unrepresentative of the in-use vibration emission. Thus there is a need for a database of vibration emission values. The OPERC HAVTEC database serves this need and is freely accessible to any user, providing emission values from many commonly used tools in most common usage configurations. Sometimes, there will be a residual requirement for on-site vibration measurements.

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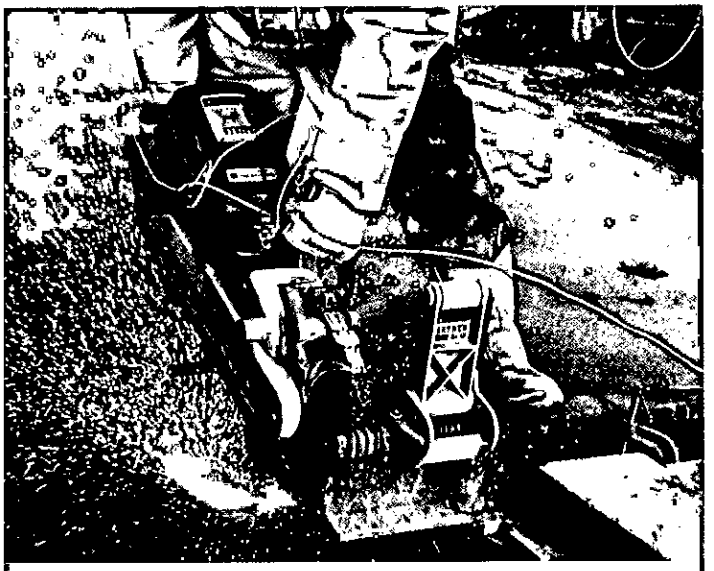

An example of a heavy portable vibrating tool - a power cutter

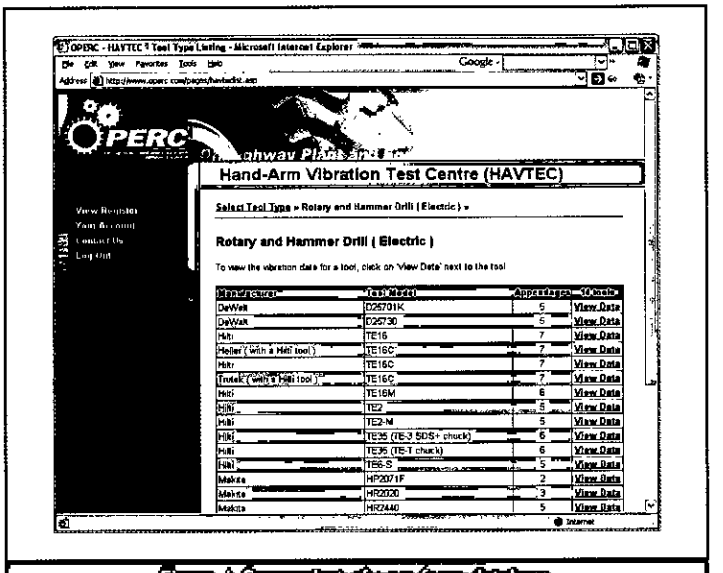

Figure 1. Screenshot of page from database, if user selects 'rotary and hammer drill (electric)'

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Parliamentary reports

From Hansard

Commons Written Answers

15 May 2006 Sound insulation

Mr Gordon Prentice: To ask the Deputy Prime Minister how many dwellings constructed in each year since 2000 have failed to satisfy the relevant regulations on sound insulation; and if he will make a statement.

Angela E Smith: I have been asked to reply. The information requested is not available, but surveys carried out by the Building Research Establishment have indicated that about 25 per cent of the party walls and 40 per cent of the party floors between dwellings failed to meet the standards expected by the 1992 edition of Part E of the Building Regulations, which deals with sound insulation. To improve this situation the ODPM revised Part E in 2003 and the evidence is that compliance rates are now much higher, in excess of 90 per cent.

Lords Hansard

16 June 2006 Piped Music and Showing of Television Programmes Bill

Lord Beaumont of Whitley: My Lords, I beg to move that this Bill be now read a second time.

First, I feel that I owe the House an apology for the Title of the Bill, which I am afraid has given in some quarters the mistaken impression that it is a frivolous Bill put forward to air my own prejudices. Far from it; it is a deeply serious Bill designed to protect the health of vulnerable people. Of course, like many of your Lordships, I dislike most forms of noise pollution, including wallpaper music.

The central purpose of the Bill is to protect vulnerable groups, principally hospital patients and minorities, on public transport. At the moment, people attending hospital, whether as out-patients or confined to a hospital bed, have no control over piped music systems or over where television systems are installed in the public and waiting areas of hospitals, such as clinics or accident and emergency departments. Indeed, only this morning I had a rather tearful submission from a lady who had just recently watched her husband die in a hospital bed while 'Match of the Day' was being broadcast rather loudly from a television set in the next cubicle.

It is the same situation on public transport systems. The use of these captive audiences for advertising purposes is another example of growing intrusion into people's lives. It was reported in the Times on 9 February 2005 that passengers were demonstrating against train companies' plans to install television screens in each carriage. It takes quite a lot of provocation to make railway passengers demonstrate.

Before turning to the main clauses of the Bill, I need to explain briefly why piped music needs to be prohibited in these particular circumstances. When we listen to a sound, whatever that sound is, including music, if the listener does not want it, it is noise. Noise is defined as unwanted sound. The World Health Organisation, the global authority on health matters, states in its guidelines for community noise, which were published in 2000:

'Vulnerable subgroups of the general population should be considered when recommending noise protection or noise regulations. Examples of vulnerable subgroups are: people with particular diseases or medical problems (e.g. high blood pressure); people in hospitals or rehabilitating at home; people dealing with complex cognitive tasks; the blind; people with hearing impediment; foetuses, babies and young children; and the elderly in general'.

The WHO guidelines also go on to describe in detail how noise affects people:

'Acute noise exposures activate the autonomic and hormonal systems, leading to temporary changes such as increased blood pressure, increased heart rate and vasoconstriction. After prolonged exposure, susceptible individuals in the general population may develop permanent effects, such as hypertension and ischemic heart disease associated with exposures to high sound pressure levels. Sounds also evoke reflex responses, particularly when they are unfamiliar and have a sudden onset'.

Piped music is not just confined to hospitals or public transport; it can also be found in retail shops and restaurants. However, in most instances, people have a choice: to walk out of a shop or to refuse to frequent a restaurant. This Bill specifically relates to piped music and the showing of television programmes in the public areas of hospitals and public transport, because those are places where people do not have those choices. From surveys and anecdotal evidence given to campaign groups such as Pipedown and the UK Noise Association, we know that where piped music is not desired, it is not a minor irritant but an extreme annoyance. An annoyance leads to stress and stress has an impact on our health.

In recent years, some train companies have responded positively to complaints about the nuisance caused by mobile phones on intercity trains. Many train carriers, such as Virgin Trains, offer a choice for travellers wanting peace and quiet by providing quiet carriages. That move is very welcome; it is even more welcome when it is observed by the passengers using the trains.

Music can be a wonderful thing, as we all know. Indeed, it has its positive uses in healthcare. For example, recent research reveals that listening to music can have a significant and positive impact on perception of chronic pain. US researchers tested the effects of music on 60 patients who had endured years of chronic pain. The patients had suffered from conditions such as osteoarthritis, rheumatoid arthritis and back problems. Half the group spent two weeks listening to music for 20 minutes a day and the other half spent 20 minutes sitting quietly. A scientific analysis found that pain levels in the music group were cut by 50 per cent. As a strategy for coping, there is no doubt that listening to music for the control of pain will help.

But the crucial factor is that patients must have control over the music that they listen to. The Montefiore hospital in New York is working towards cutting noise levels to provide a better environment for its patients, so that they can heal faster. That decision followed the findings of a study of cardiac patients, which showed that patients in rooms with sound-absorbing ceiling tiles were less likely to be readmitted to hospital within 30 to 60 days than those patients in rooms with typical hard, sound-reflecting tiles. That is proof that a quieter environment aids the healing process.

