Acoustics BULLETIN

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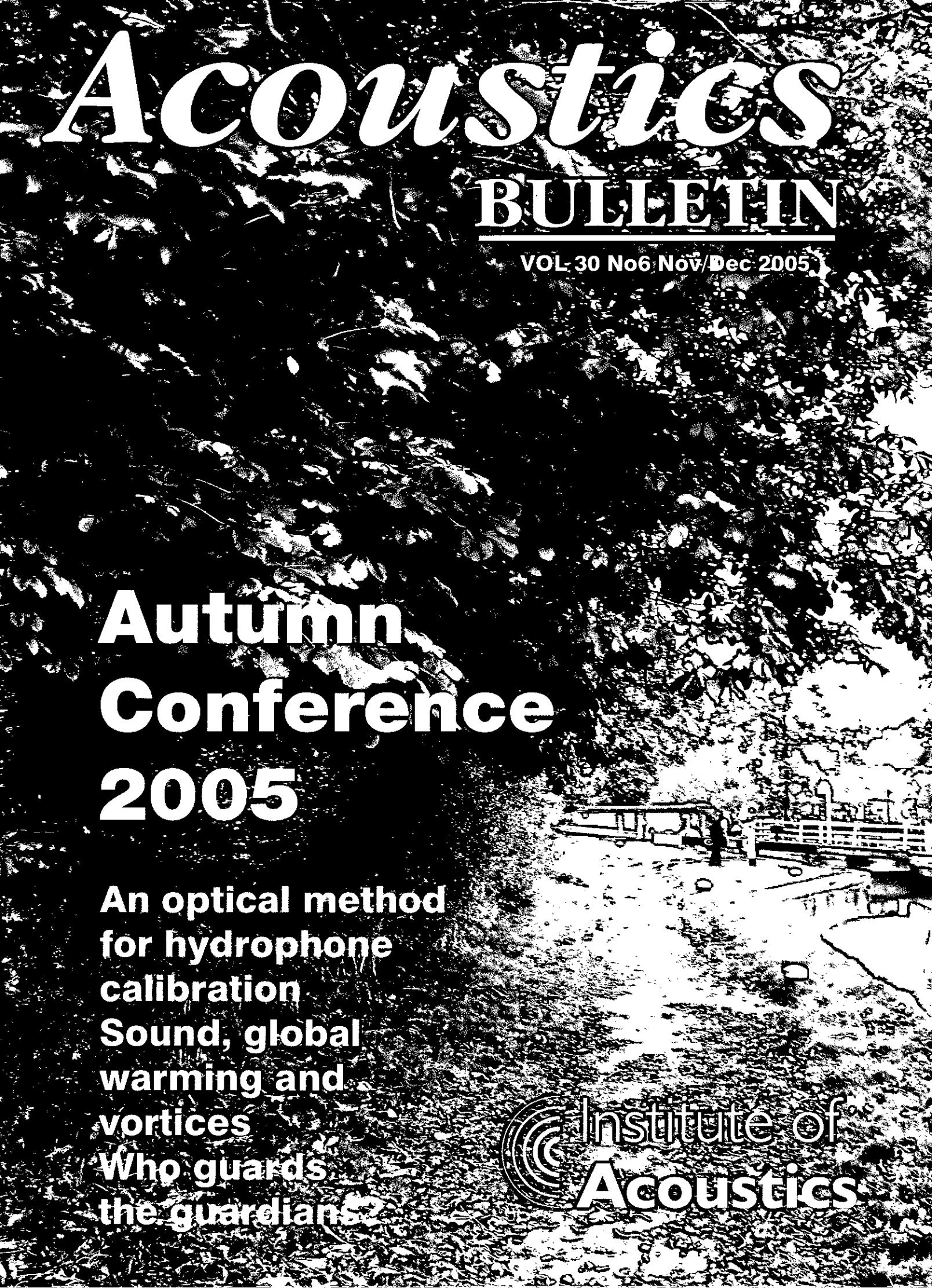

Autumn Conference 2005

An optical method for hydrophone calibration

Sound, global warming and vortices

Who guards the guardians?

Institute of Acoustics

Acoustics BULLETIN

Vol:30 No:6 Nov/Dec 2005

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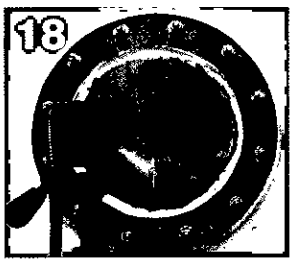

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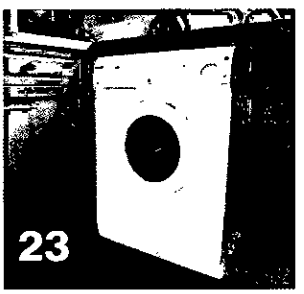

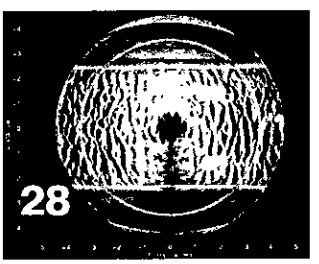

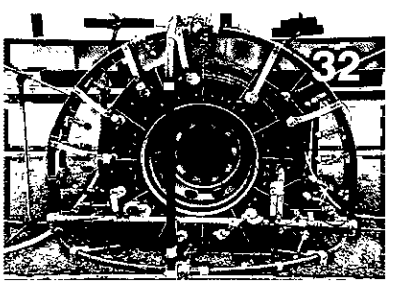

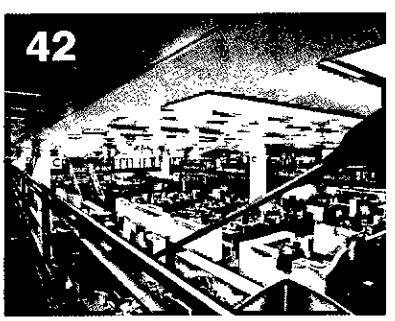

The Institute of Acoustics was formed in 1974 through the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society and is the premier organisation in the United Kingdom concerned with acoustics. The present membership is in excess of two thousand and since 1977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

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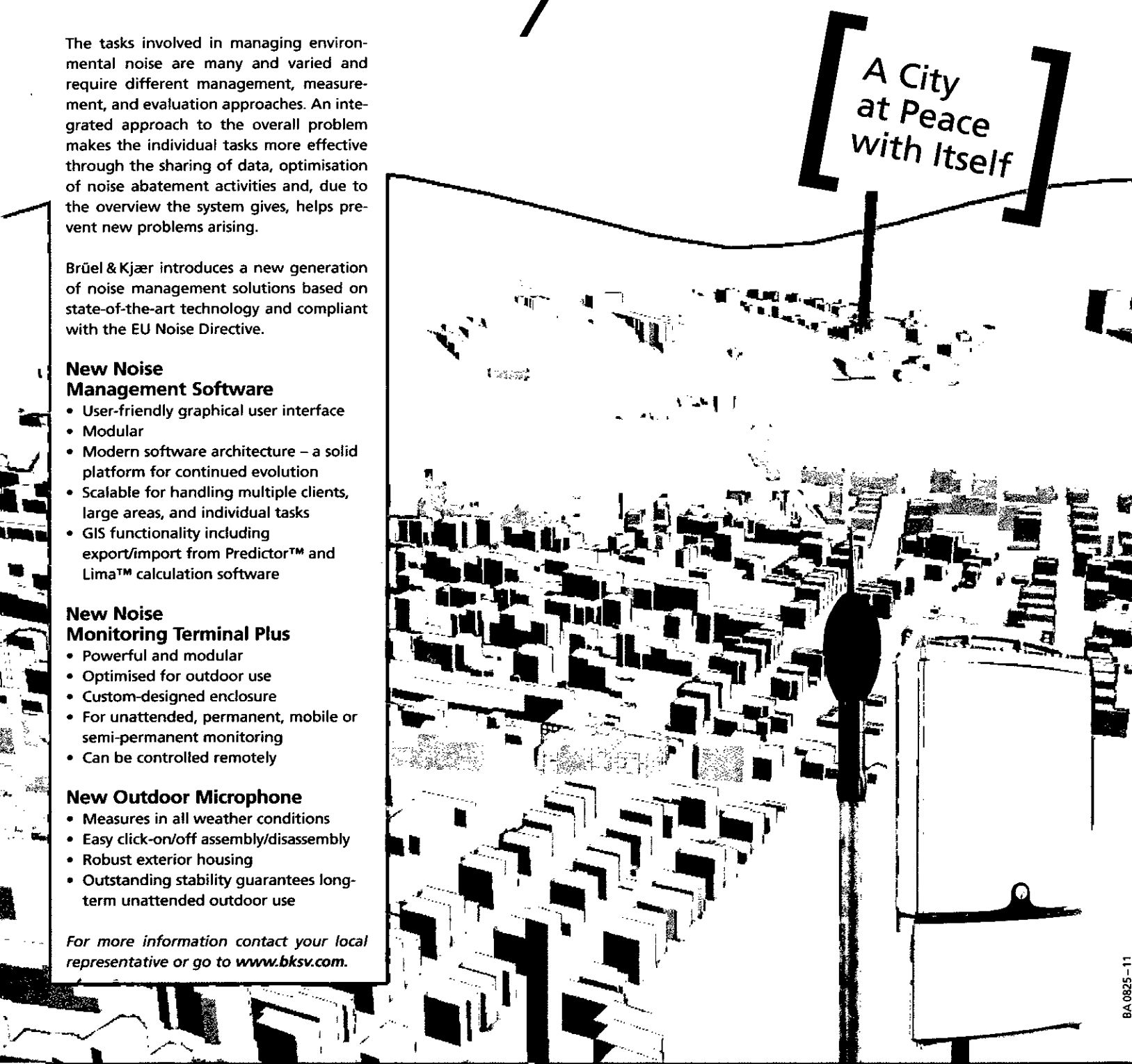

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An Integrated *Approach*

Brüel & Kjær

Dear Members

Stimulating public awareness of acoustics, and thereby of the Institute, is one of our objectives and I am pleased to reflect on a number of ways in which this is being achieved.

You will have read in the last issue of Acoustics Bulletin about John Hinton's OBE for his pioneering noise mapping work, since when we have learned of another external award which publicises acoustics as well as honouring the recipient's achievements. Tim Leighton has won the Institute of Physics Paterson Medal for 2006 (recognising outstanding early career contributions in physics and its commercial exploitation) for his world-leading work in the field of acoustics in liquids, encompassing biomedical ultrasonics, acoustical oceanography, cavitation and industrial ultrasonics. Our own awards, too, raise the profile of acoustics and our new Award for Promoting Acoustics to the Public was presented at Reproduced Sound 21 on 5 November. The winner is Bronwen Bird of Techniquest, for developing fascinating and innovative scientific exhibits and educational programmes in musical acoustics and sound propagation. Another 'first' was the announcement at the Autumn Conference of the results of the inaugural Young Persons' Award for Innovation in Acoustical Engineering, generously sponsored by IAC Ltd, one of the objectives being to increase the awareness of the value of acoustical engineering to the community. Andrew Hurrell of Precision Acoustics Ltd won the award for developing miniature high frequency hydrophones used in medical imaging, an example of acoustical engineering that benefits our lives. I am sure everyone joins me in congratulating these individuals for their achievements.

Our Research Co-ordination Committee has successfully encouraged funding bodies to recognise acoustics as a distinct subject area, and in this context it was good to hear recently of a successful bid to EPSRC jointly from Salford University and ISVR for 'Sound Matters', a project intended to inspire the next generation of acoustical engineers through the use of soundscapes and sculptural acoustic treatments.

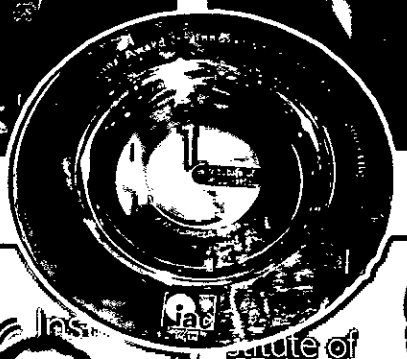
Participation in consultation processes is another way of ensuring that the Institute is in public view. We have been invited to participate in Defra's consultation on PPS24 'Planning and Noise' and also to express our views on the subject matter of the Royal Commission on Environmental Pollution's 27th report, noise pollution being one of the possible candidates. Our Environmental Noise Group is assembling our comments, so do ensure that the Group committee receives your opinions on these important issues.

As this is the last Bulletin for 2005, it remains for me to wish you all a happy Christmas and a prosperous New Year.

Tony Jones
President

Above: Andrew Hurrell, winner of the inaugural Young Persons' Award for Innovation, with Brian Quarendon (left) and Tony Jones

Kelvin Griffiths, runner-up, receives his commemorative goblet from Brian Quarendon



Below: Graeme MacLean, second runner-up, receives his commemorative goblet from the President

Some members of the judging panel for the Award for Innovation: (l to r) Geoff Crowhurst (IAC), Colin English (TECP), Roger Menaldino (IAC)

Young acoustician Andrew Hurrell wins new IOA award for innovation

Designing miniature hydrophones for medical use

A young acoustician who designs miniature hydrophones for medical applications has won the Institute of Acoustics' *Young Persons' Award for Innovation in Acoustical Engineering*, which was awarded for the first time this year.

Andrew Hurrell of Precision Acoustics Ltd received the award at the Institute's Autumn Conference in Oxford on 18 October 2005.

Brian Quarendon, chief executive officer of the award's corporate sponsor, IAC Ltd, presented Andrew with the stunning silver trophy together with his prize of a luxury weekend break for two in Copenhagen, a cheque for £500, and a tour of Denmark's new internationally acclaimed National Opera House, courtesy of Arup Acoustics.

First runner-up, Kelvin Griffiths of Harman Becker Automotive Systems, received a cheque for £200 and a commendation goblet while second runner-up, Graeme MacLean of Ricardo UK Ltd, received a commendation goblet.

The biennial award was introduced this year in a bid to celebrate and recognise the contribution of young acoustical engineers across a huge range of British industry sectors. It is aimed at those up to the age of 30, making their mark early on in their career. Entries were received from across a wide spectrum of acoustical engineering applications. These included medical ultrasound, automotive, building acoustics, loudspeaker design, noise control and acoustical detection systems.

Entrants' projects were judged on their innovation and inventiveness, feasibility and practicability. Further aspects taken into consideration by the judging panel were savings in money and time, environmental

> **'I had no idea that such a small ultrasound sensor could reap such large rewards'**

factors, user-friendliness to the end-user, and the degree of improvement offered to existing processes.

On accepting his award, Andrew Hurrell said: "I am delighted to receive this award. I had no idea that such a small ultrasound sensor could reap such large rewards. I am sure the creation of this award will serve to encourage other young acousticians by providing recognition of their achievements early in their careers."

IOA President, Dr Tony Jones, congratulated Andrew on his well-earned success, and said that his work had provided invaluable contributions to the development of high quality ultrasonic measurement devices for use in medical imaging. The achievement provided an excellent example of one of many areas of acoustical engineering that benefit our lives. The Institute of Acoustics was proud to highlight the work of young acoustical engineers.

Brian Quarendon confirmed how delighted his company was to be sponsoring this award, which demonstrated just how exciting and varied a career in acoustical engineering could be. As one of the UK's leading companies in noise control IAC did, of course, have a vested interest in promoting the sector, but the more entrants there were into the market, the wider the pool of engineers became for employers to draw from. He added his congratulations to Andrew and wished him every success in the commercial application of his product.

Award for Distinguished Service to the Institute
Citations for this year's recipients

John William Sargent MIOA

John Sargent spent most of his career in acoustics carrying out research at the Building Research Establishment where he became acting head of the acoustics section during the mid 1990's. He worked in key areas such as road traffic noise and its prediction, noise barriers, sound insulation of dwellings, noise nuisance, national noise incidence studies and low frequency environmental noise. The results of his work have been widely published.
John worked on a number of national committees such as the Department of Environment's *Noise review* (the Batho Report) and the Department of Transport's *Railway noise and the insulation of dwellings* (the Mitchell Report), and his work contributed significantly to the resulting legisation and government guidance.
He was also a member of several working parties including the working group on noise insulation regulations for new railway

John Sargent receives his Award for Distinguished Service to the Institute

lines and the technical sub-group producing calculation of railway noise, both for the Department of Transport. He was also on the IEMA and IOA working group that produced *Guidelines for noise impact assessment*.
John has also participated in BSI sub-committees; notably on industrial and residential noise (BS4142) and on noise barriers.
John Sargent has been a member of the Institute of Acoustics since 1977, having previously been a member of the British Acoustical Society. He has served on the Publications Committee for many years, indeed he is one of the longest serving of all Institute committee members. He has been both the Secretary and Chairman of the Publications Committee, and has only recently retired from the committee having remained a member for several years since giving up the chair. For many years, John also served as Assistant Editor of *Acoustics Bulletin* being responsible for producing the sections on new products and news from industry.
To acknowledge the Institute's indebtedness for his sustained contributions to the Institute over many years, the Institute of Acoustics gratefully presents an Award for Distinguished Service to the Institute to John William Sargent.

Peter Francis Dobbins, BA PhD CEng FIOA

Peter Dobbins had his first professional contact with acoustics working on transducer arrays for sonobuoys. This developed into a career in underwater acoustics which was directed mainly at research into underwater acoustic propagation and array performance.
Peter's educational qualifications were obtained as his career progressed, starting with a First Class Honours Degree in Technology and Applied Mathematics from the Open University and followed by a PhD from the University of Bath on the effects of turbulence and other environmental phenomena in the sea on sound propagation and sonar performance.
Peter became involved with dolphin sonar in 1997 and quickly developed a passion for trying to understand just this one aspect of what he believes are amazing animals; he is currently writing two books on the subject.
He also has a passion for historical musical instruments and is carrying out research into the acoustics of the hurdy gurdy.
Peter joined the Institute as a Member in 1982 and became a Fellow in 1995. During this time he has been deeply involved in the Institute's affairs. He has been a member of several Institute committees including periods as Chairman of the Underwater Acoustics Group, Chairman of the Publications Committee, and Chairman of the Musical Acoustics Group, as well as having been a Member of Council. He has also edited special issues of *Acoustics Bulletin* on the subjects of musical acoustics and underwater acoustics, in addition to writing numerous articles and papers for Institute publications.
Peter has also been an energetic organiser of IOA conferences starting in 1986 with an International Conference on fluctuation phenomena in underwater acoustics. His organisational commitments diversified to include his other interests, such as the International Symposium on musical

Peter Dobbins is presented with his Award for Distinguished Service to the Institute

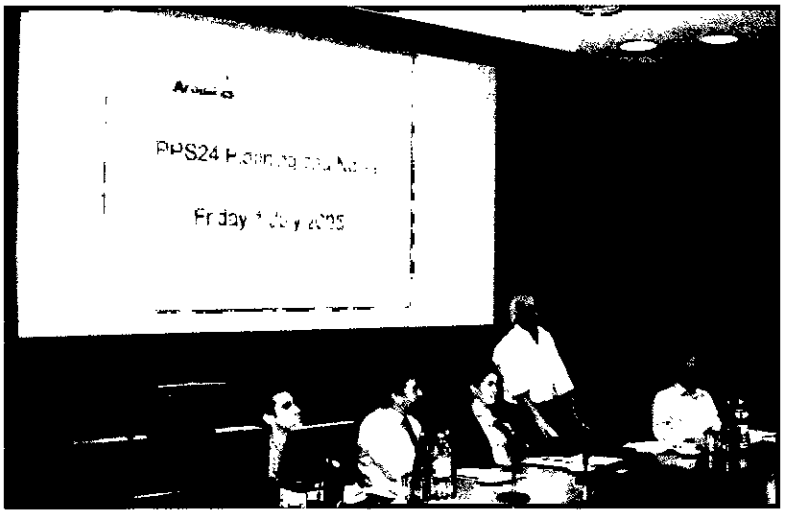
acoustics in 1997 and the Symposium on bio-sonar systems and bioacoustics which reflected his involvement with dolphin sonar.
To acknowledge the Institute's indebtedness for his sustained contributions in many fields, the Institute of Acoustics gratefully presents an Award for Distinguished Service to the Institute to Peter Francis Dobbins.