It is important to clarify the difference between wanted sound and unwanted sound, and our reactions to both. If we choose to listen to a sound, have control over it or desire to listen to it, then our response may be positive. If we consider that a sound is annoying or that we have no control over it and are unable to turn it off, our response will probably be negative. Some medical conditions are particularly vulnerable, such as tinnitus and epilepsy.

The Bill sets out clearly and precisely the scope for removing the use of piped music and the showing of television programmes in the public areas of hospitals and on public transport. It also allows choice for those who want to listen to music, by requiring the use of headphones. The Bill requires the Secretary of State to control the evils that I have identified after wide consultation and to lay a plan for that before Parliament.

Finally, I pay tribute to Robert Key, who introduced in another place a 10-minute rule Bill along these lines; and I was extremely grateful to those who advised me in this matter. But I and they are acutely aware that we are not parliamentary draftsmen. We seek a Second Reading so that your Lordships may turn it into a Bill that is worthy of becoming an Act of Parliament. I commend the Bill to the House.

Lords Written Answers

12 May 2006 Anti-social behaviour: loud music

Lord Laird asked Her Majesty's Government whether they had any plans to make it an

continued on page 39

Senior/Principal Acoustic Consultant

c£40,000+ comprehensive benefits package

Our client is a leading multi-disciplinary consulting practice employing approximately 7,000 staff globally with offices in over 70 countries. Established for 60 years and still employee-owned with a genuine 'family feel', the company has an exceptional portfolio of high profile projects and a reputation for quality and outstanding design.

The acoustics practice is one of the world's largest and most respected with offices throughout Europe, North America and Australasia. The company is looking for talented individuals for consultant positions throughout the world.

Having recently opened a new office in Central Scotland, our client is looking for a suitably qualified and experienced individual to take up a senior role within a growing business unit.

Qualifications and skills required:

- first degree in acoustics or similar scientific or engineering discipline
- ideally a post graduate qualification in acoustics
- 5 years' post graduate experience in acoustics (of which a minimum of 2 in consultancy)
- knowledge of architectural and environmental acoustics
- proven track record in project management
- knowledge of planning regulations & experience of EIAs
- knowledge of building regulation (e.g. Part E of Building Regulations and BB93)
- relationship management
- business development.

This is an opportunity to join a fledgling team as a key member working in partnership with the office principal on a wide range of projects sourced both from within the overall parent company and directly from external clients. The prospects for the successful candidate are outstanding. With the Scottish office planned to continue to grow throughout the year, opportunities exist for team leadership and mentoring as well as the prospect of working overseas in the longer term. Career progression within this organisation is meritocratic and rewards are exceptional for high achievers within the firm.

Benefits include:

- profit related bonus scheme
- private healthcare
- paid membership of relevant industry bodies (IoA, CEng, etc)
- final salary pension scheme.

Our client would be interested to hear from consultants who may be looking for similar roles in locations throughout the world.

If you are interested in finding out more please contact Mark Armstrong, Regent Consulting, Davidson House, Forbury Square, Reading, Berkshire RG1 3EU. Tel 0118 9000 920 or email your CV to 6200@regent-consulting.co.uk

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REGENT CONSULTING

Parliamentary reports - *continued from page 37*

offence to play loud music in a motor vehicle with the windows open.

Lord Davies of Oldham: The Government have no plans to introduce a new offence that specifically outlaws the playing of loud music from open-windowed vehicles. Existing legislation already provides a range of options that enable police forces and local authorities to address this problem. Relevant legislation is as follows:

Police Reform Act 2002: Local police forces may serve anti-social behaviour orders that can impose bans from certain roads, and there are even confiscation powers over vehicle owners in more serious cases.

The Road Vehicles (Construction and Use) Regulations 1986: Regulation 97 states that *'no motor vehicle shall be used on a road in such a manner as to cause any excessive noise which could have been avoided by the exercise of reasonable care on the part of the driver'.*

On-road enforcement is by the police. Environmental Protection Act 1990: under Section 79, as amended by the Noise and Statutory Nuisance Act 1993, loud music from stationary vehicles may also be defined as a statutory nuisance. Environmental health officers, therefore, have powers to serve abatement notices during these incidents. Failure to comply can lead to fines and confiscation of equipment.

As set out in Chapter 7 of the Respect Action Plan, the Government are also considering how law enforcement methods for such offences can be improved.

26 June 2006 Licensing: closure of premises

Lord Clement-Jones asked Her Majesty's Government what powers under the Licensing Act 2003 had been used to close down licensed premises with a history of disorder, and to prevent some licensed premises from screening games involving the England football team during the 2006 World Cup.

Lord Davies of Oldham: This information is not available centrally. Part 8 of the Licensing Act 2003 makes provision for closing licensed premises on grounds of disorder, imminent disorder and public nuisance resulting from noise emanating from the premises. In addition, Section 19 of the Criminal Justice and Police Act 2001 provides for the closure of premises selling alcohol for consumption on the premises in breach of the conditions of a premises licence. Sections 40 and 41 of the Anti-social Behaviour Act 2003 make provision for closing licensed premises on grounds of public nuisance resulting from noise emanating from the premises. In addition, where premises have been the scene of disorder or disturbance, the police and other responsible bodies may apply for a review of the premises licences and this can result in the suspension or revocation of the licence by the licensing authority.

Arup: Soundscaping

Improving the acoustical environment

Noise is unwanted sound. Thus the standard practice to control noise, whilst valuable, is a negative process (ie capping or reducing what is unwanted 'noise'). In response there is a drive by several authorities to take a more positive approach that will evaluate, shape, improve and manage the sound (or soundscapes) in cities and especially civic spaces. This is seen as a component in attracting and 'keeping' a broader population demographic in cities.

What is soundscape design?

Soundscape design attempts to discover principles and to develop techniques by which the social, psychological and aesthetic quality of the acoustic environment or soundscape may be improved.

The techniques of soundscape design are both educational and technical. Technical measures include the elimination or restriction of certain sounds (noise abatement), the evaluation of new sounds before they are introduced indiscriminately into the environment, as well as the preservation of certain sounds (sound signals, including sound marks, key tones and sound events), and above all the imaginative combination and balancing of sounds to create attractive and stimulating acoustic environments.

A key element of soundscaping in addition to noise control is that once any noise nuisance is mitigated, it does not necessarily mean reducing sound levels. Where a sound is consistent with the spatial, cultural and environmental context, sound levels considered appropriate and desirable are not necessarily quiet - for example, a thriving market.

The approach is therefore to plan, shape and manage the sound (having appropriately capped the noise levels) to fit each area of the master plan in terms of its civic, cultural and social character. This approach is seen as one of the keys to the next wave of urban regeneration, especially to provide urban family housing and more attractive public urban recreation space whilst maintaining the 'buzz' of a thriving energetic city in other locations.

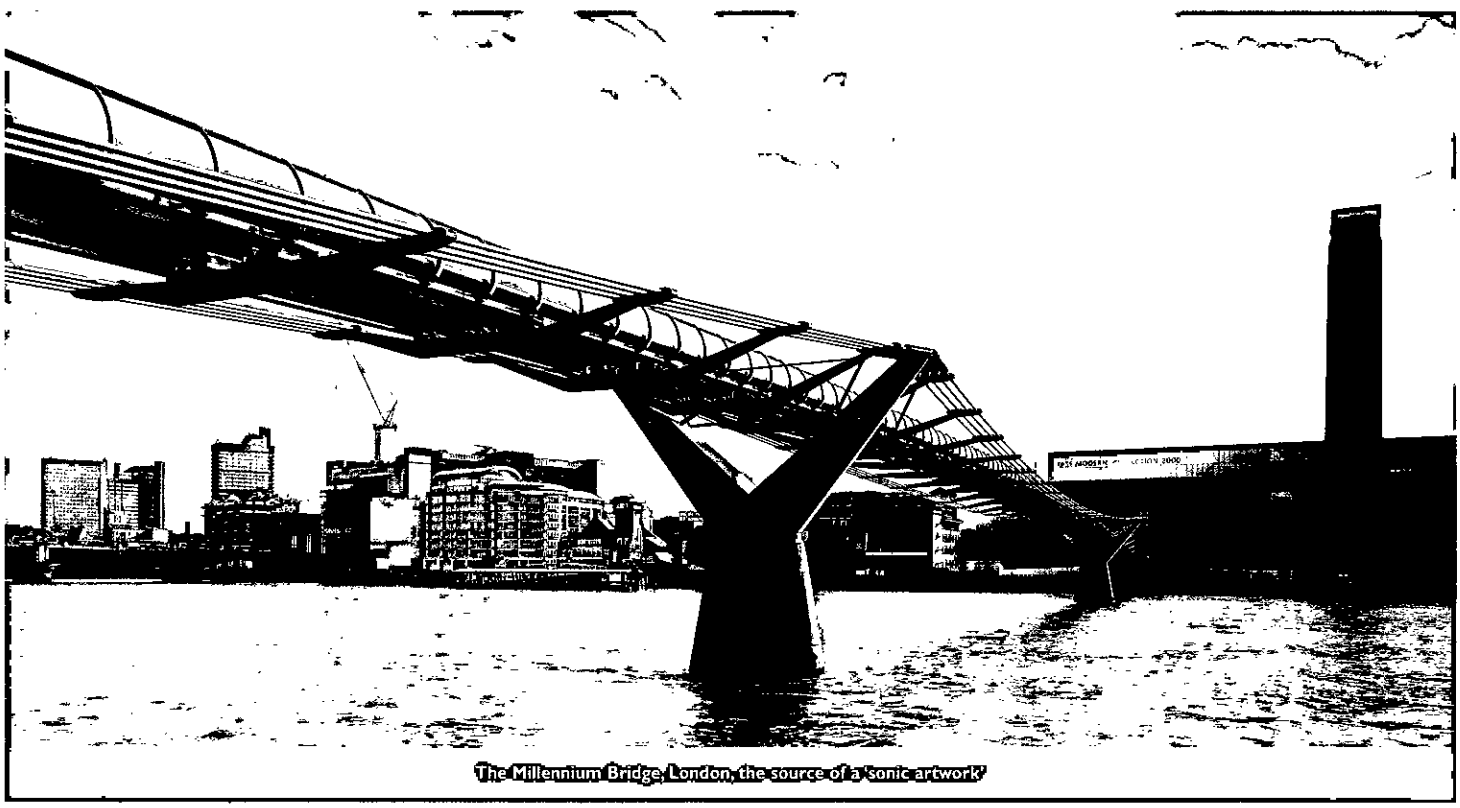
Successful urban family housing will be just as dependant on providing and maintaining the right environment as it is about the innovative design of the properties (to provide family oriented space at the densities required) and civic infrastructure (access to schools, transport, retail, and cultural facilities).

This apparently substantial agenda can actually be crystallised into some simple and practical steps at the master plan stage and then through delivery. For example, with family housing the first target is to control noise. This can be achieved through the master plan by spatial planning and using other buildings as screens. Having reduced the noise in these areas the quality of the soundscape can then improved by introducing, at controlled levels, more attractive sound, such as by the introduction of a designed water feature, which is especially effective on canalside or riverside sites. Such sounds either 'mask' the residual urban noise or mix with it to divert the listener's attention from the undesirable residual noise. There are many other means, both passive (eg a water feature) and active (eg the 'Harmonic Bridge', a form of sonic art played through a sound system) to achieve this effect.

The key to soundscaping is careful selection of the sound to be introduced (or protected) so that it is of an appropriate level and character. Furthermore, it is necessary to consider varying the level of sound during the course of each day or each week, to ensure that it is loud enough to mask peak road traffic noise, and quiet enough not to cause disturbance at night.

The approach can be further extended to:

- Shaping and zoning (as appropriate) the soundscape for other areas such as transport, entertainment and cultural areas, and
- Maintaining or creating sound marks (from civic hall bells to sonic art) as iconic features and attractions of the development, besides preserving them as cultural and community references.



The Millennium Bridge, London, the source of a 'sonic artwork'

Historic hospital opts for state-of-the-art IAC audiology suite

St Mark's in Maidenhead, Berkshire is now home to two new state-of-the-art audiology test rooms

One of the UK's most historic hospitals, St Mark's in Maidenhead, Berkshire is now home to two new state-of-the-art audiology test rooms. The facility has been commissioned by the NHS Trust in a bid to improve hearing services for patients within the town and surrounding area, comply with current national standards, and cater for the increased demand for hearing services.

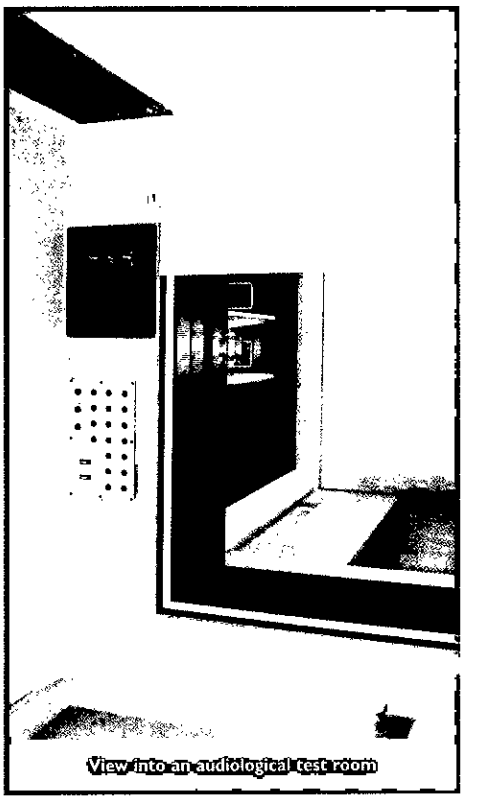
The new facility has been constructed using IAC's patented Moduline panel system, to a stringent acoustic specification. Moduline consists of high performance 102mm thick acoustic panels with integrated acoustic doors, windows, ceilings and isolated acoustic floors, all pre-fabricated off-site, delivered, and then installed with minimum dust and disruption, in a matter of days.

Tony Argyrou is part of IAC's Medical Project Management team. He says that the Trust recognised that their 20-year-old facility was no longer able to meet demand and was too often necessitating patient retesting. It was time to upgrade. The new facility eliminated background noise so that the audiometric technicians would no longer see artificial depression of low frequency thresholds. Reverberation from loudspeakers had ben eliminated, so that thresholds across the frequency range could be more accurately tested, particularly in children. Threshold testing is apparently a key part of the work of the hospital, so this would save time by giving best results, first time round.

These two fully air-conditioned audiometric test rooms are located within what was formerly the pharmacy suite. They are constructed on a room-within-a-room basis, within a completely refurbished ground floor traditionally-built shell, with good solid external and partition walls.