LET'S GET PHYSICAL

Control of Vibration at Work Regulations 2005
A one-day seminar •1 December 2005 • Buxton

The Control of Vibration at Work Regulations are the UK implementation of the EC Physical Agents Directive, which came into force in July 2005.
On 1 December 2005 at the Health and Safety Laboratory, Buxton, Derbyshire, a one-day seminar organised by the Institute of Acoustics' Measurement and Instrument Group will be held to discuss these new regulations. The meeting will be of interest to all Health and Safety Professionals, insurers and members of the legal profession.
Speakers from the Health and Safety Executive (HSE) and insurance professionals will give their views on the implications of the regulations for employers and industry. Having set the scene the meeting will then concentrate on practical aspects of hand-arm and whole-body vibration exposure, including measurement, control and health surveillance. There will also be an opportunity to hear about the role of measurement in the assessment of whole-body vibration exposure, and the assessment of other ergonomic factors associated with back pain, as well as whole body vibration in vehicles and the control of whole body vibration exposure.
The Health and Safety Laboratory, the UK's largest health and safety research and test laboratory, will be hosting the seminar. The laboratory has contributed to the preparation of the new regulations and the HSE guidance. Those attending will have the opportunity to tour the noise and vibration test facilities.

For further information regarding the seminar please contact Linda Canty, Institute of Acoustics, tel: 01727 848195 or visit the IOA website at www.ioa.org.uk



PPS24
Planning and Noise Workshop

Report Compiled by Steve Mitchell, Sarah Radcliffe and Ian Flindell

The Office of the Deputy Prime Minister is undertaking a review of PPG24, Planning and Noise 1994, in order to transpose it into a Planning Policy Statement. Following a healthy debate at the Autumn conference last year, a workshop was held to help formulate an IOA view on the new PPS that could be put to Defra in advance of the draft PPS which is due out for consultation by the end of this year

On Friday 1 July 2005, 54 delegates congregated at the Society of Chemical Industry, Belgrave Square, London. Three papers were given before lunch and the afternoon was devoted to a debate on the contents of the PPS chaired by Ian Flindell. Since the workshop the main areas where there was broad agreement have been distilled into a list of key points for Defra to consider. These are highlighted at the end of this report.

The day began with a presentation from **Sarah Radcliffe** (Peter Brett Associates) summarising the discussions at the Autumn Conference (see *Acoustics Bulletin* Report Nov/Dec 2004). Sarah's lively talk reminded us all of the numerous imponderable issues we had enthusiastically raised last Autumn, and set us all wondering how on earth we were going to agree on the key points to suggest to Defra. Ian Flindell began looking concerned at that point! Sarah reminded us of some of the more central issues where we had been more united.

- ❑ Should there be guidance on internal as well as external levels?
- ❑ Should you be allowed to choose to live in a noisy area?
- ❑ Will noise mapping under the END affect the PPS?
- ❑ Are NEC's too prescriptive?
- ❑ What about health impact assessment?

Dr Joan Carlos Blanco Matos (ISVR, University of Southampton) presented the results of a study on the relationship between the value of London apartments and their ambient noise levels. Joan Carlos reminded us of the commonly quoted result of hedonic house pricing studies that value decreases with noise levels at around 1% per dB above 55dB. He went on to show a rather different situation for London apartments based on estate agents sale offer prices and noise data from the London Noise Map.

For the 2774 apartments studied the highest values were in the 55-65 dB bands with prices dropping at lower levels as well as at higher levels. In contrast a secondary analysis of offer price against apartment size showed a highly significant relationship. Joan Carlos concluded that there are many other factors that affect house price more than noise levels, especially in high density housing areas. He asked if high density housing areas should be treated differently in the PPS, and advocated a flexible approach to development control on the basis of noise level.

Sarah Radcliffe sets up the visual aids for Martin Joseph's presentation

Joan Carlos' presentation triggered discussion, in particular on two key points: the idea that different approaches could be applicable depending on whether a resident has chosen to live in a noisy area or not; and the fact that the internal noise environment may be more relevant than the outside environment, especially in apartments.

Martin Joseph, Secretary General of the NSCA, then presented his *Alternative View of PPG24*. Martin clarified why PPGs were being replaced, gave some insight into the new format, and reminded us that the equivalent guidance documents TAN11 (Wales) and PAN56 (Scotland) were similarly being revised.

In discussing NECs Martin referred to the development work that led to the END, and how some Member States favoured weightings for different transport modes with perhaps a 10dB weighting against aircraft noise and a bonus for railway noise. EC research on this is ongoing, but the prospect of these weightings could resurface in the second round of noise mapping. Martin suggested that noise mapping should be given due attention in the PPS because of its high value in planning through studying effects in advance.

He noted that noise was sometimes addressed in a rather isolated way, yet there were often synergies with other environmental issues, so a more common approach to actions to address problems could be fruitful. Martin suggested that if, in future, Action Plans under the END required actions to reduce noise, then the PPS would need to address this and provide the tools to enable the necessary actions within the planning system.

Finally, Martin saw the transposition of PPG24 into a PPS as an opportunity to improve the planning guidance that the IOA should not pass by.

Ian Flindell chaired a lengthy and energetic post-lunch discussion. The general feeling at both the 2004 Autumn Conference and this workshop was that much of PPG24 is useful and helpful, but some areas, in particular NECs, could benefit from updating and revising. Most delegates aired views, stimulated by a list of subjects that had arisen in the morning sessions. Views from different perspectives moved the debates along and over tea a list of emerging main points was drafted.

The final session was used to try to draw out consensus views as far as we could. In most areas we were not able to conclude

exactly how best an issue should be covered in the PSS. But in terms of whether or not the PSS should address the issue, and to what extent the guidance in PPG24 needed revision, there was broad agreement on a series of issues that the group thought were important. These are summarised below and form the basis of the representation that will be made to Defra.

IOA members can make individual representations to Defra by writing to Duncan Stone, either before or after the consultation draft PPS that is due by the end of the year. The Environmental Noise Group plans to set up a further Workshop(s) at that stage to continue these debates with the aim of assisting Defra in development of this important piece of planning guidance.

There was broad agreement from the delegates on the important issues

Key points for DEFRA to consider

❑ *Scope of IOA Comments*

The IOA's input to the development of the PPS should focus on technical matters, but the wealth of experience that our members have in assessing and managing environmental noise should also be used by the Department to assist in the development of policy and the tools with which that policy is applied.

❑ *Format of the Guidance*

We understand the PPS will be in two volumes, a main text and a Companion Guide providing the more detailed guidance. We would suggest that the Companion Guide should be updatable, so as to accommodate the findings of future research as it emerges. We would also ask that Defra consult on the Companion Guide as well as the main text.

❑ *Flexible Guidance*

There is a danger in applying noise guidance simplistically without considering all important local noise factors. The PPS should warn against this and allow flexibility accordingly. The PPS should also emphasise that noise is only one aspect of planning decision making, and the noise assessor should be aware of other factors and should look for synergies in mitigation wherever possible. Whereas the main body of the PPS will state policy, the companion guide could offer options for best practice allowing for more flexibility.

❑ *Freedom to Choose*

There is much evidence of people choosing to live in desirable areas where external noise levels are very high. Defra should consider, as a matter of policy, if the same planning guidance should apply to social housing (or other forms of residence where that choice is absent) as to housing that is to be occupied by choice (eg. purchased or rented through the open market).

❑ *New Noise Sources*

PPG24 provides only brief guidance on planning new sources of noise. More guidance should be offered in the PPS if possible, eg. in relation to new transport infrastructure.

❑ *Noise Exposure Categories*

There may be scope to reduce the number of categories from 4 to 3. Whilst it is important for the categories to be defined in terms of external noise levels, guidance should be offered on internal levels too to improve consistency. The guidance should allow for 'green field' assessments but also for the benefit of committed mitigation measures to be included. Guidance on good noise standards for external areas around a property should also be given. The guidance on L_{max} levels for relevant sources should be augmented if possible.

❑ *Health Impact Assessments*

The PPS should emphasise that there is much research to be completed in this area and it should advise caution in using tentative dose response relationships in Health Impact Assessments.

The Environmental Noise Directive

The PPS should give an account of the implications of the END. It should provide the necessary policies to assist planners to work within the END's requirements. It should clarify the important role of Noise Mapping in strategic planning rather than in site specific studies.

Quiet Areas

The PPS should offer guidance as to the meaning and importance of Quiet Areas (as referred to in the END) in England, Wales and Northern Ireland. Future research may assist in this area, in which case an updatable section in the companion guide may be useful.

Noise Indicators

The noise indictors advocated in the END should be referenced in the PPS. The guidance in PPG24 on converting between indicators should be extended to include L_{den}, even though the PPS may not use this as its preferred indicator for site-specific studies.

Planning and Noise

PPS24 and related topics

IOA Meeting, London, 7 December 2005

Since it was issued in 1994 the Department of the Environment's Planning Policy Guidance Note 24 (PPG24) Planning and Noise has been the main source of reference for those involved in planning decisions where noise disturbance is likely to be a significant factor. The guidance has been under review by Defra and is expected to be re-issued as a draft for comment, Planning Policy Statement 24 (PPS24) with an associated guidance doucment, early in 2006.

The IOA meeting, to be held at the Royal Society in London, is designed to promote discussion around the various issues relating to noise and planning. With Defra's permission, the opening paper will review content of the new draft document, and set the focus for the rest of the meeting. There will be an opportunity, via discussion at the end, for delegates to pass on their views to Defra about the draft's proposed contents. This meeting will be of relevance to all those with an interest in the planning application process including local authority planning and environmental health officers, consulting engineers, developers, architects, noise consultants and planning consultants.

For a copy of the full programme or to register, please visit the IOA website at www.ioa.org.uk or contact Linda Canty by telephone 01727 848195 or e-mail linda.canty@ioa.org.uk

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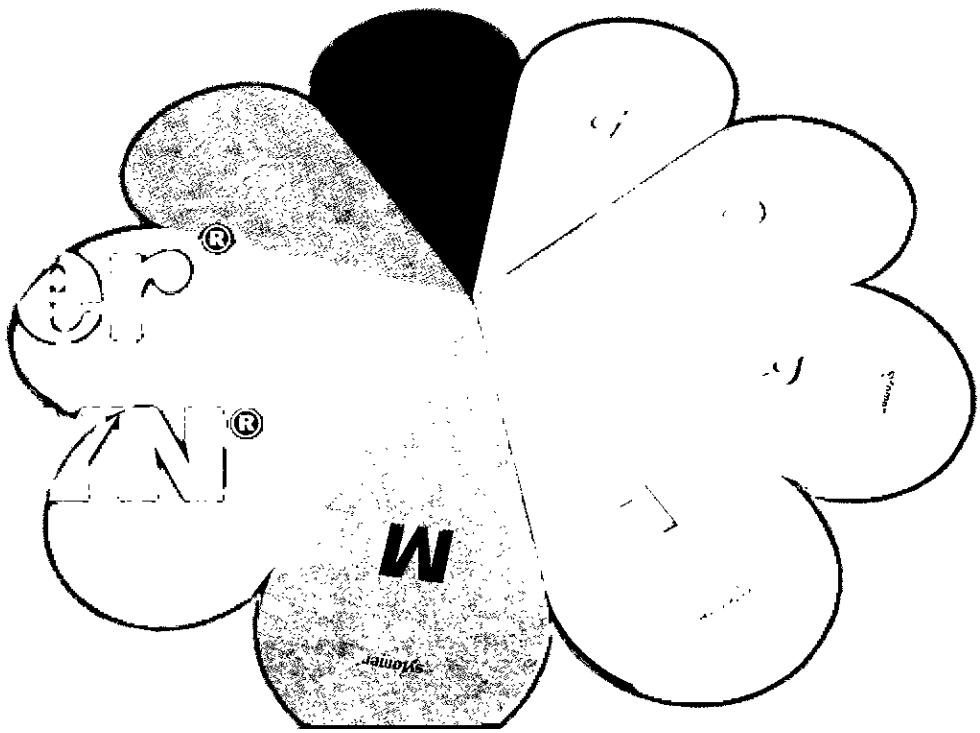

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Midlands Branch

Students present their projects

The University of Derby was the venue for the fourth Midlands Branch meeting of the year, held on 27 September, when appropriately enough, the topic for the evening was student presentations. This was the third year in which the Midlands Branch had hosted this event, where the best student projects of the year from both Diploma and Masters courses go head-to-head and make a presentation to the meeting. This year Scott Wilson generously donated a prize for the best presentation on the night. It was a very successful meeting, with 37 members and new diploma students attending.

First, Peter Dyson gave a very interesting talk on how he had gone about assessing the noise exposure of TV production crews resulting from their use of headphones during filming. Peter's first hand knowledge of the TV industry played a significant part in making his talk informative and entertaining. He was followed by Ester Drury, who continued the theme of noise in the workplace through her project which assessed the noise exposure of police dog handlers. Barking dog problems are familiar to us all but this was an unusual slant which made for another interesting and well-presented talk.

Finally, Mike Dean reported on the noise exposure of piling operatives in the field. A highlight of his talk was an animated model with ear shattering sound of a driven piling rig. Following the talks, committee members faced the difficult task of selecting a winner, eventually awarding the prize to Mike Dean.

Finally, Mike Fillery on behalf of the Branch congratulated the chairman, John Hinton, on his recent award of an OBE for services to noise mapping.

Mike Dean receives the Scott Wilson prize from chairman John Hinton

Mike Fillery

Sound insulation in dwellings

are current standards adequate?

The degree of sound insulation between our homes is an issue of increasing concern, particularly in higher density developments. Anecdotal evidence suggests that it is the greatest source of complaint and increasingly the source of litigation between the parties involved.

With the advent of the new Approved Document E to the Building Regulations 2000 in England and Wales, and the alternative routes of Robust Standard Details and Pre-Completion Testing, it is an opportune time to examine the situation in Ireland and identify issues that need to be addressed.

The Institute of Acoustics will be holding a joint meeting of the Irish and Scottish branches on 25 November 2005 at Clontarf Castle, Dublin, to discuss the implemention of the current English and Welsh Building Regulations and the proposed revision to the Scottish Building Regulations. It is considered that this meeting will provide a forum for discussion as to the suitability of the Buildings Regulations within the UK being implemented in the Republic of Ireland.

International conference to discuss the latest on auditorium acoustics

Copenhagen, 5-7 May 2006

The British Institute of Acoustics, in collaboration with the Danish Acoustical Society, is holding the latest in a 14 year series of international conferences linked to new auditoria.

The 2006 event will be held in Copenhagen, Denmark from 5 to 7 May 2006. The new auditorium projects in the capital and other Danish locations make this the ideal centre for such a conference.

Projects in Copenhagen include the recently completed Copenhagen Opera House, the new Danish Radio Concert Hall and the new National Playhouse.

The conference will look at recent auditorium designs, consider the latest thinking in auditorium analysis, modelling and design, and will review techniques in refurbishment, as well as looking at historical contributions.

For further information, please visit the IOA website at www.ioa.org.uk or telephone Linda Canty on +44 (0) 1727 848195

Editor's Notes

Ian F Bennett BSc CEng MIOA

Another Autumn Conference has come and gone, and it was a good reason not to venture out into two solid days of Oxford rain. They try to tell me Manchester is wet, but we are so generous in the North West that we let Southerners have some, too! However, the hotel was dry and warm, and the quality of the papers was well up to the usual standard. More than 100 delegates attended, and the numbers meant that the social aspects of the gathering (and the bar takings) were impressive too. A full report appears in this issue. This is the first year that the Autumn Conference and Reproduced Sound have not followed each other directly: we will be presenting a report on RS21 next time, since it will have taken place by then.

Plans are well advanced for the establishment of a Central Branch of the Institute, covering Hertfordshire, Bedfordshire and Buckinghamshire and surrounding areas. Council gave its approval on 13 October 2005, and the primary contact is David Watts, the chairman. He can be reached on davidwatts@airoltd.fsnet.co.uk. Watch this space!

Just as we went to press we received the sad news of the death of Gerry McCullach. He was one of the founding fathers, so to speak, of the Irish Branch, and will be sorely missed. An appreciation will be published in the next issue of the *Bulletin*.

Because the seasonal break gets in the way of the production process for the January/February issue, please let me have contributions, whether articles, letters or announcements, in good time and definitely by 5 December 2005. I can be reached on 0161-487 2225 or e-mailed via ian@acia-acoustics.co.uk.

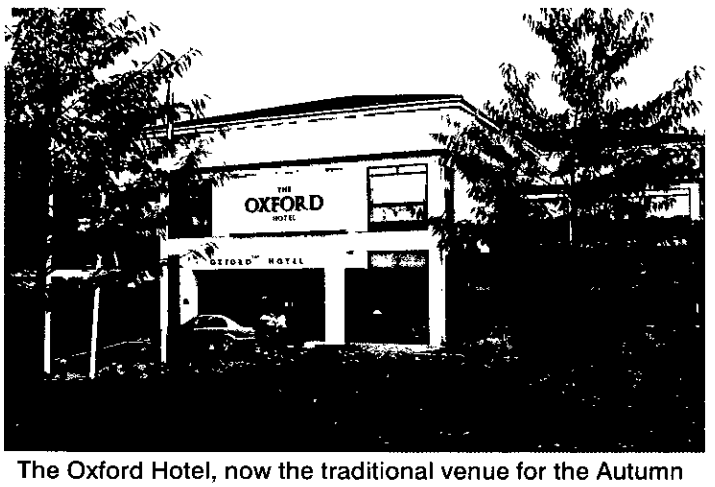
Ian Bennett
Editor

Ian Bennett reviews the highlights - and also took the photos

What noise annoys?

The IOA Autumn Conference took place in the Cranmer Conference Suite at the Oxford Hotel, Wolvercote, on 18-19 October 2005. The venue again lived up to expectations, being a combination of a modern conference centre and comfortable surroundings, even if a long walk is necessary to reach some of the bedrooms. As is now customary, the Conference Dinner took place in the main conference lecture room, which was transformed by the hotel staff in a very short space of time, and reinstated in time for 9 o'clock on Wednesday morning. Over 100 delegates attended (although not everybody was able to attend on both days).

The subtitle to the conference was 'What noise annoys', which produced a large number of environmentally related presentations together with papers on instrumentation and measurement. The organising committee, mainly members of the Measurement and Instrumentation Group, is to be congratulated on the high standard of papers attracted.



The Oxford Hotel, now the traditional venue for the Autumn Conference

TECHNICAL SESSIONS

After a welcome by **Richard Tyler**, chairman of the Measurement and Instrumentation Group of the Institute, Tuesday's proceedings began with an invited paper by **Wendy Hartnell** (DEFRA) on *Environmental Noise - Current Policy Issues*. Wendy covered three current areas of environmental noise policy, firstly outlining DEFRA's current thinking on the development of a national ambient noise strategy. The background to the EU Environmental Noise Directive was then explained, and how this will be implemented in the UK was discussed. Lastly, she was able to give the current 'state of play' on the review of Planning Policy Statement 23 (PPS23), a matter of particular interest to many consultants and local authority representatives in the audience.

Environmental Noise Legislation

The first of four themed technical sessions, on Environmental Noise Legislation, then opened with **Ian Campbell** in the chair. **Bernard Berry** (Berry Environmental Ltd) gave the first paper, *A review of methods for quantifying acoustic features in environmental noise*, co-written with Nicole Porter (independent consultant).

The Department of Trade and Industry, through the National Measurement System Directorate, has been funding a major research project on Environmental Noise. Its aims were to improve the quality and validity of environmental noise measurements, and to contribute to the improvement of British and International Standards on environmental noise.

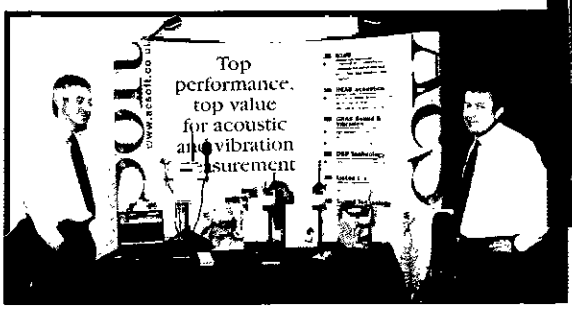
The project has three related aspects, with a separate work package being organised for each aspect. Work package 1 is a critical review and inter-comparison of methods of quantifying acoustic features in environmental noise, such as tones and impulses; work package 2 is to identify and quantify the sources of uncertainty in environmental noise measurements; work package 3 is the publication of practical guidance to minimise these uncertainties.

The authors are in a consortium of consultants undertaking the project and were responsible for the first work package, on acoustic features (work packages 2 and 3 were discussed later in this conference). Bernard summarised the environmental noise project, and then described the later phases of his and Nicole's specific part of the project, including a detailed review and synthesis of numerous previous research publications, in which intercomparisons were documented of the 'performance' of methods of quantifying acoustic features. He then covered a survey of the state-of-the-art on practical implementations of various methods in commercial instrumentation, and in measurement systems used in research. Some new small-scale intercomparisons were mentioned, and recommendations made.