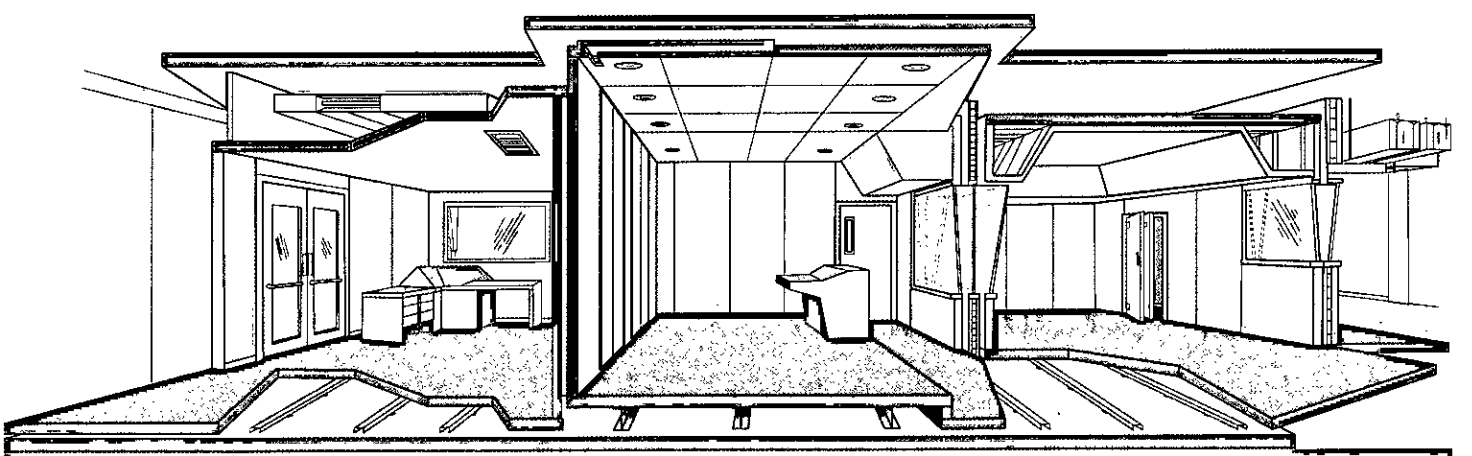
A quadruple-glazed, tinted acoustic window links the control room with test room 1, while the Noiselock acoustic 'link' doors have double magnetic seals for superior noise isolation. Each room is finished internally with attractive wall fabric covering, carpets to the floors and mineral tile acoustic ceilings. The electrical system uses 3-compartment dado trunking complete with full VRA wiring, dimmable high frequency lighting and a special cable transit system for connection of specialist equipment from the control room directly into test room 1. The complete facility provides a comfortable and stylish work environment for patients and the audiology team.

Dr Roger Green is the Clinical Director of the East Berkshire Audiology Unit at the Windsor, Ascot and Maidenhead Primary Care Trust. He heads a team of 25 clinical and administrative staff which deals with 35,000 patients per year. The Unit provides a full range of paediatric and adult care - a mature 'modernised' service throughout, including digital hearing aids for adults and children, comprehensive balance assessment and management, community newborn hearing screening programme, programmes for tinnitus, hyperacusis, central processing disorders and bone anchored hearing aids. The Unit is an accredited training centre for scientists and audiologists. Pauline Warner is the project manager for the refurbishment of the Audiology Unit at St Marks Hospital, Maidenhead. She said that this was the only site within the Trust that had not been fitted with IAC booths, and so with the new installation the Unit would be able to provide its services in facilities that met the National Standards.



View into an audiological test room

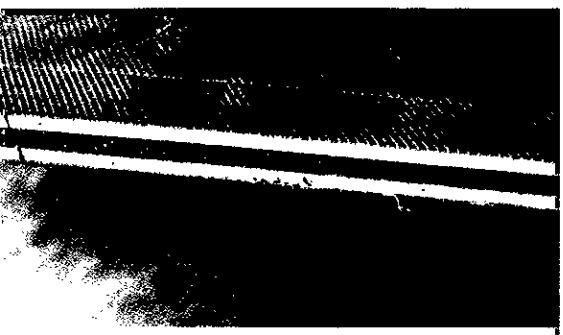
More information on IAC's high performance audiology booths and rooms can be found on **www.industrialacoustics.com/uk** or by contacting Jason Saunders, IAC's Business Manager on
Telephone: **+ 44 (0)1962 873027**
Email: **jasons@iacl.co.uk**



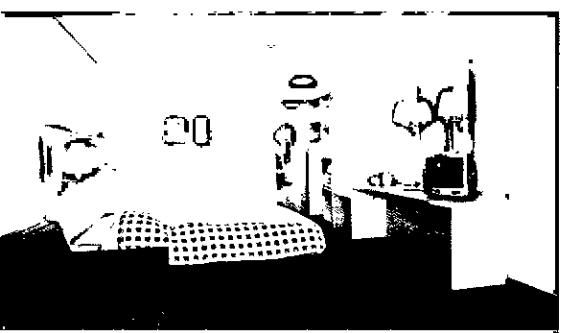
Schematic cross-section through the audiological test suite

CMS Acoustics ensures Travelodge guests sleep soundly

Preston Central Travelodge can enjoy a quiet night's sleep



SoundLay Plus acoustic underlay system



A typical Travelodge bedroom at Preston Central

Multibuild consulted CMS Acoustic Solutions to that ensure guests at the recently renovated Preston Central Travelodge can enjoy a quiet night's sleep. As the first budget hotel brand to launch in the UK in 1985, Travelodge currently has approximately 292 hotels across the UK in city centres, near attractions and airports. Preston Central Travelodge opened in March 2006 at Preston Farmers Office, New Hall Lane, Preston.

CMS Acoustics recommended SoundLay Plus, a high performance acoustic underlay system designed for timber floors, to insulate airborne and impact sound at the refurbishment project. When applied to timber floors, the product can achieve an airborne sound insulation of 49dB and an impact sound transmission level of 55dB. The product is a composite sandwich layer with an overall thickness of 12mm.

Preston Central Travelodge, a 72-bedroom mill conversion, required an acoustic solution that would reduce impact and airborne noise transmission between rooms, whilst minimising construction heights. SoundLay Plus exceeded the required airborne sound insulation of 43dB by achieving 55dB ($D_{nT,w}$ + C_{tr}) through separating floors. Impact sound was so low that it could not be measured.

Kevin Beech, site manager for Multibuild, explained that the use of floating floors in the project meant headroom was at a premium. As a thin material, SoundLay Plus kept the build-up depth to a minimum, whilst achieving the necessary airborne and impact sound performance. The product is simple to install and can be used with any final floor finish. This makes it a flexible choice for developers and a cost-effective solution for overcoming impact and airborne sound simultaneously.

SoundLay Plus is suitable for use in both commercial and residential applications, including new, retrofit and renovation projects. The material can also be used underneath concrete floors. A composite sandwich laminate, it is available in thin, easy-to-handle tiles which are quick and simple to install.

CMS Acoustics is the UK's leading independent provider of acoustic products, and delivers high quality solutions at competitive prices. This includes the leading acoustic floor system, Regupol, as well as CMS-manufactured products.

CMS Acoustics launches 'Sound Guide' for specifiers

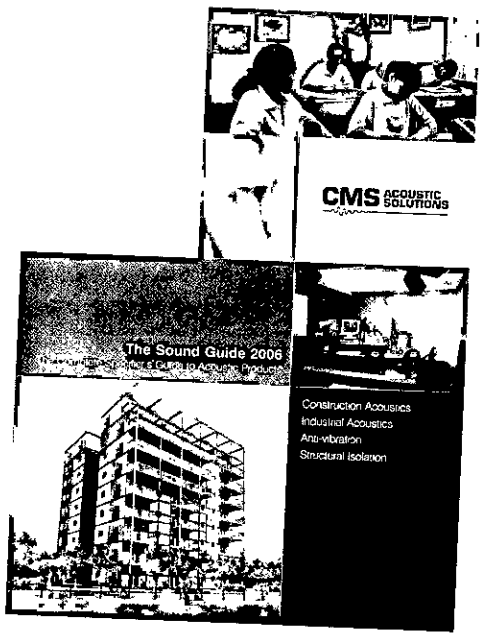
'ultimate specifiers' guide to acoustics'

CMS Acoustic Solutions has launched its 'Sound Guide', which the company says is the ultimate specifiers' guide to acoustics. This application-led directory provides detailed information on over 200 acoustic and anti-vibration products, making it the most comprehensive sound resource for the construction and industrial industries.

Updated annually, the CMS Sound Guide contains key technical data, physical information and acoustic performance figures for the full CMS product portfolio. This includes impact and airborne sound solutions for both new build and refurbishment. For ease of identification, Robust Detail products and approved types are clearly referenced.

CMS Acoustics delivers high quality solutions at competitive prices, including the leading acoustic floor system, Regupol. The group also includes CMS Vibration Solutions, which specialises in anti-vibration and structural isolation products for construction and industrial applications. Through exclusive partnerships with manufacturers of market leading systems, it has access to the full range of anti-vibration and structural isolation solutions.

David Holder, sales director, commented that understanding acoustics could be a complex task, which was why it was important for the company to make sure the right information was available when it is needed. A lot of time had been invested in developing an easy to use resource that made technical information accessible, and allowed much more straightforward selection of an appropriate acoustic solution. The company was committed to providing customers with ongoing support, whether it was delivered by their acoustically trained team, through the web site, or by consulting the Sound Guide.



The CMS Sound Guide is provided free of charge and can be requested online at **www.cmsacoustics.co.uk** or by calling **01925 577 711**.

House Builders' Federation

HBF Annual Planning Conference - Milton Keynes

This year's conference, to be held on 14 September 2006, looks at both the new challenges within planning resulting from PPS3 and the implementation of the Planning and Compulsory Purchase Act 2004, and the issues concerning the provision of affordable housing. Speakers include Colin Byrne, DCLG, Michael Gove MP and Steve Douglas, Housing Corporation. For more details contact **events@hbmedia.co.uk** or call **020 7960 1646**

ANV on the move

New headquarters in Milton Keynes

Noise and vibration instrument sales and hire company ANV Measurement Systems has moved to a new, more spacious headquarters. The company will now be supplying the ranges of instruments from Rion and Profound, and its own sound insulation measurement systems, from the ground and first floor suite in a more central commercial building in Milton Keynes. Continuing success of its instrumentation, calibration and consultancy arms has prompted the move to larger, well-appointed premises, but anyone who has returned hire equipment in person to the old address will be delighted that there will no longer be any need to carry it up two flights of stairs!

ANV can be found at Beaufort Court, 17 Roebuck Way, Milton Keynes MK5 8HL. Telephone (**01908 642846**) and fax (**01908 642814**) numbers remain unchanged for the present, as do the web site **www.noise-and-vibration.co.uk** and the e-mail address **info@ noise-and-vibration.co.uk**

2006 Queen's Anniversary Prize

Award presented to ISVR, Southampton University

Professor Steve Elliot, the Director of the University's Institute of Sound and Vibration Research (ISVR), has received the Institute's 2006 Queen's Anniversary Prize from HM the Queen.

The award formally recognises the ISVR's sustained excellence and outstanding achievements as Europe's leading centre for research, teaching, and consultancy in sound and vibration. It particularly acknowledges its achievements in improving the quality of life for the profoundly deaf and reducing noise pollution.

The work of the Institute centres on the interface between technology and humans. It has played a major part in making aircraft quieter, developing more efficient cochlear implants for people with hearing loss, and improving sound systems. At the core of these projects are clinics, including the South of England Cochlear Implant Centre, and collaborations with hospitals in the region.

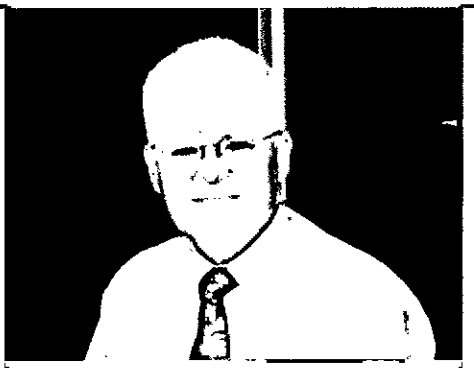
This Award formally recognises ISVR's sustained excellence and outstanding achievements in research in the field of sound and vibration over the past 40 years, and also its contribution to business and the wider community. It provides an opportunity for the University to highlight this achievement to the world at large and to celebrate the success with colleagues in ISVR,' said the Vice-Chancellor, Professor Bill Wakeham.

Prof Steve Elliott expressed his delight that the ISVR's work had been recognised in this way.

For more information, visit: **www.isvr.soton.ac.uk**

New face at CMS Acoustic Solutions

David Holder, sales director



David Holder

CMS Acoustic Solutions has appointed David Holder as sales director, to further develop the company's leading acoustic product portfolio and drive forward nationwide sales activity.

Commenting on his appointment, Holder said that since CMS Acoustics had quickly established itself as a leader in the acoustics field, he intended to build on this using his experience to ensure the continued smooth running of the company. Taking responsibility for building on the company's success, Holder is tasked with developing the existing product portfolio, expanding the sales team nationally and working with suppliers to provide increased support across the customer base.

He joins CMS Acoustics from Orion Trent, where he developed the acoustics division as national acoustics manager. With a proven track record in the construction industry, he spent 25 years at British Gypsum, before specialising in acoustics with Hodgson and Hodgson and Ecomax. He is an exclusive partnerships with manufacturers of market leading systems, it has access to the full range of anti-vibration and structural isolation solutions.

'Separation principle'

I would like to make a comment on Wendy Hartnell's article on current policy on environmental noise in Acoustics Bulletin March/April 2006 (pp.32-34) regarding the 'separation principle' in PPG24. Wendy says that it is becoming difficult to reconcile brownfield development policies with current guidance to separate noisy and noise-sensitive development. While I agree this can certainly be a challenge, not least in a city like London where high-density development is often necessary, I hope that this does not signal the total abandonment of a fundamental principle of good acoustic design in the new PPS24.

In fact, PPG24 guidance is to separate noise-sensitive development from major sources of noise, wherever practicable. This means that it does not place an insuperable obstacle to development in noisy areas, but rather promotes the idea that everything possible in the way of good design should be considered before resorting to the poorest option of simply installing acoustic glazing that has to be kept closed at all times. Separation can be by distance, noise barriers, layouts which place only non-habitable rooms on the noisy façade, and so on. Even if these measures cannot be applied in every case, there are nearly always other solutions better than just using double-glazing. For example, it is feasible in many situations to provide each habitable room with at least one window on a quiet facade so it can be opened without excessive noise intrusion, even if the other windows must be kept closed.

While noisy sites do need to be developed, we should aim to do so in the most sustainable and positive way possible to create a good and healthy living environment for the residents.

Alan Bloomfield
Senior Policy Officer - Noise,
Greater London Authority

Averaging of noise and loudspeaker positions in AD-E

I write with reference to Sue Bird's Technical Contribution to July's Bulletin, and in particular the Averaging of microphone and speaker positions in AD-E. Sue wrote a paragraph on the topic of the arithmetic averaging of the two source positions suggested by B2.6 in AD-E.

"The level differences obtained from each source position should be arithmetically averaged to determine the level difference, D as defined in BS EN ISO 140-4:1998"

To my eyes this statement specifically contradicts itself! AD-E states in 6 statements that the measurement and calculations methods in ISO 140 should be used for these tests. The relevant statement in BS EN ISO 140-4:1998 states in clause 6.3.1

"The sound pressure levels at the different microphone positions shall be averaged on an energy basis [see equation(1)] for all sound source positions."

I could ramble on for pages on this topic, but to keep it brief, surely with six statements saying that the ISO method for measurement and calculation should be followed, and one statement requiring arithmetic averaging as defined in ISO140 (when ISO 140 says use energy averaging), surely this should be treated as a mistake or misprint, as it appears to be a direct contradiction.

This one sentence has caused product manufacturers and numerous consultancies to invest in new calculation methods and procedures for what is, in its most basic form, an annex to a non-mandatory guidance document. See the third paragraph on page 3:

"Approved Documents are intended to provide guidance for some of the more common building situations. However, there may well be alternative ways of achieving compliance with the requirements. Thus there is no obligation to adopt any particular solution contained in an Approved Document if you prefer to meet the relevant requirement in some other way."