Reference was also made to recent relevant developments arising from the Plenary Meeting of ISO Technical Committee 43 'Acoustics'/Sub-committee 1 'Noise' in Canada in June 2005. Here, a formal Resolution was adopted to register a new Preliminary Work Item 'Acoustics: Determination of tonal components of noise and determination of a tone adjustment for the assessment of noise immissions'.

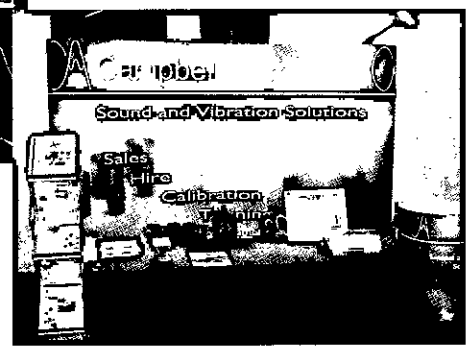
Next, **Jonathan Lartice**, also from DEFRA, developed Wendy Hartnell's presentation by discussing current developments in neighbour noise policy, with particular

Exhibitors' Corner....1



Steve Thomas and John Shelton man the AcSoft exhibition stand

ProsCon showed a range of instrumentation and software



Campbell and Associates with their Norsonic range

reference to current and near-future guidance and statutory regulations.

After the coffee break, **Helen Morrissey**, Belfast City Council, asked *Is the Noise Act 1996 an effective means of limiting disturbance due to noise in dwellings at night?* The Act was introduced specifically to deal with night-time noise affecting dwellings. Action can be taken under this Act if the noise complained of exceeds, or is likely to exceed, the permitted level. Anecdotal evidence from Belfast City Council (BCC) officers has suggested that in many instances people have genuinely been disturbed by noise even though the measured noise level did not exceed the permitted level.

Helen's paper was based on a study which sought to investigate an appropriate method of assessing disturbance due to night-time noise, and to make recommendations for an appropriate standard. A representative sample of complaints about noise disturbance in dwellings at night was investigated. Complainants and investigating officers were required to give an 'annoyance rating' for the noise complained of, and appropriate measurements were taken. It was possible to conclude that the continued use of the existing assessment method under the Act, which involves noise level and level difference, was more appropriate than introducing a new criterion based solely on level difference. However, in order to make the Act more effective it was concluded that the minimum permitted level should be reduced from 35dB(A) to 30dB(A).

CRASBOS: New tools for noise control was a paper presented by **Dave Strevens** (London Borough of Greenwich). The control of unreasonable noise from domestic premises has traditionally relied on statutory nuisance legislation, specifically the Environmental Protection Act 1990 (EPA). In serious cases, the introduction of anti-social behaviour legislation gives noise professionals some significant new enforcement tools to complement the sanctions already available under the EPA.

The 'antisocial behaviour order on conviction' (CRASBO) appears likely to be the most useful of these new tools. Potentially granted after a conviction for the breach of an EPA Abatement Notice, the CRASBO adds the power of arrest, unlimited fines and up to five years' imprisonment. Very usefully, CRASBOs can also be used to tackle some of the underlying problems of difficult noise cases (such as alcohol or drug abuse). Dave spoke about his experiences and those of colleagues in gaining CRASBOs, and offered his advice on appropriate procedures, wording and enforcement. The necessary Human Rights considerations were also discussed.

After lunch, the technical session on Sound Quality, chaired by John Shelton, was to have begun with a presentation by Patrick Chevret of a paper co-authored with four colleagues at 01dB (France), EADS-Deutschland GmbH (Germany), and SNECMA Moteur (France). Unfortunately, the problems caused by early fog at Heathrow Airport resulted in the cancellation of Patrick's flight from Paris, so the papers scheduled to follow his were moved up the running order. It is hoped that the paper can be presented at a future Institute conference, or that the content can be offered in a future issue of *Acoustics Bulletin*.

Stepping smartly into the breach, **Daniel Simmons** (National Physical Laboratory) proposed some *Test signals for validating sound quality measurement instrumentation*. Psychoacoustically-based metrics used for the assessment of sound quality are increasingly used in the design process of consumer products and machines. The most commonly used metrics have been defined, but not standardised (except for loudness) and as a result, the manufacturers of sound quality measurement instruments adopt their own implementations for the calculation of these metrics.

A validation exercise is being conducted by NPL with the objective of assessing, for a set of commonly used metrics, the variation among commercially available sound quality measurement systems. This is achieved by applying to the instruments a suite of input signals comprising a variety of specially produced digital test signals. These include electronically created signals with particular characteristics, and recordings of actual machines and products from common application areas of sound quality metrics. Initially, the performan ce of three sound quality measurement systems was assessed using a representative selection of the test signals. Daniel was able to summarise the preliminary results of this validation exercise.

On behalf of her two colleagues F Karalekas and CH Charemis at the Department of Civil Engineering and Architecture, Technical University of Athens (Greece), **Alexandra Sotiropoulou** gave a paper entitled *Subjective evaluation of urban noise in Athens: a multidimensional description of evaluations*. This was despite her own delayed travel: we understand that Richard Tyler was mightily relieved at Alexandra's arrival! Subjective evaluation experiments of urban noise were carried out in the city of Athens, drawing a listening panel from a wide cross-section of citizens. The experiments involved the development by experimental means of a list of twenty

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opposite labels as descriptors of urban noise. These labels were then used at the poles of bipolar rating scales in three subjective evaluation experiments at distinct urban locations. Factor analysis of the raw scale judgments produced four independent factors for each experiment.

Three of these influences, social behaviour, state of awakening, and ordinary daily activities, emerged in more than one experiment. The last factor is in general agreement with results from earlier studies which employed assessors from a different cultural background from those of the current study. Four other factors emerged only once in the present experiments: common leisure activities, personality, mode and choice of location of home location, and task performance. The results provided evidence that the subjective impact of urban noise does not correspond to a single experience, and illuminated some of the ways a relatively wide cross-section of citizens might describe their experience of being exposed to urban noise.

The gap left by the missing paper was filled at short notice by **Stephen Turner** (Casella Stanger) and **David Waddington** (University of Salford), who dealt with the role of measurements in environmental noise assessment. To the uninitiated this might seem obvious, but the fascinating experiences of the two substitute speakers, and the all-too-brief discussion that followed, illustrated many frequently-encountered misapprehensions.

Environmental Factors in Noise Assessment

'Environmental Factors in Noise Assessment' had by far the greatest number of technical papers, so it was conveniently split into two sessions, both chaired by **Susan Dowson**.

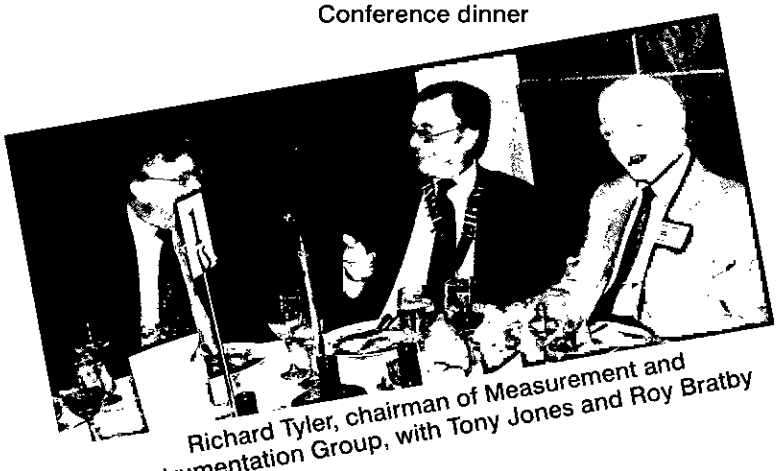
The first paper after tea, *Variability in environmental sound fields,* was presented by **Ian Flindell** (ISVR, University of Southampton) on behalf of his co-authors A J Bullmore and J Adcock (Hoare Lea Acoustics, Bristol) and J Alberola (ExxonMobil, London). To obtain a fully comprehensive picture of an indicated environment, the extent of variability was often as important as the long term average required by current assessment procedures. There were various methods for estimating variability, with various advantages and disadvantages. The investigation reported in this paper examined three separate measurement databases to identify empirical relationships between variability and other factors which could also be soundly based on established theory. The data suggested that variability increased with increasing distance from the most dominant source and also increased with decreasing sound level. The effects of turbulence appeared to be limited to the higher frequency bands and did not increase with increasing distance. The 'worse case' approach adopted within practical engineering methods such as ISO 9613 was likely to give representative results in many situations but not where the prevailing wind was unfavourable to acoustic propagation.

Next, **David Waddington** gave the paper he had actually

The social highlight

Conference dinner

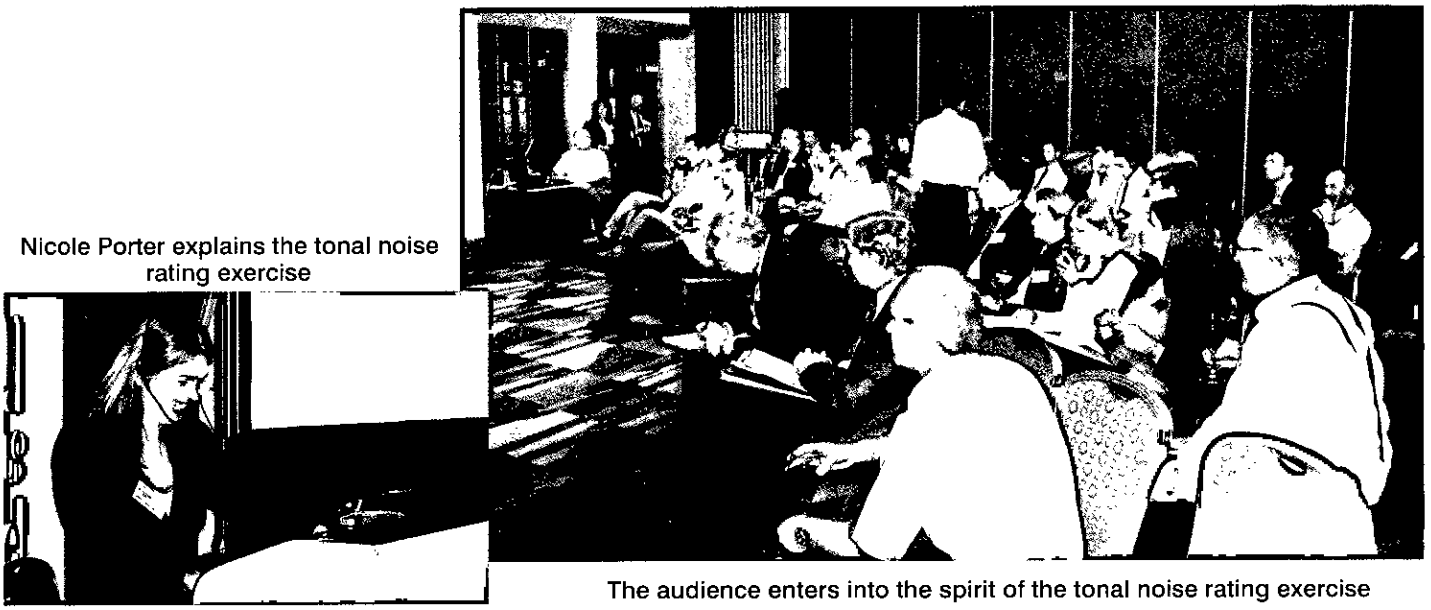
Sherry reception: Sue Bird, Peter Bird and Bernadette McKell



Richard Tyler, chairman of Measurement and Instrumentation Group, with Tony Jones and Roy Bratby

The Conference Dinner lived up to standards we have come to expect of the Oxford Hotel: the staff certainly seems able to provide a good-quality three-course meal, well presented and hot, to more than 100 people at once, which is no mean achievement in itself. Immediately after the dinner, Tony Jones, President of the Institute, presented the award for the best Diploma 2005 to Simon Faircloth, and Awards for Distinguished Service to John Sargent and Peter Dobbins. He then introduced Colin English, President-Elect and chairman of the judging panel, and Brian Quarendon, Chief Executive Officer, IAC Ltd, who spoke about the inaugural presentation of the Young Persons' Award for Innovation in Acoustical Engineering. The two runners-up, Graeme MacLean and Kelvin Griffiths, and the winner, Dr Andrew Hurrell, were presented with their prizes and trophies.

The Citations and presentations of Awards are reported on pages 4 and 5 of this issue



Nicole Porter explains the tonal noise rating exercise

The audience enters into the spirit of the tonal noise rating exercise

been expecting to present, co-written with Geoff Kerry (University of Salford). *Considering uncertainty when performing environmental noise measurements* was about the most recent developments arising from the project originated in 2000, which had led to the publication of the Good Practice Guide now well-known by environmental noise practitioners. The use of current instrumentation and metrics in environmental noise survey work was discussed, in keeping with the remit of this conference and its emphasis on measurement and instrumentation.

The final mentally-demanding activity of the first day involved the rating of various sample sounds by the delegates. The exercise was led by **Nicole Porter**, ably assisted by Ian Campbell and Bernard Berry, and with the invaluable technical assistance of Ken Dibble. A range of sample sounds with varying degrees of tonal content has been used in the development of the latest version of ISO1996 Part 2: 2005. These sounds were played to delegates, who first were obliged to 'down' a complimentary glass of wine provided by a sponsor who wished to remain anonymous. We were told by Nicole, in her best 'mother knows best' voice, that we must empty our glasses *before* marking the sample sounds from 0 to 5. Most delegates had no difficulty with this particular instruction, despite the attempts of some to obtain clearer terms of reference. However, the idea was to reproduce exactly what the original listening panel had to do. The results will be published in a forthcoming *Acoustics Bulletin*, but there seemed to be general agreement that the obviously tonal noises were, well, tonal, and broad band noises ... were not! The standard of professionalism of the listeners, and the 'pin drop' quiet between sample sounds was particularly praiseworthy. Please can all delegates arrange to attend the same Bridgwater Hall concert as me, the next time I go?

Noise Mapping

The session on *Noise Mapping*, chaired by **William Egan,** began on Wednesday 19 October with a paper by **Dietrich Kuehner** (deBAKOM GmbH, Odenthal, Germany) on *Measured and Calculated Reception Noise Levels*. The strategic noise maps required by EU Directive (2002/49/EC) relating to the assessment and management of environmental noise can be produced by calculation from information such as the numbers of trains or road vehicles per day, and can also incorporate measured data from industrial sources or air transport noise. Once the strategic noise maps have been established, action plans are required in order to demonstrate how the noise load may be reduced.

The question therefore arose as to how accurate the noise maps were in the first place. Dietrich spoke about the major deviations between the calculated results and actual experience, which included the calculation method for sound emissions, meteorological conditions such as wind direction and temperature inversion, and the accuracy and detail in the topographical model. The need to correct real data for atmospheric conditions was specifically mentioned. Where road traffic was concerned, an example was given where the actual noise levels were 10dB greater than predicted by model, because of the poor condition of the road surface on a busy highway. Data for the number of trains passing along a particular stretch of track could be unreliable (in Germany, at least) because the train operators overstate the traffic rates for financial reasons. Aircraft noise could be over-calculated because the actual variation in aircraft flight paths was much greater than was assumed by the noise calculation model, meaning fewer aircraft overflew a particular location. In conclusion, it was possible to control the quality of the strategic noise model by using data from real measurement, although this should only be attempted if the reasons for the deviations are well understood.

Following directly the subject matter of the first paper, **John Shelton** (AcSoft) then gave a presentation on *A wide-area noise monitoring system for the validation and*

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Exhibitors' Corner....2

John Gregory, ANV, demonstrates the company's products

What noise annoys?

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optimisation of noise maps. John described the architecture and realisation of a new noise monitoring system, and its application to the validation and optimisation of noise maps. The practicalities of monitoring noise over a wide area with any degree of accuracy have always been dominated by issues such as capital cost, running cost, complexity, communications and data management. Continuous developments in both measurement and information technology now permit large-scale collection of data on a cost-effective basis, offering a powerful tool for both noise management and public communication.

Several pilot schemes had been installed, and organic growth of these systems provided invaluable practical experience for further development, both in systems capability as well as future applications such as source identification and automatic control. The requirements of a wide-area noise monitoring system could broadly be classified into two technologies: measurement technology, concerned with acquisition of the noise data, accuracy, dynamic range, calibration, weather protection and stability; and information technology, concerned with gathering measurement results, storage, management, analysis and publication. In both cases, recent advances had brought efficiencies, making a true multi-point system practically feasible.

The pre-coffee morning session was then brought to a close by **Andrew Jellyman**, who gave a paper jointly prepared with John Hinton and Kevin Howell (all Birmingham City Council), *BUMP: the Birmingham Updated Noise Mapping Project*. Birmingham was the first city in the UK to produce citywide noise maps of the main transportation noise sources. This project was supported by the UK Government's Department of Environment Transport and the Regions and was completed in 2000. Its main achievement was to demonstrate that it was possible to carry out such an exercise in the UK by employing modern computer-based techniques to produce noise mapping data, subsequently produce data on noise exposure across the city and, thereby, examine the effects on noise exposure of potential noise reduction initiatives.

In 2004, with the support and encouragement of central government, it was decided that the Birmingham Updated Noise Mapping Project (BUMP) would be undertaken. This project aimed to extend the expertise the city's officers gained from the original noise mapping project, in order to create a new and integrated environmental noise assessment methodology to aid in the future management of environmental noise in the City of Birmingham. In carrying out the updating project the technical and reporting requirements of the so-called Environmental Noise Directive for the first round of strategic noise mapping are to be fulfilled as far as possible. All EU member states are required to complete such mapping, for major roads, railways and airports and for all agglomerations with more than 250,000 inhabitants, by the middle of 2007. The intention is to complete and report on the BUMP project by April 2006, meaning that the paper at this Autumn Conference was effectively a progress report.

The next paper was *Error propagation analysis of XPS 31-133 and CRTN to help develop a noise mapping data standard*, by Hans van Leeuwen and Renez Dota (DGMR Industrie Verkeer & Milieu BV, den Haag, Netherlands) and **Simon Shilton** (Acustica Ltd, Manchester) who presented the work. In its capacity of support for the chair of the European Working Group - Assessment of exposure to noise (WG-AEN), the UK government Department for the Environment, Food, and Rural Affairs (DEFRA) led a research project to determine the likely effects on the acoustic accuracy of calculated noise levels, if the advice contained within the Working Group's Position Paper (GPG) were followed.

The GPG provides a series of 'toolkits' designed to assist EU member states, and their designated competent authorities, in fulfilling their obligations under the Environmental Noise Directive (END). The GPG toolkits provide guidance on possible steps to be taken, or assumptions to be made, when all the data needed by member states, in order to undertake the large scale wide area noise mapping required by the END, lacks coverage or detail. The research project brought the authors of this paper to the question of how the results of such an accuracy study could be used for drawing up requirements for noise mapping input data, depending on the required level of acoustic accuracy. In fact, it is the antitheses of the GPG accuracy study, asking what level of input dataset accuracy is required in order to achieve a sufficiently accurate noise map. The answers could inform data suppliers in their process of capturing and processing datasets so that they provide the suitable input for noise mapping.

Uncertainties in the prediction of environmental noise and in noise mapping was then given by **Wolfgang Probst**

Important business - coffee time and another opportunity to exchange views with professional colleagues

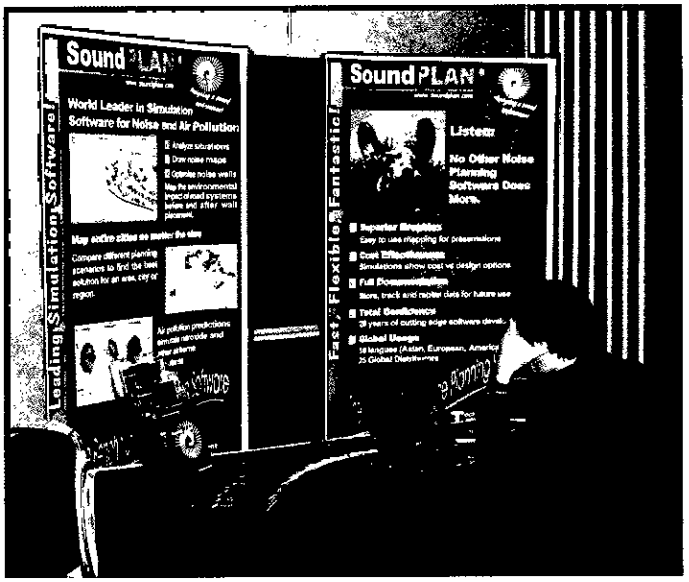
(ACCON GmbH (and DataKustik GmbH), Germany). Quantifying noise effects and annoyance from noise as demanded by Directive 2002/49/EC on a large scale needed a knowledge of the noise indicators where local people actually live, and of the relationship between these indicators and the harmful effects that should be avoided or minimised. If the noise climate in our cities and communities in different countries are to be compared using the methods described in the directive, it was of great importance that we had some knowledge of the uncertainties included in the whole process. We were only able to decide that differences in the determined quantities about noise for different cities were significant if we can rule out stochastic variations.