Ruairí O'Dúill
Sharps Redmore Partnership, Ipswich

[It seems to me that some definitive ruling is needed on this one, especially since the guidance appears to be mathematically naïve, if not plain wrong. Does the term 'arithmetic averaging' mean linear, ie non-logarithmic, averaging, or is it a poorly-expressed way of saying 'average the results by using arithmetic'? Does not the process of dividing numbers by 10, raising them to a power, averaging the results, taking the logarithm, then multiplying by ten require some arithmetic? — Ed.]

Definitions for the 21st Century Office

Alpha Geek
The most knowledgeable, technically proficient person in an office or work group: *'Ask Fred, he's the alpha geek around here'.*

Blamestorming
Sitting around in a group discussing why a deadline was missed or why a project failed, and who was responsible.

Percussive Maintenance
The fine art of attacking an electronic device to get it to work again.

Seagull Manager
A manager who flies in, makes a lot of noise, and then leaves.

SITCOMs
What yuppies turned into when they had children and one of them stopped working to stay at home with them. Stands for **S**ingle **I**ncome, **T**wo **C**hildren, **O**ppressive **M**ortgage.

Handheld sound level meter/analyser for environmental noise analysis

Larson Davis introduces the Model 831

Larson Davis has introduced the Model 831, a class 1 handheld sound level meter with exceedance-based logging analysis (ELA) for community noise assessment. The unit is designed to be small, lightweight and ergonomic, and provides real-time octave and third octave spectra over a 120dB dynamic range as standard. Ten customisable markers are provided to annotate time history data. The sound level meter also has audio and voice recording with replay, supported by up to 2GB of on-board memory and an optional USB 2.0 data stick.

For unattended noise monitoring, its event-based logging routines process data on-board to provide time, date, duration, average, maximum and minimum sound levels, frequency spectra, time history records of selected sound levels and even digital sound recordings for each event. The routines are specifically designed to save the user time in downloading and post-processing massive amounts of unprocessed sampled data.

For optimal digital communication, the USB 2.0 port allows the meter to communicate with a PC for control and downloading data. In addition, using native support for TCP/IP and the built-in USB host port, the 831 can interface directly with GPRS and Ethernet devices for simple internet connectivity. The instrument can be operated with one hand and has an easy-to-read backlit display, whether in direct sunlight or in a dark factory environment. When used with a PC, the USB cable provides instrument power and recharges batteries, much as it does on an MP3 player.

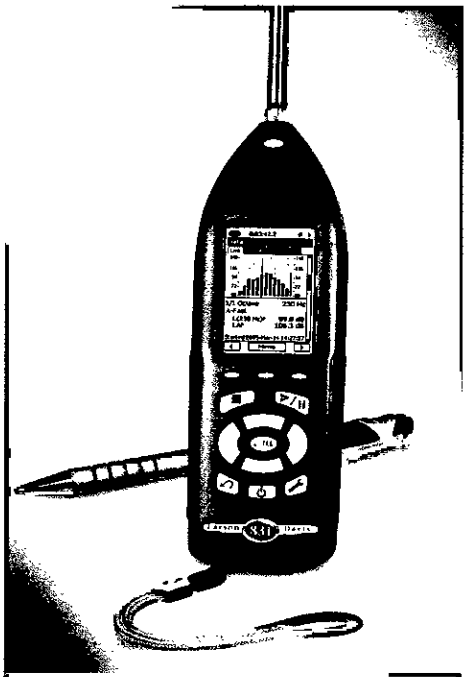
A full range of accessories is available including software, sound level calibrators, outdoor microphone systems with electrostatic actuators, weatherproof enclosures for short and long-term monitoring and a variety of tripods and tilt-down poles. All Larson Davis products are accompanied by full technical support and a guarantee of total customer satisfaction.

For more information, please contact Larson Davis on

Tel **+001 716 926 8243**

E-mail: **sales@larsondavis.com**

or visit: **www.larsondavis.com**



Larson Davis Model 831

Kemo

Fifth generation dual channel benchtop filter/amplifier

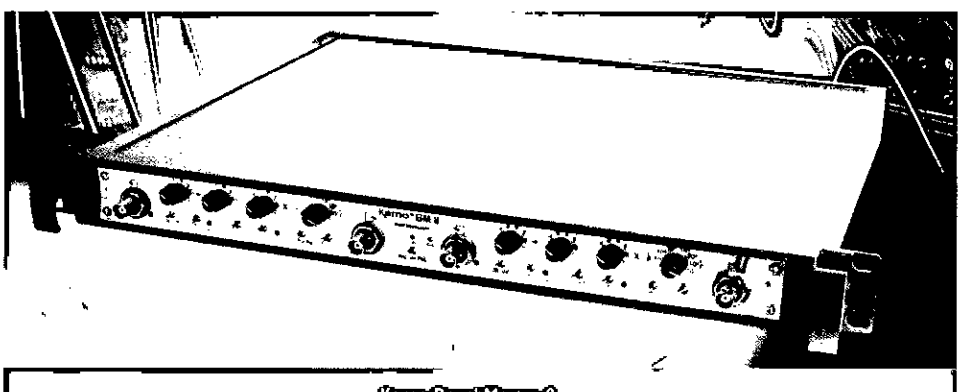
BenchMaster 8 from Kemo is a full redesign of the company's classis VBF8 dual channel benchtop filter/amplifier originally launched in 1975, of which thousands of examples are in service worldwide. The new version makes extensive use of surface mount technology to speed manufacture and delivery, as well as offering a number of performance enhancements including increased gain, lower noise, a greater dynamic range and a wider range of filter responses.

The new unit is available with a range of different filter types, including Butterworth, Bessel (4-pole and 8-pole), general purpose linear phase, and anti-aliasing responses. The filter frequency range is from 0.01Hz to 99.9kHz.

The two independent channels can each be switched between high-pass and low-pass. They can also be combined in series or parallel to give two channels of low-pass, two channels of high-pass, one of each, band pass (in series), and band stop or notch filtering (in parallel). The basic filter response has three 'modifier' settings: a minimum overshoot pulse mode for impulsive signals, a 'flat' mode which provides a flattened response to cut-off, and a Butterworth type response with -3dB at cut-off frequency. Using the 'flat' modifier, true 16-pole Bessel and Butterworth filters can be set, maintaining -3dB at cut-off.

The BenchMaster 8 has easy-to-use, clear controls on the front panel, with BNC inputs and outputs. The inputs can be AC or DC coupled, single-ended, or differential. Up to 54dB of gain in nine steps can be applied to the input before filtering, with four-stage LED signal level indication. A 4mA current source is also available for powering integrated electronics piezoelectric (IEPE) transducers, with indication of correct connection. An optional 10-30V DC power input allows the instrument to be used for portable and in-vehicle applications. The compact 1U metal case is designed for both benchtop use and rack mounting, and an optional transport and storage case is available.

For more information contact Kemo Ltd, Beckenham, Kent tel: **020 8658 3838**, fax: **020 8658 4084**, e-mail: **info@kemo.com**, web site: **www.kemo.com**



Kemo BenchMaster 8

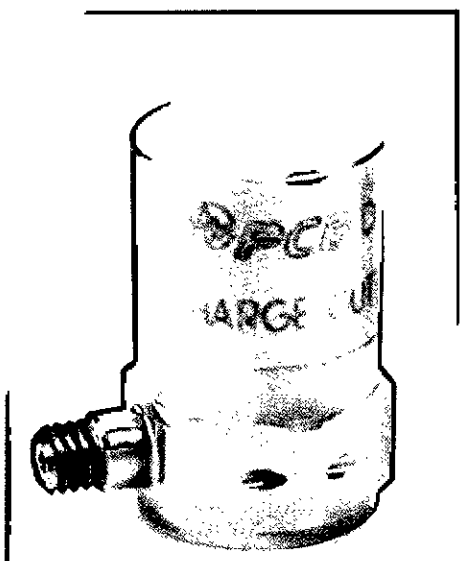
PCB Piezotronics

New Products

Miniature accelerometer for shock and vibration testing of electronic consumer products

The Vibration Division of PCB Piezotronics has announced the release of the Model 352C23 miniature ICP® accelerometer, designed for shock and vibration measurements in space-restricted locations and on small, lightweight structures. The unit weighs a mere 0.2g and occupies only a 2.8mm by 5.7mm footprint for minimal mass loading of the test article. The device is ideally suited for vibration studies and package testing of circuit boards, disc drive mechanisms, cellular phones, PDAs, and other consumer electronics. Other applications include NVH studies on automotive parts and modal analysis and structural testing of solar panels and satellite components.

The sensor is structured with a shear mode, piezoceramic sensing element and produces a 5mV/g output signal. It has an anodized aluminum housing, electrical ground isolation, 3-56 coaxial electrical connector, and a replaceable 3m low-noise cable.



High-temperature accelerometer for automotive exhaust system testing

Nose cone protects microphone and ensures sound measurement quality

New high-temperature accelerometer for automotive exhaust system testing

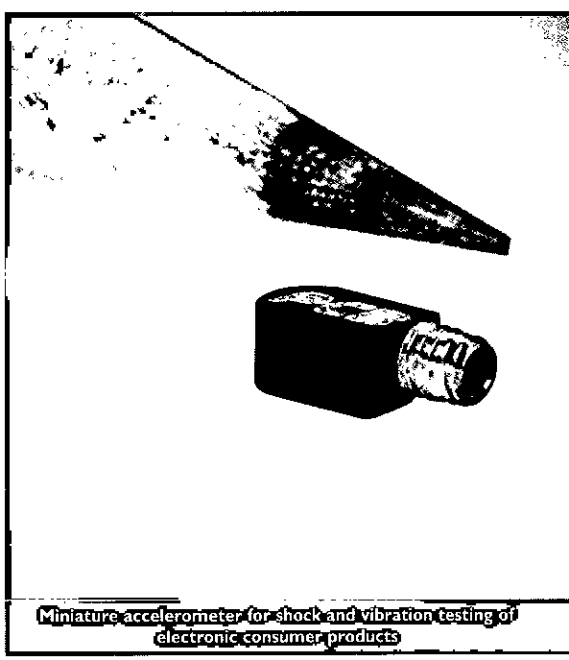
The model 357B65 high-temperature piezoelectric charge output accelerometer from the Vibration Division of PCB Piezotronics operates in temperature ranges of -54 to +482 °C), and is designed for vibration studies in the high-temperature environments found in power generation turbines and equipment, aircraft engines, and automotive vehicle engine test and exhaust systems.

The accelerometer connects to laboratory-style charge amplifiers or in-line charge converters, which condition the output signal for recording or analysis. The robust sensor is structured with a piezoceramic sensing element and an all-welded, hermetically-sealed housing. It has a sensitivity of 4pC/g and uses a 10-32 coaxial electrical connector.

Nose cone protects microphone and ensures sound measurement quality

A new accessory is introduced to the PCB acoustic product line. Model 079B21 is a nose cone designed to be used with quarter-inch test and measurement condenser microphones. Its aerodynamic shape is designed to minimise noise due to wind and other high-speed laminar flows while permitting the sound intended to be measured to pass through. Another advantage of the nose cone is its ability to protect the diaphragm and minimise damage by sand, dirt and other contaminates that might be picked up and directed toward the microphone by the wind. Typical applications are wind tunnel testing and outdoor environmental testing.

PCB also offers a complete line of modern prepolarised (0V) and traditional externally polarised (200V) microphones to go along with its value-oriented electret microphones and acoustic related accessories, to service most sound pressure, NVH, holography, acoustic test and measurement applications.



Miniature accelerometer for shock and vibration testing of electronic consumer products

For additional information on any of the above products contact the Vibration Division of PCB Piezotronics.

Tel: **+001 716 684 0001**

Fax: **+001 716 685 3886**

E-mail: **vibration@pcb.com**

Web site: **www.pcb.com**

Brüel & Kjær

Pulse helps hearing aid design

Brüel & Kjær Pulse helps hearing aid design

Widex, a pioneer in the hearing aid industry and one of the world's leading producers of high-quality hearing instruments, is a Danish company established in 1956 by Christian Tøpholm and Erik Westermann. Still family-owned, the company's hearing instruments are marketed and distributed through an international network of distributors in 80 countries. Some 97 percent of Widex's production is exported.

The relationship between Widex and Brüel & Kjær started 39 years ago, so Widex's search for a new measurement platform to replace the legendary Type 2012 naturally included Brüel & Kjær. The new instrumentation would not only have to accommodate Widex's current needs but also represent a secure investment for the future.

The challenges of hearing aid design

The ultimate goal for hearing aid designers at Widex is to give users the same opportunities for communication as people with normal hearing. Hearing aid designers take into consideration a long list of expectations, and corresponding challenges such as improving speech intelligibility in noise, reproducing natural sounds, ensuring that soft sounds are audible and loud sounds are never uncomfortably loud, effecting optimum music reproduction, and improving the user's perception of his or her own voice.

Although no hearing aid can restore normal hearing, recent advances in digital electronics, acoustics and audiological science have combined to make today's instruments of greater help than ever before. Widex believes it has the products and technology to help the hard of hearing to get the most out of everyday situations.

Keeping it in-house

Widex is a self-sufficient company, doing all of its research and development, testing, design and production in-house. This knowledge-based company is at the cutting edge of innovation within hearing aid technology, earmarking considerable resources for audiological and technological research to yield state-of-the-art, reliable hearing instruments. Like Brüel & Kjær, it has been in the business of innovation from the beginning. For example, it developed Quattro, the first hearing system making use of remote control, and Senso, the first fully digital in-the-ear hearing aid, up to the award-winning Senso CIC (completely-in-canal) model.

When a company of Widex's calibre decides that its current acoustic measurement platform can no longer fulfil its technical requirements, huge effort is put into an intense investigation of all possible solutions on the market. Only the best is good enough.

Open and flexible solution required

Widex's main requirement was a solution able to make the traditional standardised electroacoustic measurements performed on hearing aids. For many years, these measurements have successfully been made using the Type 2012 with its own dedicated software. However, being a technology-driven company, a solution was

required that was open and flexible enough to perform measurements not previously possible with the Type 2012. Measurements such as noise floor, directivity, EMC immunity etc were also considered important.

Introducing the PULSE platform

Brüel & Kjær presented a solution fulfilling the essential requirements, and introduced the PULSE platform to technicians, engineers and management at Widex. It is easy to imagine how attractive the PULSE platform must have appeared to a customer familiar with the user interface of the Type 2012. However, Widex's Measuring Engineer R&D, Søren Christensen, responsible for finding the replacement, was initially cautious.

Shortly after the introductory meeting, Widex engineers attended two days of PULSE training at Brüel & Kjær University in Denmark, with Brüel & Kjær engineers on hand to provide all the support needed. The primary objective of this training was to ascertain to what extent a standard PULSE system could replace the Type 2012. PULSE SSR analysis software Type 7772 went a long way to satisfying the requirements, leaving only two tasks outstanding which could easily be resolved with the help of VBA (Visual Basic® for Applications) programming.

Out with the old, in with the new

Widex is the first customer to use PULSE 9.0, and in the months after delivery Brüel & Kjær following its progress closely, helping it to successfully make the transfer to PULSE. The measurement system supplied includes the PULSE electroacoustic test system, PULSE data recorder, PULSE time file management, and PULSE data manager for five users. This set-up allows a comprehensive range of measurements on hearing aids.