The principles of quantifying uncertainties in noise level prediction according to GUM were presented. Source modelling was the first and one of the most important steps in the whole chain of error propagation. In most cases, technical sources were simulated in the computer model as simple point sources described by an A-weighted sound power level. If this assumption were correct, and the source was in reality 'small', the uncertainty of the assumed sound power level could be expressed as standard deviation in dB. Further reasons for uncertainties in source description were demonstrated, such as the distribution of emission from extended sources, the distribution of sound power over frequency bands, directivity in each frequency band, and some of the influences of approximations in the source modelling.

Hardy Stapelfeldt (Stapelfeldt Ingenieurgesellschaft mbh, Dortmund, Germany) then presented *Validation and calibration in noise mapping: the Madrid study*, a paper jointly authored with R Sanz Pozo (Brüel & Kjær A/S, Denmark). Major noise mapping activities had been started all over Europe, and the quality of results needed to be proved to avoid the presentation of inappropriate results to the public, which would instantly provoke a political backlash. Revising digital models over and over again might asymptotically reduce input errors but would never enable definition of the deviation between calculated data and real life situation. A noise map represented either a stationary situation with traffic input data from the past, or a predicted situation based on assumptions about the evolution in the future. It was not, therefore, representative of an actual situation with traffic modifications and special events.

Madrid Environmental Administration therefore decided to develop a new concept of data post-processing, that is, dynamic noise maps or SADMAM (Sistema Actualización Dinámica Mapa Acústico Madrid). Of course, it was not possible to install thousands of noise monitoring terminals all over the city, but if the areas of interest were known, then it was feasible to zoom in more precisely by installing mobile devices at strategic places. For this purpose, Madrid invested in a system consisting of 'Lima' noise calculation software, together with Brüel & Kjær noise monitoring software and several noise monitoring terminals. The results were encouraging.

The Institute's Key Sponsors Brüel & Kjær were again represented in the following paper, in the person of **Douglas Manvell** who discussed *Environmental noise management: combining measurements and calculations to your advantage*. He described how combining measurements and calculations could make environmental noise management more efficient within a range of aspects, from complaint handling to noise mapping, from action planning to noise assessment.



A quiet moment for David Winterbottom on the SoundPlan stand

Exhibitors' Corner....3

Dennis Baylis, advertising manager, contemplates another booking for next year

The similarities and differences between measured and calculated results were presented and good practice described. In particular, Douglas dealt with the role of measurements in strategic noise maps and in action plans, focusing on why and how to validate strategic noise maps. State-of-the-art environmental noise management systems were then described, highlighting the latest developments.

Environmental Factors in Noise Assessment

After another excellent lunch in the acoustically challenging restaurant we all know so well, it was time to resume the session on Environmental Factors in Noise Assessment under the chairmanship of **Susan Dowson**. The first paper was *Environmental influences on microphones and sound calibrators* by **Janine Avison** (National Physical Laboratory, Teddington). Calibrated microphones and sound calibrators provided the traceability that allowed sound pressure measurements to be made on a common basis. However, measurements made using these instruments were susceptible to changes in environmental conditions. Although they were calibrated in the laboratory at reference conditions, when they were used in practice they may be exposed to different environmental conditions which could affect measurement uncertainty. As an example, microphone sensitivity was pressure-dependent and temperature-dependent, but humidity had no measurable effect. Air pressure in the cavity behind a microphone's diaphragm

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presented compliance to that diaphragm and so influenced its dynamic behaviour.

Two temperature effects acted upon the microphone sensitivity in opposite directions, providing a low net temperature dependence. Increases in temperature caused thermal expansion of the microphone leading to an increase in the diaphragm tension, reducing the microphone sensitivity. Simultaneously, the air density decreased with increasing temperatures, causing a reduction in the stiffness of the air behind the diaphragm, increasing the sensitivity.

The sound pressure level provided by a pistonphone had a direct dependence on static pressure but neither temperature nor humidity had very much influence. In contrast, sound calibrators were designed to maintain the correct sound pressure level regardless of environmental influences.

Next, **Ole-Herman Bjor** (Norsonic AS, Norway) gave a presentation written jointly with Svein Arne Nordby (also Norsonic) on *An integrated approach to the assessment of noise and weather data in environmental noise monitoring systems*. The weather had been identified as a major contributor to the uncertainties associated with environmental noise measurements. Wind direction, temperature profile, humidity and ground condition could change the amount of sound transmitted. Further, precipitation and wind could act as noise sources and affect the measurement of low sound pressure levels such as background sound levels. Wet or frosty windshields on the environmental measurement microphones may influence the sensitivity and directional response and thus corrupt the precision of the instrumentation.

In order to assess the influence of weather conditions on the measured levels, logging of various weather observations was required. Unattended measurements of environmental noise, according to Ole-Herman, should always be coupled with reliable weather data. He presented noise-monitoring systems with integrated measurement channels for weather data, and showed how the measurement results might be sorted to gain reliable results.

There followed another presentation by **Douglas Manvell** (Bruel and Kjaer) on *The influence of atmospheric conditions on environmental noise measurement.*

After tea, the last two papers were *Environmental noise modelling using stochastic techniques,* by **Z Haron** and **D J Oldham** (Acoustic Research Unit, School of Architecture, University of Liverpool) and *A balanced approach to managing uncertainty in environmental sound measurements*, by **J Adcock** and **AJ Bullmore** (Hoare Lea Acoustics, London and Bristol respectively), **C English** (The English Cogger LLP) and **I H Flindell** (ISVR, University of Southampton).

Zaiton spoke about a stochastic model based on a probabilistic approach, established to enable the prediction of the temporal distribution of noise levels arising from open site operations. The method was capable of predicting the probability distribution of the noise level due to either individual noise sources or a combination of noise sources, and had a similar degree of accuracy to the Monte Carlo method. The model may be used as the basis of a prediction technique to derive simple design charts for planning, design and management purposes.

The concluding paper, presented by **Justin Adcock**, provided an overview of new guidelines developed to assist all users of environmental noise assessments to understand the sources and scale of risk involved when using environmental noise measurements as a basis for decision making. The paper followed a series of recent presentations of the new guidelines at recent European conferences dealing with uncertainty surrounding environmental noise measurement and prediction. The guidelines were the result of a Department for Trade & Industry (DTI)-funded study into the measurement uncertainty associated with environmental sound variability, and its relevance in the context of practical noise assessments.

A rapt audience, even during the final session

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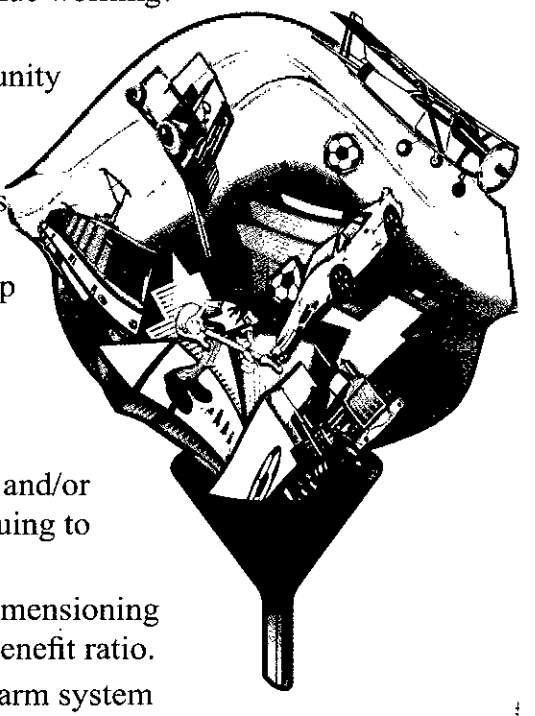
- ❒ What is the most cost effective method to minimize community noise?
- ❒ How loud is it inside a building? Which sounds dominate? Can the noise breakout be minimized with new doors, gates or window applications?
- ❒ Can I document my data sufficiently? Will the software help me comply with ISO 9000 quality control?
- ❒ Will I get the hotline support I might need in my language?



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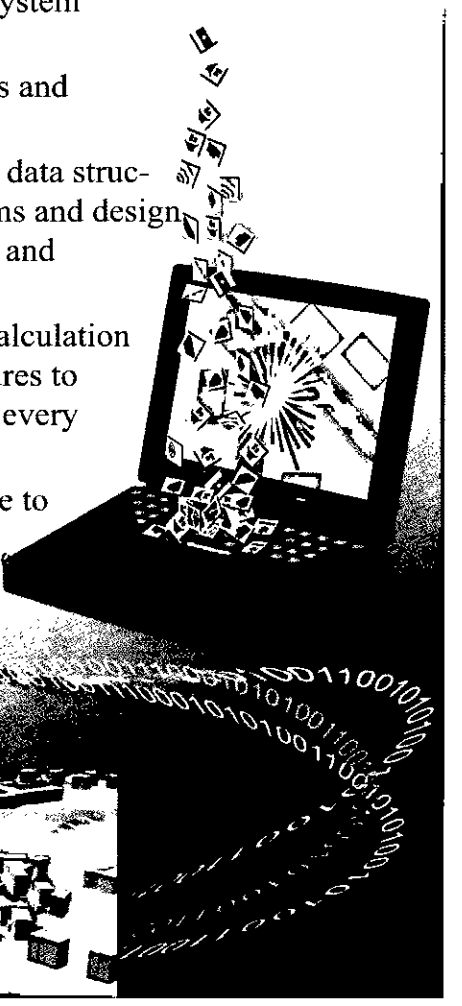

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An optical method for hydrophone calibration

Pete Theobald, Stephen Robinson and Alex Thompson

Optical methods have long been used in metrology, for example in the measurement of length, acceleration and vibration. In recent times, optical methods have also been used increasingly for the measurement of sound, and at NPL there is a history of using optical techniques in calibration. Recently, we have been investigating the use of optical methods for the free-field calibration of hydrophones, in the frequency range 10kHz to 600kHz. In this article we present a description of this work, which has the potential to provide a new primary standard calibration technique to replace the traditional methods based on the principle of reciprocity.

Background

Underwater acousticians typically use hydrophones to measure the level of ambient noise in the ocean as well as the level of unwanted sound generated from man-made sources. Alternatively, one might want to characterise the output of transducers used in active sonar systems, where the source level and transmit sensitivity are vital in determining the detection range of the system. If these measurements are to be meaningful in determining the absolute level of an acoustical parameter in the ocean or other body of water, the hydrophone used must be calibrated using an appropriate method and the calibration must be traceable to agreed standards.

The absolute methods used today for the calibration of hydrophones are based on the principle of reciprocity **(1,2,3)** and are similar to those used for microphone calibration which date back to 1940 **(4)**. Reciprocity for hydrophone calibration has undergone several refinements since its introduction and now offers typical calibration uncertainties of 0.5dB expressed for a 95% confidence level. This is achieved through an international standard which strictly specifies the requirements for the free-field calibration of a hydrophone by the method of three-transducer spherical-wave reciprocity **(5)**. However, the uncertainties for hydrophone calibration obtained today are beginning to reach the limits of what is attainable and crucially depend on the availability of a reciprocal transducer.

Optical methods have the potential for a more direct realisation of an acoustic quantity as they do not depend on a transducer being reciprocal, and are less dependent on a particular acoustic field geometry. Furthermore, optical interferometers inherently provide traceability to primary standards of length via the wavelength of the laser light. Optical methods may therefore form the basis of the primary standard for underwater hydrophone calibration in the future.

Acoustic particle velocity measurement

To perform a 'direct' free-field calibration of a hydrophone, it must be exposed to a known acoustic pressure, in a plane-wave field. The problem then becomes a matter of how to measure the acoustic pressure at the point in the field where the hydrophone is inserted.

Optical interferometry can be employed in a number of ways, generally to measure the displacement or velocity of an object by observing the interference patterns produced between two coherent laser beams, one of which has been modified by the motion of an optically reflecting object. Doppler interferometers specifically use the Doppler shift imparted on the laser beam by a moving target to establish the velocity and direction of motion of the target **(6)**.

For the calibration of a hydrophone, the acoustic particle velocity or the acoustic pressure at a point in the field is required and to do this, one can employ an acoustically compliant, optically reflecting membrane, termed a pellicle. The pellicle thickness is small compared to the acoustic wavelength and its acoustic impedance is similar to that of water so that the pellicle moves in sympathy with the acoustic field. This allows the acoustic particle velocity to be measured using an interferometer, and from this, the acoustic pressure can easily be derived for a specific point in the field.

By using optical interferometry in this way to measure acoustic pressure, 'direct' traceability to units of length via the wavelength of light is provided.

Using a laser interferometry to calibrate a hydrophone

To perform the hydrophone calibration using the optical method requires a measurement arrangement similar to that shown in *Figure 1*. This shows the pellicle, which is a vertical strip of aluminium coated Mylar around 2mm wide, positioned in the far-field of an underwater acoustic source transducer. The pellicle strip is supported on a large aluminium frame in a water tank measuring 2m in length and 1.5m wide by 1.5m deep, allowing a reflection-free time window of around

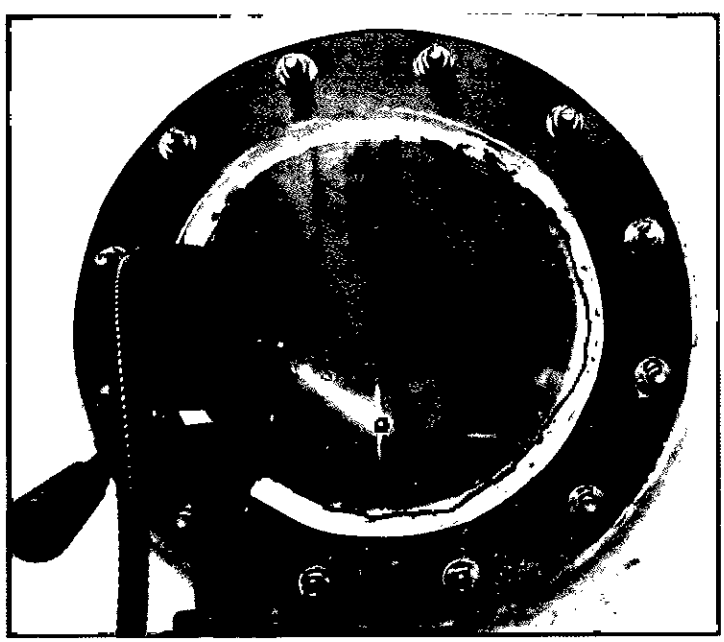

Figure 1: Measurement arrangement used to measure acoustic velocity using an optical interferometer

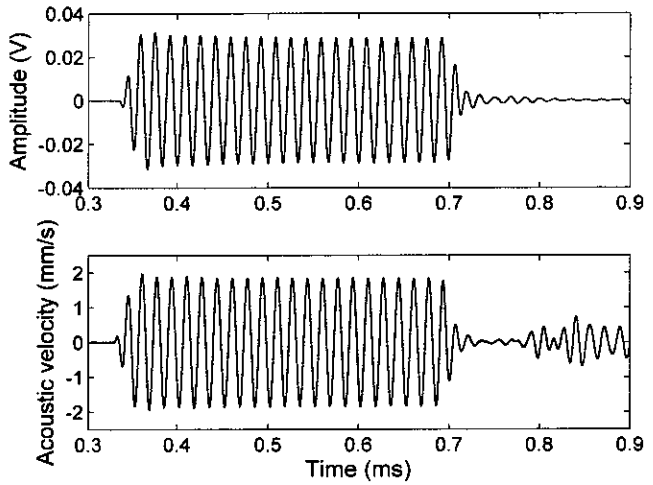

Figure 2: Comparison of waveforms recorded by the reference hydrophone (blue) and the interferometer (red) for an acoustic signal of 60kHz

0.65ms, for a 0.5m source-receiver separation. The laser beam of the interferometer is aligned through the optical window of the tank, onto the acoustic centre of the acoustic source transducer, the pellicle being positioned to intercept the laser beam and reflect light back through the glass window into the optical collection head of the interferometer.

To approximate a free-field condition during the calibration, the source transducers were driven with finite length tone-bursts at a number of discrete frequencies between 10kHz and 600kHz, similar to those shown in *Figure 2*.

Once the acoustic pressure had been established at the measurement point, the pellicle was substituted for a measurement hydrophone, which was aligned so that the laser beam was incident on the acoustic centre of the hydrophone. In this case, the hydrophone calibrated was a Reson TC4034, which consists of a 6mm diameter spherical element and has a resonance frequency of approximately 350kHz. This hydrophone had previously been calibrated using the method of three-transducer spherical-wave reciprocity in accordance with IEC 565 **(5)**.

Three acoustic projectors were used to cover a frequency range from 10kHz to 600kHz: an ITC1042, 25mm diameter spherical transducer with a resonance frequency of 75kHz was used for the range 10kHz to 120kHz; a 1.5 inch diameter Ultran piston transducer with a resonance frequency of 250kHz was used for the range 100kHz to 400kHz; a 1 inch diameter Panametrics piston transducer with a resonance frequency of 500kHz was used for the range 300kHz to 600kHz.

The velocity (interferometer) and voltage (hydrophone) measurements were performed by measuring the amplitude of the steady-state portion of the tone-burst signals. This is achieved by measuring the central portion of the waveforms shown in *Figure 2*. This ensures that the amplitude measured is at the frequency drive signal and that the measurement is not contaminated with any resonant features of either the source transducer or the hydrophone. The interferometer has a broader bandwidth than the hydrophone and behaves very much as a low-Q device. The waveform measured using the interferometer is therefore a more accurate reconstruction of the source transducer output than the hydrophone, which exhibits slightly more ringing than the interferometer signal. The

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interferometer velocity plot shown in *Figure 2* does, however, exhibit a reflection at around 0.8ms from the pellicle mounting frame which is not observed in the hydrophone signal as the frame is not in place during the hydrophone measurement.

The derived sensitivity of the TC4034 hydrophone in the frequency range 10kHz to 600kHz is shown in *Figure 3*, established using both optical and reciprocity methods. The two agree very closely, a point emphasised in *Figure 4*, where the difference in the sensitivity values derived using the two techniques is plotted. At this point, it should be noted that the overall uncertainty for the free-field calibration using reciprocity is typically of the order of 0.5dB when expressed as an expanded uncertainty for a coverage factor of κ=2. Agreement between the optical method and reciprocity shown in *Figure 4*, is generally within 0.5dB. The establishment of the calibration uncertainties achievable using the optical interferometric method is an ongoing area of research at NPL.

Potential sources of uncertainty

When using interferometry for the measurement of the movement of a thin membrane in an acoustic field, there are several factors which could contribute to the overall uncertainty of the measurement.

a) Pellicle transmission loss

The measurement of velocity at the pellicle surface is made on the 'back surface', ie. after the acoustic wave has passed through the pellicle. Therefore, any reflection or absorption in the pellicle membrane will influence the measured velocity. At the frequencies of interest reported here (below 600kHz), the transmission loss is expected to be negligible. To predict the transmission losses, a simple layered model was used to represent an infinite water layer, a Mylar layer, an aluminium layer and a second infinite water layer **(7)**. The results of the model agree well with experimental data from megahertz frequencies where the measurable proportion of the incident sound field is reflected from the membrane **(8,9,10)**. The transmission coefficients predicted for 23μm and 50μm thick infinite membranes of Mylar coated with a 40nm aluminium film and surrounded by water at 600kHz, were 0.9987 and 0.9958 respectively, showing that the transmission loss is essentially negligible for a 23μm membrane at frequencies below 600kHz. Increasing the thickness of the membrane causes the expected increase in the transmission loss, although this is still very small for a 50μm membrane at 600kHz.

b) Pellicle modes

The displacement or velocity of a pellicle in response to an acoustic field may not always be fully representative of particle movement in the surrounding medium. There is a possibility that pellicle movement is governed by modes excited by the acoustic field **(9)**. For the measurements considered here, the pellicle chosen has a finite width and this can influence the motion of

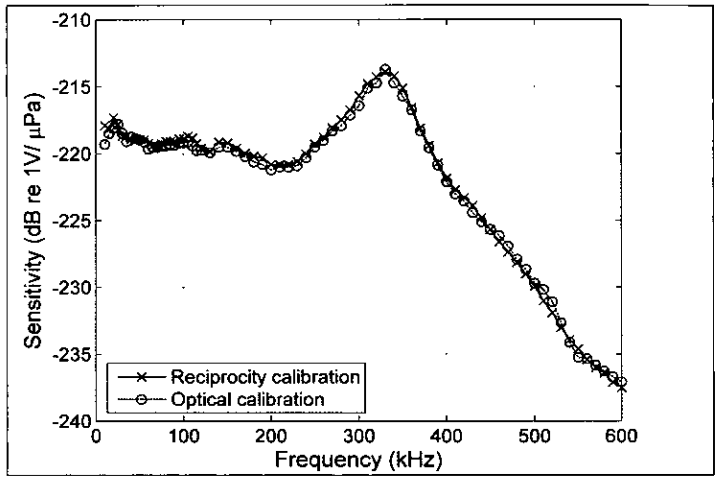

Figure 3: Comparison of sensitivities for a TC4034 hydrophone obtained by the free-field reciprocity method and the optical method using a 2mm wide pellicle

the pellicle in response to the acoustic wave. The modes of vibration of such a structure will depend on the boundary conditions imposed. The mounting method for the pellicle dictates that the ends are clamped, while the edges of the pellicle can move freely within the medium.

To investigate the vibration modes of the pellicle a number of different pellicle widths were investigated by scanning the laser beam across the width of the pellicle, using a similar experimental arrangement to that shown in *Figure 1*. The measurements showed that vibration modes do exist across the width of the pellicle and that they are a function of frequency. Optical hydrophone calibrations performed using pellicle widths greater than 2mm showed evidence of this behaviour below 600kHz with spurious sensitivity variations. For a 12.6mm wide pellicle for example, sensitivity variations became apparent at frequencies above 120kHz. It was found that by using a pellicle width of 2mm or less, the effect of these modes became negligible below 600kHz.

c) Acousto-optic influence

The change of refractive index of the water in the presence of an acoustic field, termed the acousto-optic effect, could give rise to uncertainties in the velocity that the interferometer measures by changing the effective optical path length of the laser beam. For a velocity interferometer, the rate of change of refractive index or optical path length will be interpreted as an apparent velocity by the interferometer. This effect can be extremely useful and can be exploited in configurations where the optical beam and acoustic beam are arranged to be orthogonal, as in the work of Harland **(11)**.

However, the configuration for the hydrophone calibration is designed to measure only the pellicle movement. If the laser beam subtends an angle to the direction of acoustic propagation, there may be some component of the signal due to the refractive index variation along the optical beam, leading to an error in the measurement of pellicle velocity. The measurement arrangement used helps minimise this error by ensuring co-linearity between the acoustic beam, the incident laser beam and the reflected laser beam. However, the acousto-optic influence is an area of on-going research at NPL aimed at both reducing the calibration uncertainty and exploiting the effect for mapping of acoustic fields.

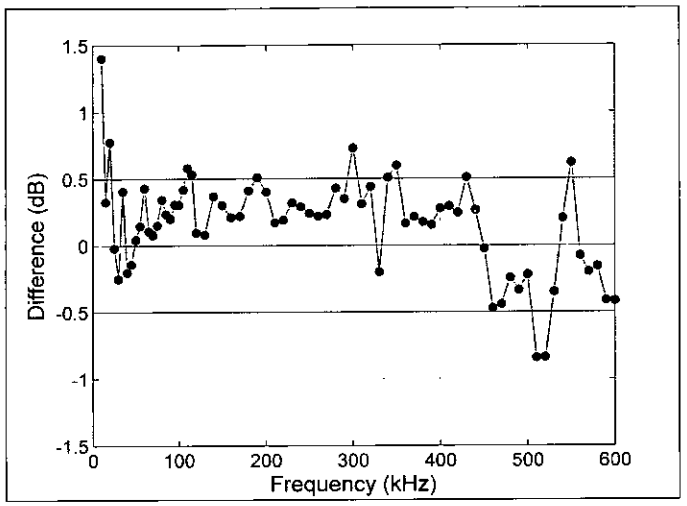

Figure 4: Difference between hydrophone sensitivity determined using the free-field reciprocity method and the optical method using a 2mm wide pellicle

Optics - the future of acoustics?

So, are optical methods really the future of acoustic measurement? This question has to be assessed on the merits for each individual case. Optical methods offer huge potential for direct traceability when measuring acoustical quantities and therefore have a bright future in acoustical metrology. They also offer non-invasive measurement capability, extremely high spatial resolution and the ability for rapid scanning of measurement areas. For these reasons, interferometry has been applied to a wide range of acoustic measurement problems, including: calibration of ultrasonic hydrophones **(8,9,10)**; calibration of acoustic emission sensors **(12)**; near-field scanning of underwater sonar arrays **(13,14)**; acousto-optic field mapping of underwater acoustic fields **(11)**; acousto-optic measurement of airborne acoustic fields **(15)**; laser Doppler anemometry for acoustic measurements in air **(16)**; and ultrasonic NDT **(6)** measurement.

The ability to perform measurements non-invasively using optical methods means they can be applied in measurement environments that might not be practical using conventional measurement devices. One example of this is the acousto-optic mapping of acoustic fields in water. The use of optical methods may allow the measurement of high intensity focussed ultrasonic (HIFU) fields which generate acoustic conditions hostile enough to damage conventional hydrophones.

In airborne acoustics, an application which has always been problematic is the measurement of fan noise. The problem arises when a microphone is placed in the air-flow of the fan to measure the noise generated by the fan motor and the rotation of the fan blades. The turbulent flow introduced by inserting the microphone into the air-flow limits the accuracy to which the fan noise can be measured. Laser Doppler anemometry (LDA), which has successfully been applied to the measurement of sound fields in a pipe **(16)**, could potentially be a solution to the problem of fan noise. Intersecting two laser beams in the air-flow allows the velocity of the air-particles to be measured, which when de-convolved into the acoustic AC component and the DC flow component of velocity would allow the acoustic fan noise to be predicted. The LDA method has also been identified as a potential future primary standard for the free-field calibration of measurement microphones.

Of course, such optical methods require sophisticated equipment and can be expensive to implement. However, it is certainly the case that optical inteferometry is the future for a number of acoustic primary standards and will offer solutions to specialised acoustic measurement problems. Nevertheless, there will always be a requirement for affordable measurement devices that can provide the necessary robustness, versatility and sensitivity required for non-laboratory measurements.

Conclusions

A novel technique for the absolute calibration of hydrophones in water which uses an optical method based on laser interferometry has been described. The method relies on the use of a thin plastic pellicle which is used to reflect the signal beam of a commercial laser interferometer, the pellicle being thin enough to be acoustically transparent at the frequency of interest. The pellicle motion is taken to represent the acoustic particle velocity in the medium. The hydrophone response to this known acoustic field is measured and the hydrophone sensitivity derived. Excellent agreement has been achieved with the classic method of three-transducer spherical-wave reciprocity over the frequency range 10kHz to 600kHz, with agreement better than 0.5dB over the majority of the frequency range. The method has been shown to offer the potential for a new primary standard method, with calibrations traceable to standards of length measurement through the wavelength of the laser light.

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Acknowledgement

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References

1 R J Bobber, *Underwater Electroacoustic Measurements*, Peninsula Press, Los Altos, USA, 2nd edition, 1988

2 W R Maclean, Absolute measurement of sound without a primary standard, *J Acoust Soc Am*, volume 12, pp 140-146, 1940

3 R J Bobber, General reciprocity parameter, *J Acoust Soc Am*, volume 39, pp 680-687, 1966

4 R K Cook, Absolute Pressure Calibrations of Micro-phones, *J Res Natl Bur of Stand* **25**, 489-505 (1940)

5 IEC 565, *The calibration of hydrophones*, International Electrotechnical Commission, Geneva Switzerland, 1977

6 C B Scruby and L E Drain, *Laser ultrasonics* Bristol: Adam Hilger, 1990

7 L M Brekhovskikh, *Waves in layered media*, Academic Press, 2nd edition, 1980

8 D R Bacon, Primary calibration of ultrasonic hydrophones using optical interferometry, *IEEE Trans Ultrason Ferroelectr Freq Control*, volume 35, pp 152-161, 1988

9 T J Esward and S P Robinson, Extending the frequency range of the National Physical Laboratory primary standard laser interferometer for hydrophone calibrations to 60 MHz, *IEEE Trans Ultrason Ferroelectr Freq Control*, volume 46, pp 737-744, 1999

10 R C Preston, S P Robinson, B Zeqiri, T J Esward, P N Gelat and N D Lee, Primary calibration of membrane hydrophones in the frequency range 05 MHz to 60 MHz, *Metrologia*, volume 36, pp 331-343, 1999

11 A R Harland, J N Petzing, and J R Tyrer, Nonperturbing measurements of spatially distributed underwater acoustic fields using a scanning laser Doppler vibrometer, *J Acoust Soc Am*, volume 115, pp 187-195, 2004

12 P D Theobald, T J Esward, S P Dowson and R C Preston, Acoustic emission transducers: development of a facility for traceable out-of-plane displacement calibration, *Ultrasonics*, volume 43, pp 343-350, 2005

13 P D Theobald, A D Thompson, S P Robinson, R C Preston, P Lepper, W Yuebing, C Swift and J Tyrer, *Fundamental standards for acoustics based on optical methods - Phase three report for sound in water*, NPL Report CAIR 9, 2004

14 V F Humphrey, S P Robinson, P D Theobald, G Hayman, P N Gelat and A D Thompson, Comparison of optical and hydrophone-based near-field techniques for full characterisation of high frequency sonar, *Proceeding of the International Conference on underwater acoustic measurement: Technologies and results*, Crete, Greece, 2005

15 R Rustad and L H Morset, Investigation of the near field of a loudspeaker using tomographic reconstruction from TV-holography measurements, *J Acoust Soc Am*, volume 104, pp 1503-1508, 1998

16 P D Theobald, A D Thompson, S P Robinson, R Barham, R C Preston, P Lepper, , C Swift, J Tyrer, C Greated, M Campbell, T Schlicke and W Yuebing, *Fundamental standards for acoustics based on optical methods - Final report*, NPL Report DQL-AC-001, April 2004

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Quis custodiet ipsos custodes?

Focusing on two domestic appliances, Mervyn Randall questions the merits and shortcomings of current noise legislation

I have never been a fan of the EU/EC/EEC except for its prevention of a fourth war between France and Germany, and the establishment of a common market place for the rest of us.

The 'level playing field' of the common marketplace appears still to be some way off, but the foundations for noise control have been created by the EC Directives that are being brought into UK law, and the unsung heroes of our Standardisation Committees. There is the little matter of some people's opinion that those of us who give (or gave) our time (or at least, our company's time) to attend standards meetings did so to line our pockets. With this personal article I ask only that 1990/SI/161 and the origination directive is read and fully comprehended, and that the measurement standards that are available are used as the path to better methods as found necessary. I shall restrict myself to two examples of domestic appliances: washing machines and gas-fired boilers.

Some will remember those many years when Europe had only one noise-related publication. Soon afterwards, someone remarked on this at an IOA or BAS meeting, then the dam broke and more and more publications including Directives descended on us. I have been one of the few who called for a single list of all EEC/EC/EU laws, let alone other publications, related to noise. For that we still wait. The same is true for UK noise laws, and we still wait, but I tip my cap to those who make efforts to provide such lists on the world wide web.

EC Directives

Many will be aware of the basic format of EC Directives. First come the 'having' paragraphs, then the 'whereas' paragraphs, and then the 'directions' paragraphs or 'articles'. Some will have noticed that the 'whereas' paragraphs are now grouped together without the word 'whereas' in front of each paragraph, which seems to be a most confusing development **(1)**.

The important distinction between the 'whereas' and 'directions' paragraphs is the same as that between the answers to questions *'why?'* and *'what?'*. The 'whereas' paragraphs say why the Directive is to be promulgated. I must admit that I personally find them hard work, but they do provide an insight to past practices, the current situation, expectations of and intentions for the future.

The 'directions' paragraphs say what is to be applied in the member states. Clear distinction between these two parts is to be respected. Any member state which took any part of the 'whereas' paragraphs and gave it legal force before a Directive was issued on the subject might be accused of 'gold plating' the requirements. Similarly a misreading of the directions could lead to a State having laws more lax than the Directive intended.

We will all accept the good that would come from reducing the noise from a two-stroke engine-driven lawn-mower at 7am on a Sunday, or a paint spray compressor in the neighbour's workshop late in the evening. Similarly there is a general good from an action to remove the noisiest machines and appliances from the market, by preventing their being sold. In **(2)** the final sentence of 'whereas' paragraph 11 is an example of this intention.

Directives applied in the UK

Directives are brought into UK legislation by Statutory Instruments (SI's). The example I will examine here is Directive 86/594/EEC, on Household Appliance Airborne Noise **(3)**, which was transposed as 1990/SI/161 **(4)**. This SI is 'owned' by the DTI. *Box 1* gives my own interpretation of UK law as it affects domestic gas-fired boilers.

I complain, and have done for years, that the common market should rely more on compulsion and less on voluntary action, and that compulsion should naturally be adopted into UK law. We still find, however, that companies can avoid providing noise data for their product, so long a they make no claims about the noisiness or quietness of their product; note the word 'such' and not 'that' in Article 3.2 of **(3)**. I interpret this to mean that if a manufacturer wants to label his appliance as quiet, inaudible, or any other noise-related descriptor, he is 'publishing such information' and is required to provide the data for the noise label. If the manufacturer says nothing of noise he can expect that measuring and declaring noise levels is not required. Even if he does say something, nobody appears to complain and nobody

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BOX 1 Domestic and gas-fired boilers

Requirements of 86/594/EEC and 1990/SI/161

Strict interpretation of the SI is that where the manufacturer has made a claim in respect of noise he shall provide the data required by the SI. The manufacturer's publications and web sites can be taken as evidence of such a claim, but even here there are limits. For examples, a 'silencer' label on a manufacturer's diagram is not a claim in respect of noise or quiet, nor is a reference to reduced velocity noise levels as pressure-drop or flow is reduced. Third-party publications and web sites might imply the manufacturer has made such a claim but until the source is known, the SI cannot be invoked.

Oil-fired boilers are specifically exempted by 86/594/EEC, thus implying that gas-fired boilers are included. I conclude that the SI requires gas boilers to be provided with noise data where the manufacturer makes any claim in respect of noise.

Quis custodiet ipsos custodes?

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appears to prosecute them. It is only recently that the link between the Energy Label and the Noise Label has started to be seen for white goods in the High Street but that is a positive step.

We are familiar with such stories along the lines of:

- The lady who bought a quiet washing machine and when she went back to complain about the noise, she was told: "Ah yes, but you only bought the quiet one of the three product range, not the silent one or the hypersilent one"; and
- The man who moved into his new house, but was woken at 3am by the boiler making a noise. It did it again the next night, and the next. He came to realise that these were extraordinary cold nights and the boiler was switched on by a 'frost-stat'. He said that it had annoyed him from the start, and even after he knew what it was, he would still be woken by it.

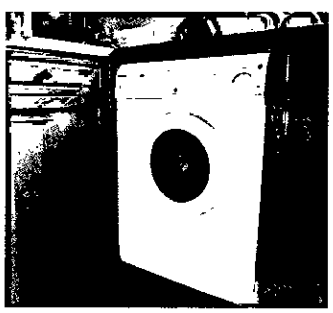
Box 2 gives a snapshot of the current state of the UK's energy and noise labels for washing machines. As yet, there is no energy implementation directive for domestic gas boilers, and thus no energy SI.

Now might be a good time to ask:

1 Are the Directives to be enforced in the UK, and if so, by whom?
2 Should there be a review both of policy and existing Directives, to determine where the gaps are, and where there are doubled standards?
3 Should there be a review of UK law so as to bring it into line with the precise requirements of the EC?
4 Should the EC requirements be strengthened?

BOX 2 Washing machines

UK energy and noise labelling



A quick look at www.kelkoo.domestic.appliance might show more than 400 washing machines and washer-dryers, with noise levels claimed to vary over the range:

noise level range in dB	number in range
< 40	1
40-50	14
50-60	46
60-70	13
70-80	10

Whether this is a comparison of like with like, dB or dB(A), L_P at a specified distance or L_W is not clear.

To establish what was measured and the conditions of measurement would take more research, but it is perhaps a reasonable guess that the model buyer will not even know what questions to ask. Nor does it help to say 'I know what it should be': one needs to know what it is.

A fundamental error appears to have been the use as a title in Directive 86/594/EEC of the phrase 'airborne noise emitted', as it could not easily be contracted and yet retain the essence of its identity. Sound power level would have been so much better. What about the other 300-odd machines?

Noise of replacement gas boilers

An interesting and topical matter of noise regulation is that of gas-fired boilers for domestic dwellings. The new Building Regulations Part L1 **(5)** applicable to domestic boilers make no reference to noise. Moreover, the concepts of noise internal to the dwelling or external to the neighbours do not appear to have been considered. The Building Regulations are 'owned' by the Office of the Deputy Prime Minister (ODPM), and *Box 3* gives a view of the latest Part L1.

I am advised that for some reason (I know not what) gas-fired boilers may no longer be installed in domestic lounges, and another position has to be found for the replacement in or around the dwelling. Moreover, since 1 April 2005 the boiler has to be a condensing type unless there are exceptional circumstances that make it impracticable. The Condensing Boiler Installation Assessment Procedure **(6)** gives details.

Thus the noise from gas-fired boilers has to be assessed in respect of the boiler's final position, and the uses of this space and the spaces around it. The original position of the domestic boiler, as well as its flue and flue outlet, were probably architect-designed and was unlikely to be a cause of annoyance because of its encasement in brick, or its location where noise would not be a nuisance. The new position might be in a back yard or in an airing cupboard **(7)**.

I suggest the use of an aide memoire along the lines of *Table 1*. There might be some concern when it is realised that an airing cupboard will often be on a hall leading to bedrooms, or will have walls contiguous with bedrooms, and that flues from out-houses and garages might be below bedroom windows. Concerns will all but vanish when, for example:

- the boiler casing-radiated noise is 20dB(A) at 1m;
- the boiler flue noise is 30dB(A) at 1m;
- the boiler flue terminal noise is 35dB(A) at 1m.

Unfortunately, few manufacturers will provide this data: I suspect that many actually cannot do so today.

The A-weighted decibel might not be an appropriate unit of measurement for some gas boiler flues. Some can be expected to have a tonal character, others might be expected to contain low frequency sound. *Box 4* shows a link to BS.4142 which has been suggested.

I am aware that at least one national installation company of gas-fired central heating (CH) and domestic hot water systems (DHW) will not provide a guaranteed maximum noise level.

Comparison of domestic appliance noise with domestic background sound

The noise levels of various gas boilers can be found on the www or by telephone, but rarely in the manufacturer's printed literature. Usually, there are only simple word descriptions of noise. The levels I have obtained are roughly in the range 45 to 55 dB(A), but no distances were quoted, and it is not clear what part of the installation was measured. As a quick comparison I might mention that my 'tower' PC emits a level of about 38dB(A) at 1m, in a room subject to background noise at 22dB(A) .

Which of us would design the bedroom corridor of an hotel, or items within it, for a noise level of 45 to 55 dB(A)? Sleeping accommodation on board ships or offshore oil and gas installations might be designed to a level of 45 to 55 dB(A), and the upper limit is barely acceptable there. Remember that these gas boilers are for modern domestic dwellings (possibly lightweight or timber-framed), and are being used as replacements for other (oil, gas or solid fuel) central heating appliances in older, more massive, and thus better sound-insulated properties.

Manufacturers' noise data

A few boiler manufacturers do mention noise, silence or quiet in their printed and on-line publications. Worcester Bosch is, so far as I am aware, the only manufacturer to warn against noise from the flue terminal. They say that 'the terminal must not ... discharge a nuisance', and that 'particular care should be exercised with regards to ... any increase in noise levels' **(8)**.

Some gas boiler manufacturers say they do not have to provide noise data. Some say they do make measurements but keep the data for themselves. Others say that noise measurement is a very difficult matter, that there is no standard by which they can measure, and that any single set of measurements from one installation can not be compared with any other.

TABLE 1

Noise caused by or from?

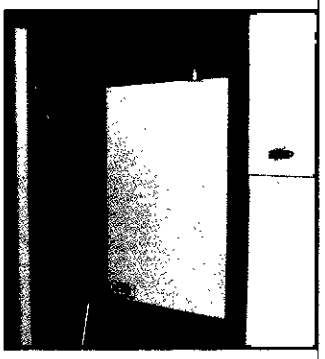
Readers are invited to add to or delete from this table

noise from	sound level at 1m	background sound level	to
boiler casing (including fan, pump, valve)			room
			adjacent rooms
boiler flue			room
			adjacent rooms
boiler flue terminal			dwelling via windows
			dwelling via doors
			dwelling via roof conformation
			adjacent properties
boiler burner resonance			
boiler chimney resonance			
all structure-borne noise			adjacent rooms and properties

BOX 3

Replacement boilers in domestic dwellings

Part L1 of the Building Regulations requires that a replacement boiler be of condensing type, where practicable, at some position in the property. It allows the householder to select where the boiler is finally positioned after the practicability is established. An analysis procedure is given and where no practicable position is found the householder may have a non-condensing boiler installed. Obvious positions are out-houses, purpose-made enclosures in a back yard, garage, kitchen, bathroom or airing cupboard.