Gain and output measurements include output sound pressure level response, full-on acoustic gain, frequency response, the effect on gain with different battery impedance or voltage settings, and OSPL90 with different battery impedance or voltage settings. Measurements of amplitude non-linearities include harmonic distortion with different battery impedance or voltage settings, and intermodulation distortion with different battery impedance or voltage settings. Measurements of internal noise generated are determined by third-octave analysis. Induction pick-up coil measurements include frequency response and harmonic distortion. Automatic gain control measurements include input/output characteristics for sinusoidal signals and dynamic output characteristics for speech signals at different levels.

Special test mode measurements include the effect of band gain control on the basic frequency control, group delay, and phase and amplitude characteristics. Real mode measurements include input/output characteristics at different bands and filter settings, attack and release time, oscillator frequency sensitivity and range, and absolute gain level check microphone noise squelch at different bands.

The future for Widex looks bright indeed. With untiring commitment to R&D, and now with the help of the PULSE platform, Søren Christensen and his colleagues can only succeed in their quest to break new ground and enhance hearing aid performance.

For further information contact Rebecca McCullough, Marketing Coordinator, Brüel & Kjær UK Ltd, Stevenage.

Tel: **01438 739000**

Fax: **01438 739099**

E-mail: **ukinfo@bksv.com**

Web site: **www.bksv.com**

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Committee meetings 2006

DAY	DATE	TIME	MEETING
Thursday	7 September	10.30	Membership (St Albans)
Thursday	14 September	11.00	Medals & Awards (St Albans)
Thursday	14 September	1.30	Executive (St Albans)
Thursday	**28 September**	**11.30**	**Council (St Albans)**
Thursday	5 October	10.30	Diploma Tutors and Examiners (St Albans)
Thursday	5 October	1.30	Education (St Albans)
Thursday	12 October	10.30	Engineering Division (St Albans)
Thursday	19 October	10.30	Publications (St Albans)
Thursday	2 November	11.00	Research Co-ordination (London)
Tuesday	7 November	10.30	CCENM Examiners (St Albans)
Tuesday	7 November	1.30	CCENM Committee (St Albans)
Thursday	9 November	10.30	Membership (St Albans)
Tuesday	14 November	10.30	ASBA Examiners (St Albans)
Tuesday	14 November	1.30	ASBA Committee (St Albans)
Thursday	16 November	10.30	Meetings
Thursday	23 November	11.00	Executive (St Albans)
Tuesday	5 December	10.30	CMOHAV Examiners (St Albans)
Tuesday	5 December	1.30	CMOHAV Committee (St Albans)
Thursday	**7 December**	**11.30**	**Council (St Albans)**
Tuesday	12 December	10.30	CCWPNA Examiners (St Albans)
Tuesday	12 December	1.30	CCWPNA Committee (St Albans)

Light refreshments will be served after or before all meetings. In order to facilitate the catering arrangements it would be appreciated if those members unable to attend meetings would send apologies at least 24 hours before the meeting.

List of advertisers

Conferences & meetings

Diary 2006 & 2007

6 September 2006
Environmental Noise Group
Draft Guidance on the Noise Act 1996 - Birmingham

11-12 September 2006
Underwater Acoustics Group
International Conference on Synthetic Aperture Sonar and Synthetic Aperture Radar - Lerici, Italy

26 September
Electroacoustics and Measurement & Instrumentation Groups
Intelligible Measurements! How accurate are speech intelligibility measurements in practice? - London

16-17 October 2006
Environmental Noise Group
Autumn Conference 2006 - Environmental Noise, WHO, Guidelines and Mapping - Oxford

3-4 November 2006
Electroacoustics Group
Reproduced Sound 22 - Raising the Standard - Oxford

6 March 2007
Underwater Acoustics Group
The Art of being a Consultant - London

10-12 April 2007
Underwater Acoustics Group
4th International Conference on Bio Acoustics - Loughborough

24-25 April 2007
Spring Conference 2007
Cambridge

5 June 2007
Envitonmental Noise Group
The Art of being a Consultant - Manchester

Further details can be obtained from
Linda Canty at the Institute of Acoustics Tel.: **01727 848195**
or on the IOA website: **www.ioa.org.uk**

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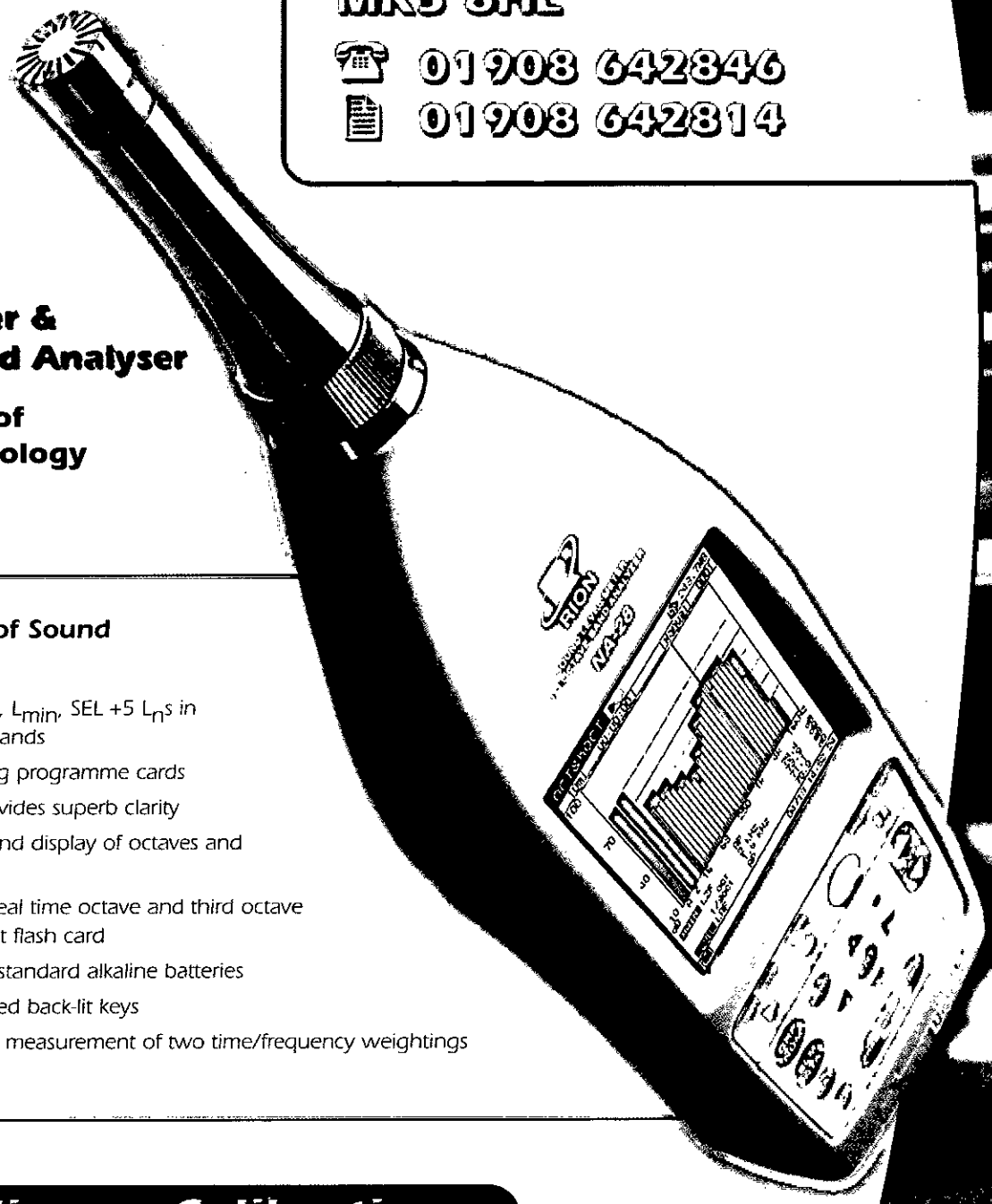

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