There is no standard list of positions provided by Part L1. Were your airing-cupboard formed of plastered brick and your ceiling formed of one layer of plasterboard

1 Where would you want your replacement boiler positioned?

2 Can CORGI be given the responsibility for this decision?

The fun is played for all it is worth online. Here Part L1 and three layers of explanation can be unearthed, each one possibly digging a hole in a different position. This is, I think, a good example of what happens when there are more than zero advisory documents purporting to explain the requirements of a perfectly good piece of legislation. If it isn't good legislation then effort must be put into its drafting, not explanatory pieces (7).

One does not have to believe this stuff, but one should be ready to react to it.

Measurement standards and declarations

British and continental standards organisations expect to write standards for which there is a demand. The fact that manufacturers of domestic gas-fired boilers, if they measure noise, do it alone, and do not appear to make inter-comparisons of their data sets, probably explains why no equipment-specific standard has been proposed for domestic central heating boilers. Only when the demand is there, and volunteers are available to act on the appropriate committee, will a standards group be formed.

There is no doubt that standards of noise measurement exist. Directive 86/594/EEC specifies the allowable measurement uncertainty. One can find measurement standards related to three grades of accuracy, Precision, Engineering and Survey.

Starting with the philosophy that anything is better than nothing, one might select an appropriate standard from at least three different groups of standards, *eg.* BS EN ISO 3740 and BS EN 60704 for sound power

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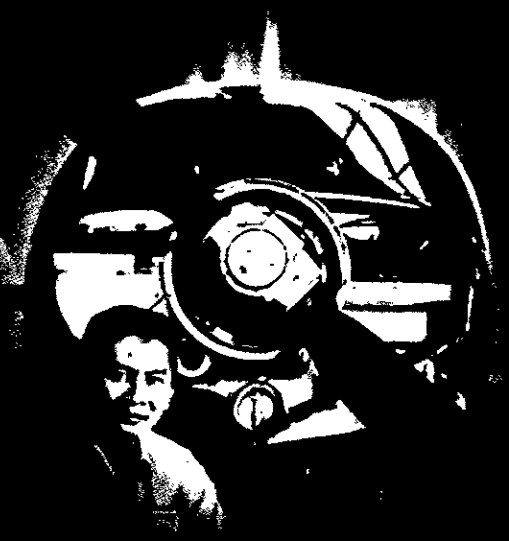

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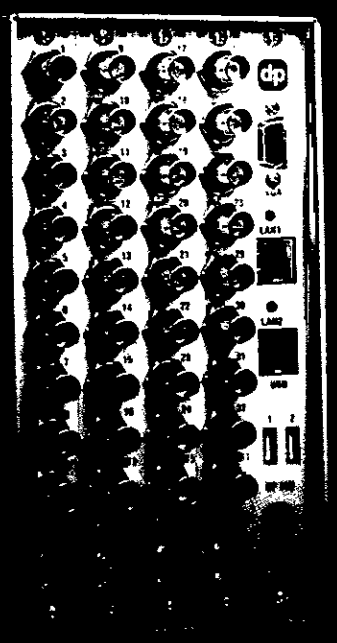

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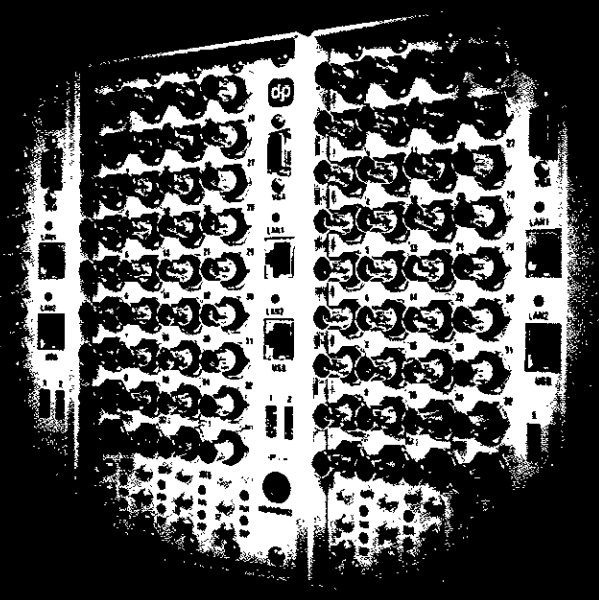

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Quis custodiet ipsos custodes?

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determination, and BS EN ISO 11200 for sound pressure level measurement. The test procedure and a specific standard might then be developed with experience of the actual properties of the appliance or the typical range of appliances.

It should be acknowledged that the domestic gas-fired boiler is unlikely to be a 'one figure' appliance. My initial guess is that the noise from the fan case, flue terminal, and flue duct will all have to be declared. This might continue at least until some appliance noises could be covered by a simple declaration along the lines of 'less than 35dB(A) at 1m' for the flue terminal, or 'less than 30dB(A) at 1m' for the flue duct. Such a simple declaration (the actual sound levels and phrases yet to be determined) would avoid considerable laboratory time and paperwork. The likelihood that this approach would be accepted by the EC is another matter.

So what rules apply?

Within the new Building Regulations, Part L does not seem to find any reason to consider noise from gas boilers, so it is as well to remember the existence of BS.4142 for the neighbours, and Directive 86/594/EEC **(3)**, as brought into UK law in 1990 by SI 161 **(4)**, for the owner.

That 1990/SI/161 applies to gas boilers is self-evident. A brief glance at the originating 86/594/EEC removes all doubt because oil-fired boilers are specifically excluded (but not gas-fired boilers).

BOX 4

A link to BS.4142

Some people are of the opinion that the application of BS.4142 by a local council will be sufficient for the resolution of all noise nuisance issues, and specifically noise nuisance from boiler installations. I have my doubts:

a) BS.4142 limits itself to external noise;

b) BS.4142 does not deal with sources and annoyances within one domestic dwelling;

c) I know of no case where the noise of a 'kettling' back boiler as heard in an adjacent semi-detached house was solved by application of BS.4142 (see above);

d) By the time the council knows of the issue, the boiler pack, flue and vent will have been installed by a CORGI-accredited fitter, who will presumably maintain that the installation was made in accordance with the latest Building Regulations;

e) The noise from the installation may be acceptable to the householder but not to the neighbours, which is the very essence of a dispute. Before BS.4142 appeared, the best, perhaps only, method of neighbour noise assessment was by Kosten and Van Os, who proposed a 5dB adjustment for an 'economic link' between any rater and the source of nuisance. This was not adopted in BS.4142. The idea is to be found in the original publication, and should be borne in mind when trying to reconcile the opinions of different parties to a question of noise nuisance.

Note that 1990/SI/161 Section 4 says that where *any steps* are taken to inform the market of the level of noise from the appliance, the noise level is to be measured and published (my italics). I interpret this to have the same intent as the word 'such' in the originating Directive. It is little stronger but removes any lingering doubt.

There is information available online to suggest that compliance with 1990/SI/161 is voluntary. There is nothing in 1990SI/161 to suggest it is anything other than mandatory. However, in some cases it can be avoided: as was explained earlier, if one publishes information on noise one is required to measure and publish in the prescribed manner. If one is required to measure, it must be in the prescribed manner.

Incidentally, the Boiler Efficiency Directive 92/42/EEC makes no mention of noise labelling or the energy labelling scheme. Surely that was a missed opportunity? Given that 86/594/EEC applies to both CH and DHW gas boilers, why do the energy labels of 92/75/EEC not apply?

Remedies for the purchaser

The lady with the 'quiet' washing machine could look to the trading standards officer for assistance with internal noise nuisance caused by an appliance in her dwelling. The man with the noisy gas boiler is less fortunate. What good is a complaint that a label is missing from his boiler, which is valid only if the manufacturer can be shown to have claimed his boiler was peaceful, quiet, silent, or the like?

Teeth for the Directive

There appears to be some lack of appreciation of 86/594/EEC, and especially the methods, persons, organisations and remedies available for its enforcement. I would wish to reconsider questions that have been asked before, i.e.:

- ❑ Who enforces the SI?
- ❑ What causes action to be taken?
- ❑ By whom is the action taken?
- ❑ Do we need stronger Directives and thus Regulations?
- ❑ When will we see noise limits set for appliance types?

Caveat emptor!

References

1 Directive 2002/49/EC Assessment and Management of Environmental Noise http://europa.eu.int/eur-lex/lex/LexUriServ/LexUriServ.do?uri=CELEX:32002L0049:EN:HTML

2 Directive 2000/14/EC Equipment for use outdoors, Noise http://europa.eu.int/comm/environment/noise/pdf/d0014_en.pdf

3 The Household Appliances Airborne Noise Directive 86/594/EEC Article3.2 http://www.nonoise.org/lawlib/euro/eurohapp.htm

4 Household Appliance Noise Regulations 1990/SI/161 http://www.opsi.gov.uk/si/si1990/Uksi_19900161_en_1.htm http/www.hmso.gov.uk/si/si1990/uksi_19900161_en-1.htm

5 Building Regulations Approved Document Part L1 2005 http://www.oftec.co.uk/news/odpm_breg_037021

6 Condensing Boiler Installation Assessment Procedure http://www.odpm.gov.uk/stellent/groups/odpm_buildreg/documents/page/odpm_breg_032807.hcsp

7 The Guide to Appendix G of Part L1 http://www.oftec.co.uk/news/Cond_Boiler_Assess_Proc.pdf

8 Worcester Bosch part no.8716103088 Issue D

9 Kirsten and Van Os. NPL Symposium on Noise. U K 1961.

10 For all BS documents see the BSI Online section at www.bsi-global.com

Mervyn Randall FIOA *is with LessNoise*

Sound, global warming and vortices

Peter Thorne

Figure 1: aerial view of a coastal resort on the Algarve

It is commonly acknowledged that global warming will impact on our coastal environment through an increase in sea level, higher wave conditions and stronger storm surges. The storm surge associated with Hurricane Katrina which devastated New Orleans and the surrounding area, brings into sharp focus the impact global warming may have on our coastlines. In addition to the impact by nature, the coastal shallow waters are utilised as a resource and for recreation, and the management of this environment is a balance of many competing interests. An example of what can happen when developments occurs without a full understanding of the ramifications on the coast is shown in *Figure1*.

It can readily be seen that the construction has impacted on the local coastline, causing the requirement for a significant shoreline barrier; such structures are in no way aesthetically pleasing and may in the long term generate as many problems as they try to solve. Our capability to predict the impact that man-made structures may have on the coastal environment is relatively limited, and in particular the influences such structures have on sediment (sand and mud) transport pathways is surprisingly difficult to forecast. There have been many occasions when a coastal development in one area has led to adjacent loss of the beach and coastline. This lack of predictability is due in part to our limited understanding of the basic mechanisms that drive sediment transport and it is in this area that acoustics has begun to make a significant contribution **(1)**.

The triad

Sediment transport can be thought of as three interacting components with feedback, this is illustrated by the triad in *Figure 2*. For example, flow separation and vortex generation due to flow over ripples on the seabed influences the suspension of sediment. Further, the shape of the ripples

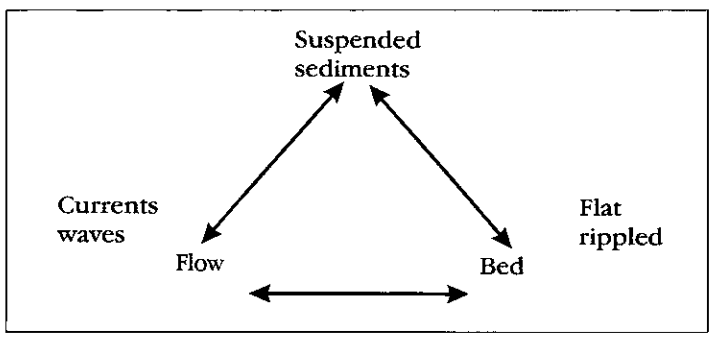

Figure 2: the sediment interacting triad showing the interrelationship between the seabed, wave-currents and the movement of the sediments

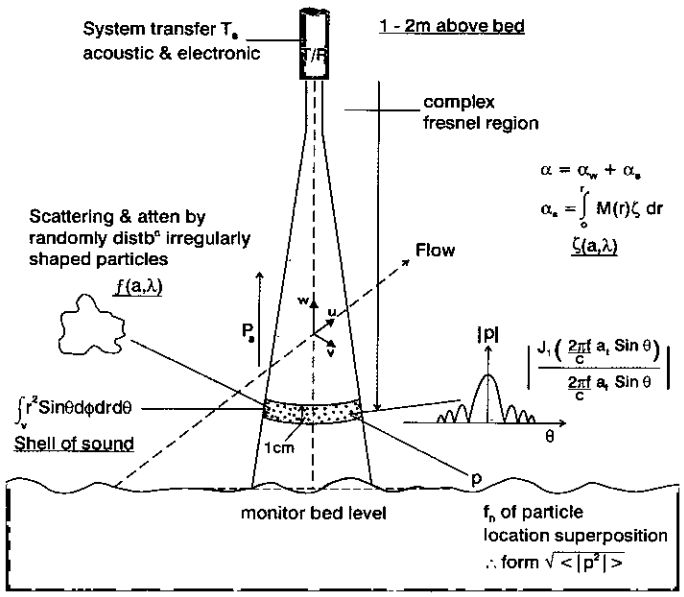

Figure 3: diagram outlining the use of acoustics for sediment transport studies

contributes to the overall flow resistance and the flow structure in the boundary layer. Yet the ripples themselves are a product of the local sediment transport.

Sounds an interesting approach

The concept of using acoustics for underwater sediment transport studies is attractive and straightforward, as illustrated by the diagram in *Figure 3*. A pulse of high frequency sound, typically in the range 0.5-5.0 MHz and centimetric in length, is transmitted from a downward pointing directional sound source, usually mounted about a metre above the bed and the backscattered signal is gated into range bins and digitised. As the sound pulse travels towards the bed, sediments in suspension backscatter a proportion of the sound and the bed generally returns a strong echo. The former has the potential to provide information on profiles of the suspended sediments and the flow, while the latter provides the time history of the bed location.

Acoustics is being developed to obtain such measurements, with sufficient spatial and temporal resolution, to allow the fundamental process of turbulence and wave processes to be probed, while at the same time being non-intrusive. No other technique combines all these capabilities.

Present deployments tend to be of the form shown in *Figure 4*. This shows schematically the acoustic vision, which has been under development for the past two decades, with all the important parameters being measured with sound. 'A' is a

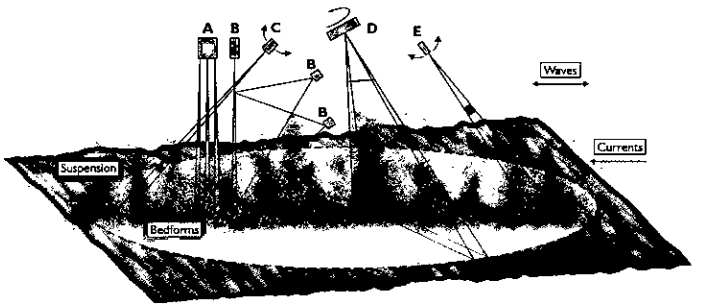

Figure 4: illustration of the setup to measure the sediment triad acoustically. 'A' three frequency backscatter system, 'B' coherent Doppler velocity profiler, 'C' ripple profiler, 'D' sector scanner and 'E' rapid bed-suspension profiler

triple frequency system, nominally operating between 1.0-5.0 MHz, which uses the amplitude of the backscattered signal, at the three frequencies, to provide detailed profiles of the suspended sediment particle size and concentration **(2, 3, 4)**. 'B' is composed of three transducers, typically operating around 1 MHz, which use the change in phase of the same backscattered signal to measure profiles of the vertical and the two horizontal components of flow **(5,6)**. 'C' is a rotating pencil beam scanner which measures the profile of a transect along the bed, usually over a distance of about 3m, and 'D' is a high frequency (typically 2MHz) rotating sector scanner which provides high resolution images of the bed **(7, 8)**. 'E' is a rapid pencil beam scanner providing high temporal resolution measurements of the bed and near bed suspended sediments. This combination of acoustic instruments provides co-located, simultaneous, high resolution profiles of the three components of the sediment triad.

Specific case: vortex ripples and the huge flume

To illustrate this application of acoustics, the problem of understanding sand transport over a rippled bed under waves is described. For waves propagating over a steeply rippled bed, vortex generation and shedding at flow reversal is considered to provide a mechanism capable of lifting sand into suspension to significant heights above the bed. The process of vortex generation and sediment entrainment into the water is shown schematically in *Figure 5*.

Figure 5a shows the growth of a vortex, V1, occurring around the time of maximum wave velocity. This vortex is trapped near the bed and becomes sediment laden rich. As the wave velocity decreases and the flow reverses, *Figures 5b-5d*, the sediment loaded vortex becomes detached from the bed, gets carried over the crest carrying the sand high

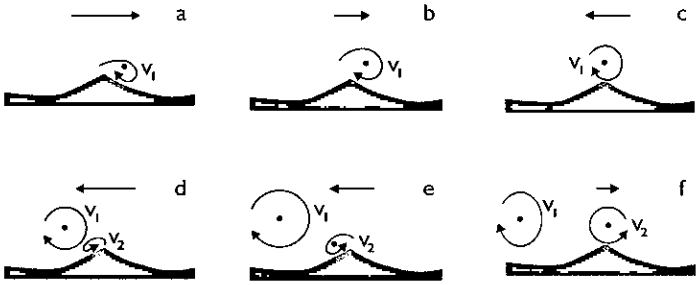

Figure 5: schematic of vortex entrainment of sediment over a rippled sandy bed. The horizontal arrow at the top of each figure represents the near-bed velocity

up into the water. At the same time, *Figure 5d*, a vortex V2 is formed on the opposite side of the ripple due to the reversed flow. As shown in *Figures 5d-5f*, V2 grows, entrains sediment, becomes detached and moves over the crest at the next flow reversal carrying sediments into suspension. The main feature of this mechanism is that sediment is carried up into the water twice per wave cycle at flow reversal; this is the main prediction of the vortex model.

To investigate experimentally the concept of vortex entrainment of sediments, an experiment was conducted in the large flume shown in *Figure 6*. The flume, one of the largest in the world, is 230m in length, 5m in width and 7m deep, and allowed the waves and sediment transport to be studied at full scale. A huge paddle at one end of the flume generated a wave which propagated along the flume over a sandy bed and dissipated on a beach at the opposite end. The bed comprised of coarse sand which was located in a layer of thickness 0.5m and length 30m, approximately halfway along the flume. To make the acoustic and other auxiliary measurements an instrumented tripod platform was developed and this is shown in *Figure 7*.

To investigate the vortex entrainment model it was

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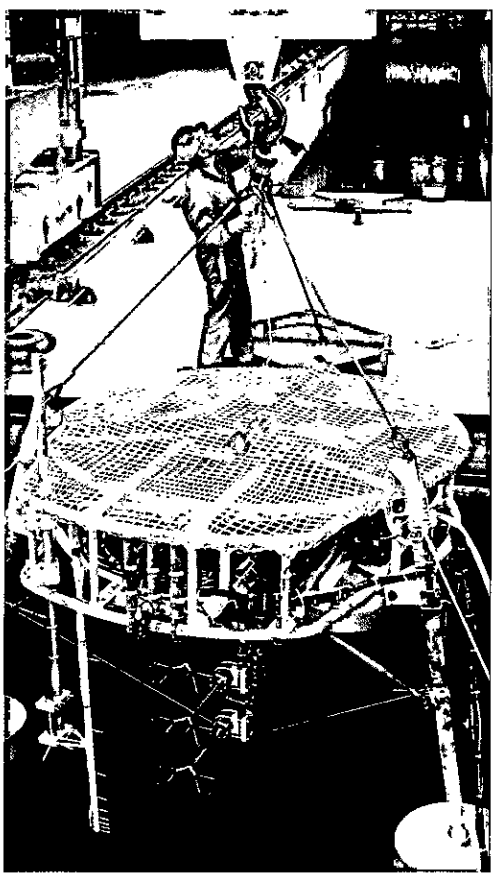
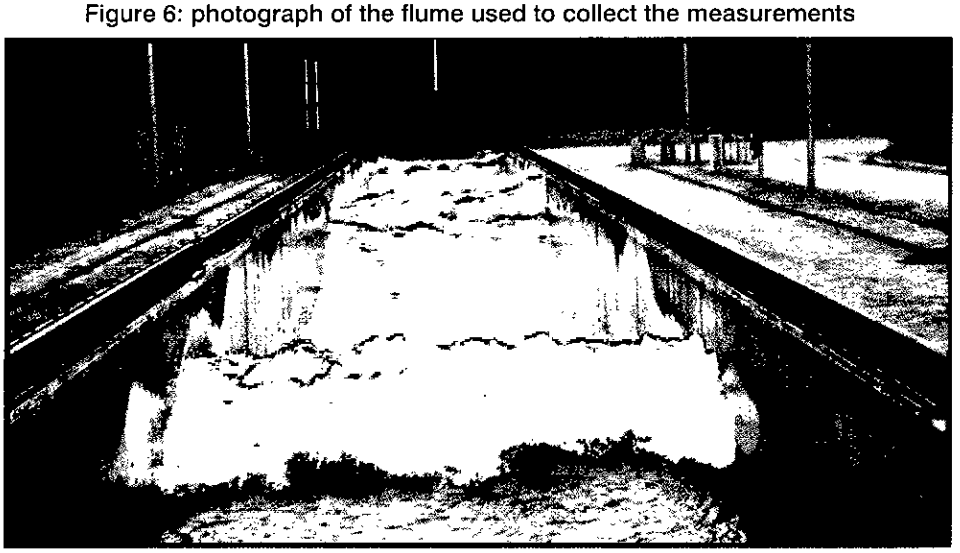


Figure 7: the instrumented tripod platform used to make the acoustic measurements

Figure 6: photograph of the flume used to collect the measurements



Sound, global warming and vortices

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necessary to establish if the surface waves were generating ripples on the bed in the flume. Using a sector scanner on the platform to collect images of the bed (*Figure 8*) and a

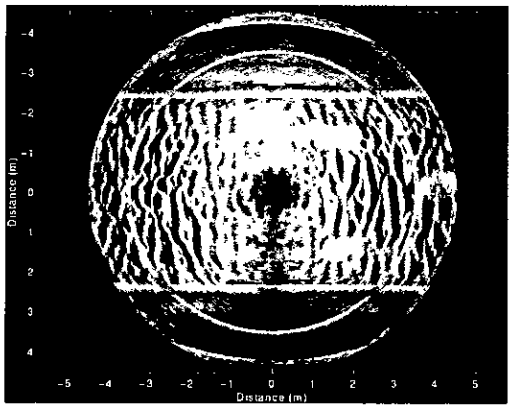

Figure 8: high resolution sector scanning image of the bed

pencil beam ripple profiler to measure the variation of a 3m transect of the bed (*Figure 9*) it was clear that ripples were being formed on the bed. To obtain flow separation and hence vortex formation requires ripples with slopes of the order of 15° or greater - analysis of the observations showed this was the case.

To obtain measurements of the flow, auxiliary current meters were used in conjunction with an acoustic 3-axis

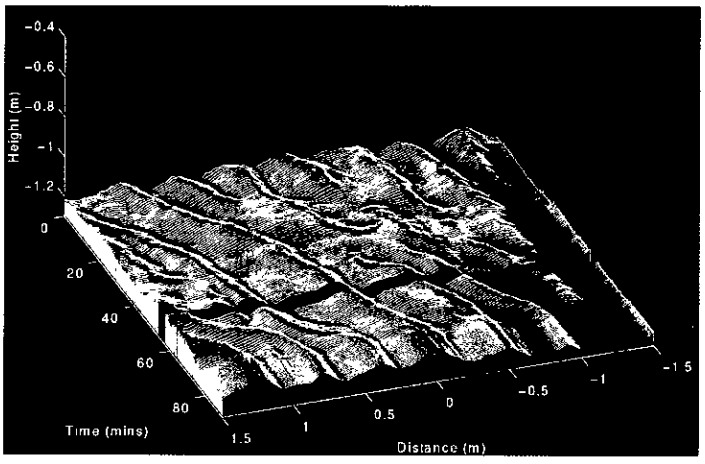

Figure 9: ripple profiler measurements of the sand ripples on the bed

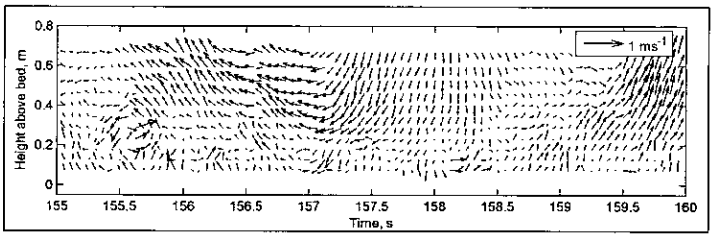

Figure 10: measurements of the vertical and along wave horizontal flow velocity obtained using a 3-axis coherent Doppler velocity profiler

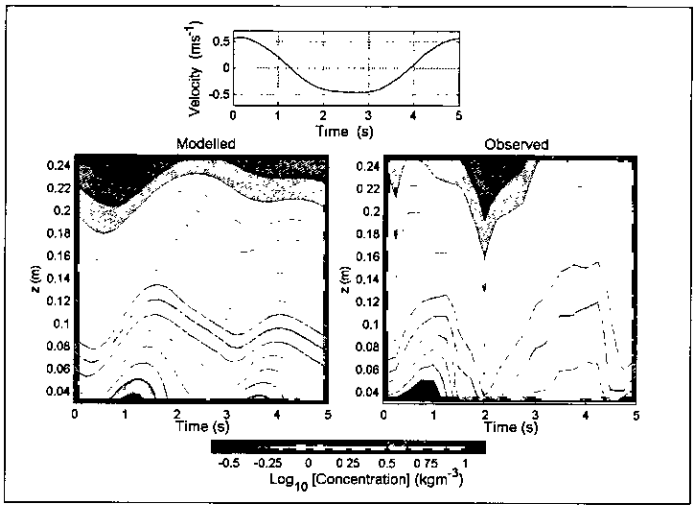

Figure 11: measurement and modelling of suspended sediments with height z above a rippled bed under a 5 s period wave

coherent Doppler velocity profiler. An example of the measurements from the velocity profiler is shown in *Figure 10*.

The data shown covers 5s in the bottom 0.8m above the bed and illustrates the detailed images of the flow that can be obtained using the acoustic approach. No other technique provides such detailed profile measurements.

To obtain the third component of the sediment transport triad, the suspended sediments, a three frequency acoustic backscatter system was used. Profiles of the suspended sediments were collected with a temporal resolution of 0.25 seconds and with a vertical spatial resolution of 0.01m over the bottom 1.24m above the bed. These measurements were synchronised with the wave velocity data, so that patterns in the suspended sediment concentration could be directly related to the near bed oscillatory flow generated by the waves. *Figure 11* shows acoustic measurements and a model,

of the variation of the suspended sediments due to the passage of waves over the ripples shown in *Figures 8 and 9*.

Focusing on the observed acoustic concentrations it can readily be seen that there are two periods of intense suspended sediment activity, at nominally 1s and 4s, in the wave cycle. From the wave velocity plot it can be seen that the suspended sediment events lie close to the times of flow reversal. Apart from flow reversal, there are only low levels of suspended sediment concentration. These observations **(9)** are consistent with the vortex entrainment description given in *Figure 5* and support the model in *Figure 11*, which is based upon the generation of vortices as the primary mechanism for lifting sediment into suspension **(10)**. These acoustic measurements represent some of the most detailed data collected to date on the interacting feedback sediment triad.

On reflection

Over the past two decades the application of acoustics to the measurements of near bed sediment transport processes has moved on from a qualitative tool, to being able to measure quantitatively detailed flow, suspended sediments and bedforms. The measurements can now be obtained with sufficient detail and accuracy, that emerging sediment transport models are being benchmarked against the acoustic observations, which are providing some of the most detailed measurements on sediment transport processes that have been obtained to date. And this is only the beginning. Oh by the way if you suffer from insomnia, there is always that short book on *Tasty Sediments* by W H O Kares, a reputed culinary delight, which sounds delectable!

References

1 P D Thorne and D M Hanes, A review of acoustic measurements of small-scale sediment processes, *Continental Shelf Research* **22**, 603-632, 2002

2 J Sheng, J A E Hay, An examination of the spherical scatterer approximation in aqueous suspensions of sand, *J. Acoust. Soc. Am.* **83**, 598-610,1988

3 P D Thorne and P J Hardcastle, Acoustic measurements of suspended sediments in turbulent currents and comparison with in-situ samples, *J. Acoust. Soc. Am.* **101** (5) (Pt. 1), 2603-2614, 1997

4 C E Vincent and D M Hanes, The accumulation and decay of near-bed suspended sand concentration due to waves and wave groups, *Continental Shelf Research* **22** (14): 1987-2000, September 2002

5 L Zedel and A E Hay, A coherent Doppler profiler for high resolution particle velocimetry in the ocean: laboratory measurements of turbulence and particle flux, *Journal of Atmosphere and Ocean Technology* **16**, 1102-1117, 1999

6 K F E Betteridge, P D Thorne and P S Bell, Assessment of acoustic coherent Doppler and cross-correlation techniques for measuring near-bed velocity and suspended sediment profiles in the marine environment, *Journal of Atmospheric and Oceanic Technology*, Vol 19, No. 3 pages 367-380, March 2002

7 P Traykovski, A E Hay, J D Irish, J F Lynch. Geometry, migration, and evolution of wave orbital ripples at LEO-15, *J. Geophysical Research*, Vol.104, No.C1, 1505-1524, 1999

8 J J Williams, P S Bell, P D Thorne, N Metje and L E Coates, Measurements and prediction of wave-generated suborbital ripples, *Journal of Geophysical Research*, Vol 109 CO2004. doi:10.1029/2003JC001882. pp1-18, 2004

9 P D Thorne, A G Davies and J J Williams, Measurements of near-bed intra-wave sediment entrainment above vortex ripples, *Geophysical Research Letter*, Vol 30, No 20, 2028. 2.1-2.4, 2003

10 A G Davies and P D Thorne, Modelling and measurement of sediment transport by waves in the vortex ripple regime, *Journal of Geophysical Researc*, Vol 110, C05017, doi:1029/2004JC002468, 2005

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Balancing research with consultancy

John W Tyler FIOA spends a day in Crowthorne with the Noise and Vibration Group

I drove into the relocated entrance to TRL Ltd from Nine Mile Ride and was immediately impressed by the attractive new building, which now houses TRL staff and their research facilities, where I was met by Professor Greg Watts, a senior member of the Noise and Vibration Group. The company moved into Crowthorne House in 2004. This completely new building, formally opened in October by HRH the Princess Royal, sits on the same site as the original TRL, but now houses all the staff, together with a wide range of new and leading-edge facilities.

Greg led me through the very thorough security measures to the modern office complex. There was no way I could have penetrated the building without escort: a very comforting thought for customers requiring absolute commercial security for their work. The general impression within is one of light and air, and it must be an inspiring place in which to work. The offices are, in general, open plan which enables free association between staff but with a reasonable degree of privacy at each workstation.

I then had discussions with the individual members of the Group from which I received a clear idea of the results achieved so far and the work in hand at the moment.

The best way of giving readers an impression of what I learned from this visit is to highlight some examples of the large range of work carried out which aims to maintain a balance between research and consultancy. Of course, in some cases the work is still in progress and is by its nature still confidential and so only a general outline can be given.

Noise and Vibration Group staff and the TRITON vehicle (l to r) Greg Watts, Mark Balsom, Mike Ainge, Phil Abbott, Richard Stait, Philip Morgan, Paul Nelson

Meet the team

To start, I should give some details of the group's seven members, whose abbreviated CV's (given below in alphabetical order) clearly show their wide range of skills and considerable experience.

Phil Abbott: *Senior Research Fellow* - Phil has over 30 years' experience at TRL investigating vehicle and road traffic noise generation, propagation and control, including developing models to predict noise levels from road and rail traffic. He was a member of the working group for the development of a standard prediction method for railway noise, of the ISO Committee considering methods of measuring road surface noise and of the Technical Sub-committee on the revision of the Noise Insulation Regulations. Phil has been a member of the Technical Working Committees and the co-author of many national and international standards and advice publications.

Mike Ainge: *Leader, noise and vibration group/Senior Research Engineer* - Mike has been with TRL for the past ten years and in his current position is responsible for the management of the group, management and completion of a variety of projects and the development of new business. He has had a broad experience of the engineering industry for over 25 years, gaining experience in a number of disciplines including design and manufacturing, defence engineering and research. He has considerable experience of the practical aspects of test work, data analysis, and his background enables him to play a leading role in a variety of projects.

Mark Balsom *(Associate IOA): Transportation noise researcher* - Mark has six years' experience in tyre/road, vehicle and traffic noise. His projects have included the influence of temperature on tyre/road noise measurements, the development of a new technique for overcoming survey site limitations and carrying out texture depth measurements using laser techniques. Mark is also the TRITON survey team leader.

Dr Philip Morgan MIOA: *Senior Researcher and Research Fellow* - Phil has been a member of the Noise and Vibration Group since 1999. He has over ten years experience in the field of numerical modelling of outdoor sound propagation using boundary element methods, including studies dealing with both road traffic and railway noise. He is currently working on the EU SILVIA project and is Secretary to the Scientific Board on the Dutch IPG (Innovatieprogramma Geluid) programme for reducing road traffic noise. Other projects include the development of a mobile MLS-based system for the static/dynamic measurement of the acoustics characteristics of porous and semi-porous road surfaces, and the application of MLS-based techniques to characterisation of noise barriers.

Dr Paul Nelson: *Consultant on environmental topics (retired Chief Research Scientist)* - Paul has worked at TRL for 32 years and is currently a Consultant there on environmental topics. Paul, who retired from his post as Chief Research Scientist in 2000, was head of profession for TRL's environmental specialists. He is a Transport Research Foundation Fellow. Paul has been responsible for a wide range of projects on environmental topics, covering tyre/road surface interaction noise, air quality, vehicle generated spray, traffic-induced vibration, railway noise and the public perception of environmental impacts. He has gained international respect for his contribution to research on road vehicle noise topics and has produced an authoritative reference book on transportation noise.

Richard Stait MIOA: *Senior Noise Engineer* - Richard worked at TRL between 1994 and 2002 and then had two years away before returning in 2004. During his time with the group, he has worked on many major projects especially those involving road surface testing and the assessment of traffic calming measures. Richard's experience covers many types of measuring equipment and measurement methods, including short and long term surveys, vehicle noise testing, tyre noise testing and pavement certification. He also has experience of noise mapping and environmental impact assessments. Richard is currently a project manager within the group and also responsible for expanding its work into new areas.

Prof. Greg Watts FIOA: *Senior Research Fellow* - Greg has over thirty years experience in noise, vibration and safety research at TRL. Projects in the noise and vibration field include numerical modelling of sound propagation, improving noise control by barriers and examining the generation and propagation of traffic noise and vibration and effects on people and buildings. Greg is Professor in the School of Engineering and Technology at the University of Bradford where he spends part of his time.

Greg's professional links have included: chair of BSI committee on noise barriers; leader of UK delegation on CEN working group and chair of European Sub-Committee TC226/W66/TG1 on acoustical performance; member of ISO committee TC 43/SC 1/WG 38 on the determination of sound absorption of road surfaces and WG42 on vehicle noise testing; and member of BSI committee EPC/1/4 on acoustics.

Range of activities of the Noise and Vibration Group

TRL has worked for more than 30 years in transport-related noise and vibration research, consultancy and monitoring, including:

- ❑ Development and assessment of low noise road surfaces;

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Balancing research with consultancy

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- ❑ Studies of quieter vehicles and tyres;
- ❑ Developing new traffic calming devices *eg.* round top road humps, rumble areas and rumblewave surfaces;
- ❑ Modelling and full-scale testing of improved noise barrier designs including the use of numerical techniques for predicting noise levels in complex environments;
- ❑ Developing standard vehicle test procedures and measurement methods;
- ❑ Studies of noise and vibration implications of different traffic management schemes and features such as speed control cushions;
- ❑ Developing road and rail traffic noise models, particularly CRTN and CRN, including appropriate modifications for noise mapping;
- ❑ Studies of the perception of vehicle and traffic noise;
- ❑ Assessment of airport expansion options in terms of noise impact on the surrounding population;
- ❑ Designing questionnaires for attitude surveys on noise and vibration perception;
- ❑ Developing and assessing regulations/standards for legislation and policy support.

Much of this work has been to inform decision makers in the development of policy for UK government departments and local government involved with noise issues, for example:

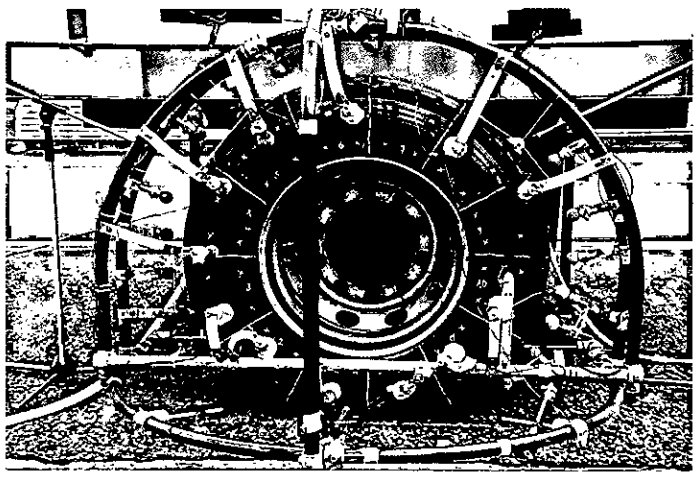
For the Highways Agency: Updating the design manual for roads and bridges;

For the Scottish Executive: Reviewing the current noise insulation regulations for Scotland;

For Transport for London: Reviewing the London lorry control scheme and the development of performance indicators for noise action plans;

For the Department for Environment, Food and Rural Affairs: Adapting CRTN to meet the requirements of the new EU Environmental Directive on environmental noise for noise mapping;

For the European Commission: Examining the potential and implication of vehicle noise reduction and advising on interim methods for calculating environmental noise for roads and railways, developing standard procedures for the type approval of tyre noise and understanding the relationships between tyre noise and safety; and



Microphone array for tyre noise tests

For the Department for Transport: Advising on proposed regulations for tyre and vehicle noise, including attending UN-ECE vehicle noise meetings as a UK expert.

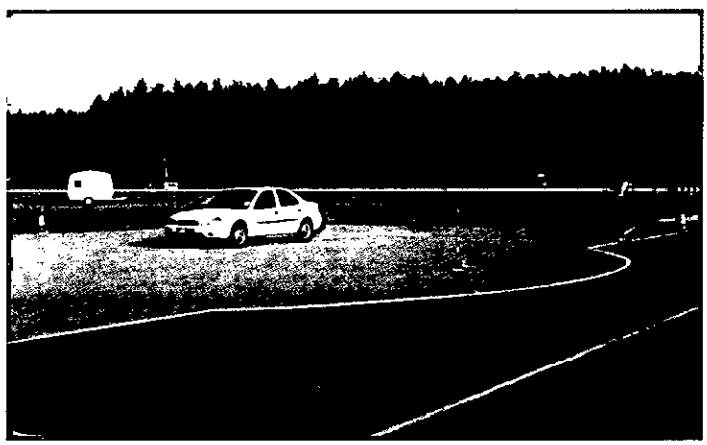
To give readers more detail about the group's activities, here are some examples of the work areas described to me.

Tyre/road noise

As many readers will know, the noise generated by tyres is often the dominant source of noise for vehicles operating at moderate and high speeds. This has followed the success of research and industry in reducing the mechanical noise from vehicles, particularly heavy goods vehicles - the TRRL Quiet Heavy Lorry Project in the 1970s and the QHV90 Project managed by TRL in the late 1980s contributed to this outcome. Research at TRL has focused on controlling and reducing tyre noise through a combination of measures involving the design of both tyres and road surfaces and the development of standard test procedures.

For example, a major study commissioned by the Department for Transport's VSE Division and the Highways Agency has examined the relationships between vehicle tyre and road surface design and their influence on tyre/road noise.

The study, which involved extensive testing both on the TRL test track and on public roads, demonstrated the important symbiosis between tyre and road surface design and provided useful observations regarding the suitability of the standard test surface for type approval testing of tyres. Other work for



ISO test surface development

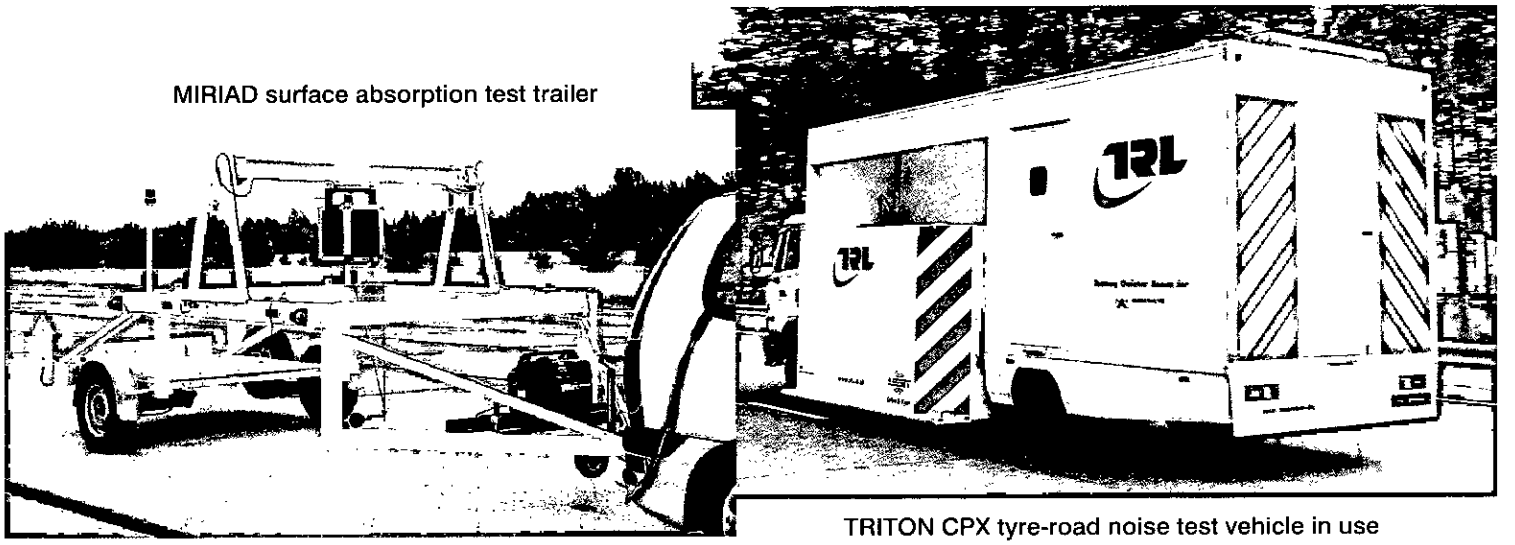
VSE examined the influence of tyre noise on the results of measurements taken using the vehicle noise type-approval test and established the importance of torque/tyre deformation on noise generation, particularly for truck tyres.

Test surface development

The group was closely involved in developing the ISO standard test track surface for vehicle noise testing (ISO 10844) and constructed the first prototype surface in the UK which was laid on the TRL test track. TRL now provides certification and monitoring services for standard test surfaces in the UK.

Research tools

TRL designed and developed TRITON, a unique purpose-built vehicle for monitoring tyre/road noise and performing 'close proximity' (CPX) noise measurements. TRITON incorporates a semi-anechoic chamber enclosing a test tyre and seven microphones, and can be operated within traffic at a range of speeds without disrupting the traffic flow. Another continuous measurement system developed at TRL is MYRIAD, a trailer which housed equipment for measuring the acoustic absorption of porous and semi-porous road surfaces under dynamic conditions.



MIRIAD surface absorption test trailer

TRITON CPX tyre-road noise test vehicle in use

Development of standards and test procedures

As a result of work commissioned by the EU and carried out at TRL, a standard test procedure for vehicle noise was developed for all vehicle categories which now forms the basis of the current type-approval method (EC Directive 2001/43/EC). The group was involved in the development of ISO standards for both statistical pass-by and CPX measurements (ISO/CD 11819-2) and for the in-situ measurements of road surface absorption.

TRL is closely involved in the EC-funded project SILVIA, whose objective is to provide decision makers with tools allowing them to determine appropriate traffic noise control measures. The main product will be a *European Guidance Manual* describing how to integrate different measures to effect reductions in noise impact including lower noise road surfacings, traffic noise control measures and the use of vehicle and tyre noise regulations.

TRL is also closely involved in the European Commission consortium project Harmonoise. Greg Watts' article in a previous issue of *Acoustics Bulletin* (vol.30 no.5, September/October 2005) fully describes this project and his contributions to other articles in the same issue give much information about recent TRL research on reducing traffic noise disturbance.

Noise barriers

TRL has considerable long-term experience with evaluating noise barrier performance, the development of barrier designs and test methods. This has entailed the development of methods for assessing the performance of barriers installed at the roadside and the effects of novel caps on barriers, using sound intensity measurements and MLS-based techniques. The consultancy has also been involved with the development of ISO and CEN standards for in-situ testing using MLS-based methods.

Much work has been done into the acoustic performance of a wide variety of noise barriers and earthworks for screening

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both road traffic and railway noise, using both numerical modelling and full scale testing on TRL's noise barrier test facility. Numerical modelling techniques have also been applied to investigate how the performance of noise barriers is degraded when used in combination with other noise reduction measures.

TRL has co-invented a noise barrier design with multiple diffracting edges mounted on a single foundation which was later patented. This device was developed using both numerical modelling and full scale testing both at its test facility and on motorway sites.

Modelling of transport noise

The group has extensive experience in the development of prediction models for both road (Calculation of Road Traffic Noise - CRTN) and railway noise (Calculation of Railway Noise 1995 - CRN95) and has developed the standard prediction models used in the UK for assessing noise insulation entitlement and those used in assessing the environmental impact of transport development schemes. A fundamental component of the work on transport noise modelling relies on developing functional relationships between individual measures of vehicle noise and traffic stream noise.

More recently, CRTN has been adapted to take account of new EU noise indices L_{den} and L_{night} for strategic noise mapping, as specified in the new EU Directive on Environmental Noise. Corrections have also been introduced for CRTN to take account of recent developments in road surface design, such as quieter surfaces for low-speed, medium-speed and high-speed roads. Of current interest is the way in which these corrections may change over time owing to the effects of traffic.

Perception of vehicle and traffic stream noise

TRL undertakes many studies which examine the correlation between physical measures of vehicle and traffic stream noise and the resulting subjective impact of this noise on people. For example, trackside studies involving members of the public have been used to establish scales of noise which best relate to the subjective perception of noise. This involved the rating of subjective noisiness from a range of vehicles driven in various operating conditions, supported by laboratory studies where high quality recordings of vehicle noise were replayed to volunteers under simulated indoor and outdoor listening conditions.

The consultancy also carries out large scale surveys of the disturbance to residents by traffic noise which enables the percentage of residents likely to be dissatisfied to be estimated at a wide range of noise exposure levels. This work has led to the establishment of dose-effect trends which can be used to estimate disturbance in new situations. These techniques have been used in a number of studies where the reaction of residents to area-wide traffic calming devices has been evaluated. In order to gauge the environmental impact of traffic calming, social surveys and noise measurements have been carried out along trunk roads in towns and villages where these measures have been applied, Craven Arms and Hayton being two examples.

Traffic calming

The group claims an international reputation in assessing the environmental impact of traffic calming on local communities by providing expert advice in reducing environmental impacts from traffic management schemes, models for predicting noise and vibration near to road humps and cushions, and noise and vibration measurements including attitude surveys to assess disturbance.

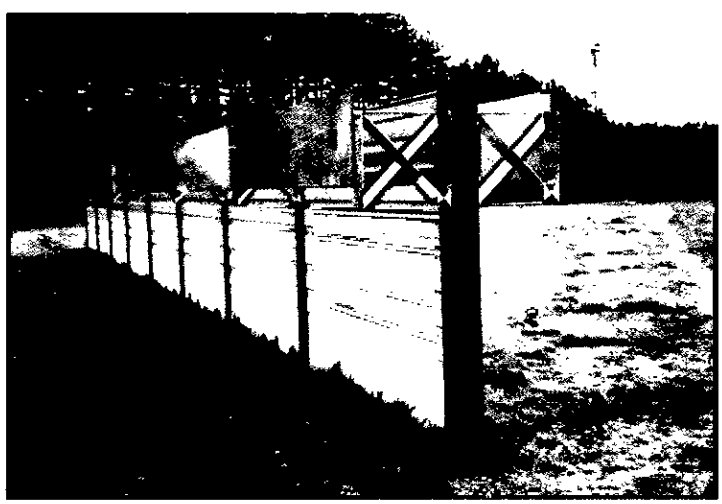
Making traffic calming surfaces quieter for residents

TRL was commissioned by DfT to seek a traffic calming surface which would increase noise and vibration within the vehicle, to alert the driver to a particular hazard, but not increase the noise levels heard by nearby residents. Such a surface would offer reduced noise nuisance in comparison to existing measures such as rumble strips. The study resulted in the design of such a rumblewave surface with a sinusoidal profile, now commercially marketed as 'Rippleprint', which was successfully trialled at six sites on public highways. Since its introduction on public highways additional work has been done by TRL, and a report was published this year on the prediction of ground-borne vibration generated by heavy vehicles crossing a rumblewave device.

Ground-borne vibration

Ground-borne vibrations are generally perceptible inside dwellings in situations where the road surface is uneven, the underlying ground is relatively soft and buildings are situated

An experimental barrier design installed next to a motorway



Development of novel barrier designs

close to the road. The heaviest vehicles produce the largest effects. Disturbance, including fears about building damage, can result. Road humps and cushions can be a potential source of this type of vibration and nuisance, in some cases resulting in legal action being taken by the owner of the building.

TRL claims to be in an excellent position to advise on many aspects of vibration induced by surface transport, having been at the forefront of UK research on this topic for many years. Thus, it can provide measurements at problem sites, then advise on the design and layout of traffic calming measures to minimise nuisance, and on acceptable levels of vibration to minimise building damage risk.

Examples of work in this field carried out by TRL include:

- a large programme of research for the UK government on the impact of traffic calming measures and uneven road surfaces on levels of ground-borne vibration and noise, building damage risk and human perception;
- measurements on a range of domestic dwellings, heritage buildings and large mediaeval churches;
- controlled tests on the TRL research track to compare noise and vibration alongside different designs of hump and cushion, and advice on suitable profiles has been developed; and
- vibration prediction equations developed for different soil conditions which allow guidance to be given on the location of humps and cushions to minimise adverse reactions.

In addition to the topics mentioned there have been numerous studies for local authorities, as well as private commissions, involving the investigation of local noise and vibration problems using noise and vibration monitoring and the use of TRITON to assess road surface noise.

Following these discussions about the consultancy's work on noise and vibration, which left me impressed by the range and depth of its capabilities, I was taken on a tour of the research facilities. Seen against a background of handsome new buildings, one might be forgiven for deducing that there was nothing in the general field of traffic and vehicle noise and vibration that this team could not tackle! The accompanying photographs give a good idea of the measurement facilities available to them.

Conclusions

To conclude this report on my visit, I invited Greg Watts to summarise the important directions of the group's current activities.

"Recently we have seen a broadening of the types of work we undertake. This presents both challenges and opportunities - and much more travel! We are working with European partners on EC part funded projects such as Harmonoise, SILVIA and IMAGINE and the Dutch IPG project. Recent clients have included Greater London Authority, the Council for the Protection of Rural England, Wandsworth Town Council, and Hampshire County Council, as well as a number of private individuals with noise and vibration problems.

"Our current work includes studies to assess and if necessary improve auditory warning systems for train doors. We are also working for the Department for Transport and the EC on assessing the tyre noise and vehicle noise regulations. The possible trade-off between tyre noise reduction and safety is clearly a significant issue to address. Of increasing importance is cost benefit analysis which involves the difficult task of assigning money values to noise changes and the costs to industry. Our work on the development of standards both within the EU and for ISO has formed a key part of our research programme and I see this work continuing into the future.

"Noise mapping is clearly on the agenda and the associated action plans will soon be the focus of interest. Using the Harmonoise traffic source model we have already been able to model a wide range of different scenarios and identify likely cost effective measures for urban areas. Further ahead it is expected that a Harmonoise type model will be used for the second round of noise mapping. This will be an opportunity to use our experience in supporting the use of the model and dealing with issues arising. Finally there are some new research ideas that we wish to progress. This will involve collaborating with our close university contacts and with forward-looking companies open to innovative ideas. As always we will be looking for cost effective solutions that can be applied in the real world."

I left the TRL site after an absorbing and interesting day with the firm impression that here was a noise and vibration group, part of a one-time government research laboratory and now a fully commercial company, totally committed to delivering a high standard of output to satisfy a wide range of customer requirements.

Main research areas

Although this article concentrates on the noise and vibration activities at TRL it is worthwhile outlining briefly the wide range of activities carried out in the Laboratory to set the group in context, and to emphasise the wealth of knowledge and research support it has available.

Safety

Includes road safety engineering, vehicle safety engineering, analysis of accident data, and the behaviour of drivers and other road users.

Transportation

Research concerned with making best use of the existing transport network, focusing on the planning, control and information provision for traffic, public transport, cycling and walking. The capabilities include traffic management, multi-modal transport modelling and intelligent transport systems. The research facilities include state of the art car driving and truck driving simulators, enabling effective testing of new ideas and driver performance.

Infrastructure and environment

Research on road construction and maintenance, the performance of structures such as tunnels and bridges, geotechnical research and an increasing emphasis on improving efficiency in the use of materials and establishing ways of recycling materials used in road construction. The research is a balance between long-term studies of a fundamental nature and shorter-term investigations targeted at solving customers' problems. Environmental research includes the prediction and control of noise and exhaust emissions and the monitoring of air quality. The Noise and Vibration Group is part of the Infrastructure and Environment Division.

International development

TRL's International Group is concerned with the transport problems of developing and emerging countries and with helping to achieve the millennium development goals for reducing world poverty. The principal clients for this work are the UK's Department for International Development, the main multilateral aid agencies such as the Asian Development Bank and the World Bank, and other bilateral aid agencies. The work includes fundamental and applied research, institutional strengthening and capacity building projects and the provision of specialist advice and training.

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Commons Written Answers

5 October 2005

Industrial injuries (hearing loss)

Roger Berry: To ask the Secretary of State for Work and Pensions **(1)** how many claims for industrial injuries disablement benefit have been made on the basis of hearing loss in each year since 1995; and how many were successful; **(2)** what percentage of *(a)* claims for industrial injuries disablement benefit (IIDB) and *(b)* IIDB claims awarded were for hearing loss in each year since 1995.

Margaret Hodge: The available information is in the tables.*(reproduced below)*

Claims to Industrial Injuries Disablement Benefit[6]

	all prescribed diseases	occupational deafness	
	number	number	percentage of total claims
1995	[6]21,900	[6]4,900	22.1
1996	44,200	6,800	15.3
1997	60,600	5,800	9.6
1998	45,600	4,300	9.4
1999	41,300	4,100	9.9
2000	48,700	4,300	8.8
2001	39,000	3,900	10.0
2002	41,050	3,430	8.4
2003	37,435	3,200	8.5
2004	[9]28,255	[9]2,705	9.6

Industrial Injuries Disablement Benefit assessments where the level of disablement was above the threshold for receiving Industrial Injuries Disablement Benefit[7]

	all prescribed diseases[12]	occupational deafness[13]	
	number	number	percentage of total assessments
1995	[6]2,835	[8]585	20.6
1996	3,770	530	14.1
1997	5,950	415	7.0
1998	6,255	260	4.2
1999	4,265	315	7.4
2000	3,205	225	7.0
2001	3,410	265	7.8
2002	4,470	265	5.9
2003	4,790	335	7.0
2004	[9]5,035	325	6.5

Notes:

[6] Claims are based on a 10% sample up to 31 March 2002 and on a 100% count thereafter

[7] Assessments are based on 100% count and rounded to the nearest 5% to ensure anonymity

[8] Figures are for 9 months only

[9] Figures for 2004 are provisional

[12] The figures for assessments for all prescribed diseases do not include cases where the level of disablement is below the threshold for receiving Industrial Injuries Disablement Benefit

[13] The figures for assessments for occupational deafness show all cases where there is a level of disablement assessed as, due to the nature of the scheme, all assessments for occupational deafness have to be at least 20% and therefore above the threshold for receiving Industrial Injuries Disablement Benefit.

(Source: DWP Information Directorate)

Roger Berry: To ask the Secretary of State for Work and Pensions what the evidential basis was for setting *(a)* the lower threshold for hearing loss caused by noise at work at 50dB when assessing claims and *(b)* a three-year time limit for hearing loss industrial injuries disablement benefit.

Margaret Hodge: The 50dB threshold for benefit payment was set following the advice of experts in audiology and the Industrial Injuries Advisory Council who determined that this level of loss equated to 20% disablement in the Industrial Injuries Scheme.

The Industrial Injuries Advisory Council advised that noise-induced hearing loss is only slowly progressive. Thus a person whose claim for disablement benefit has been disallowed is unlikely to suffer deterioration in their hearing loss due to noise to the degree that they fulfil the criteria for diagnosing occupational deafness (prescribed disease {PD} A10) in less than three years.

A claim cannot be made less than three years after the previous disallowance of a claim. This is because the Industrial Injuries Advisory Council advised that noise-induced deafness is only slowly progressive. A person who fails to fulfil the diagnostic criterion of a 50dB loss is unlikely to suffer deterioration in their hearing loss due to noise to the degree that they fulfil the criteria in less than three years.

17 October 2005

Wind farms

Mr David Jones: To ask the Secretary of State for Trade and Industry what assessment was made by the Department prior to granting consent to the construction of an offshore wind farm on the Rhyl Flats to the potential impact on *(a)* the visual amenity of residents of the North Wales coast, *(b)* shipping, *(c)* avian wildlife and *(d)* marine wildlife.

Malcolm Wicks: A comprehensive environmental statement was provided by the project developers to support the consent application for the wind farm at Rhyl Flats and this was available to stakeholders and members of the public for their information and comment. When taking the decision to grant consent for the project, Ministers considered the results of the public consultation which included responses from the Countryside Council for Wales, the Government's statutory adviser on landscape and nature conservation issues in Wales, the RSPB, the Maritime and Coastguard Agency and others, including other Government Departments. None of the organisations mentioned objected to the grant of consent for this wind farm.

Adam Price: To ask the Secretary of State for Trade and Industry what recent Government studies have been undertaken into low frequency noise and vibration emitted by wind turbines; and if he will make a statement.

Malcolm Wicks: The following recent studies have been commissioned and examined by the Department:

- The Assessment and Rating of Noise from Wind Farms, published 1996
- Noise emission from wind turbines, published 1999
- Aerodynamic noise reduction for variable speed turbines, published 2000
- Assessment of the Effects of Noise and Vibration from Offshore Wind Farms on Marine Wildlife, published 2001, and
- Microseismic and infrasound monitoring of low frequency noise and vibrations from Wind Farms on the Eskdalemuir Seismic Array. (Joint study with MOD and BWEA), published 2005.

One other study, *The measurement and assessment of low frequency noise from three UK wind farms* has been commissioned and should be available this year.

Adam Price: To ask the Secretary of State for Trade and Industry what definition his Department uses of low frequency noise and vibration in relation to wind turbines; and if he will make a statement.

Malcolm Wicks: Low frequency noise is generally regarded to mean noise in the range of 10 to 200 Hertz (Hz). There is no British Standard for measuring low frequency noise and most European countries tend to have their own criterion. The current accepted assessment methodology for low frequency noise is ETSU-R-97. It is used by planners for guidance and incorporates a robust refinement of the BS.4142:1997

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RPS

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Consultants will have around 4 – 5 years' similar experience and be a member of the Institute of Acoustics. You should be suitably qualified with MIOA being desirable.

Applicants for these posts will be capable of responsibly managing projects and liaising with clients and report writing, and competent in assessment methodologies including PPG24, BS4142, BS5228, MPG11, CRTN and DRMB. You will be IT literate, with good communication and organisational skills and will need to demonstrate your enthusiasm, commitment and ability to provide technical support to the Acoustics Teams.

Principal Acoustic Consultant – Scotland Wide

Based in either our Glasgow or Edinburgh Office the successful candidate will be suitably qualified with around 4-8 years experience in acoustics and vibration. You will be responsible for the measurement, analysis and assessment of noise and vibration, with a strong emphasis on renewable energy EIA's, particularly on-shore windfarms, as well as surface and air travel and other developments.

This position requires someone with excellent written and verbal communication skills to liaise with existing clients and develop the services within new business sectors. In addition there is a requirement to lead and develop the noise team within Scotland.

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Commons Debates

Extracts from the second reading of the Civil Aviation Bill - 10 October

Mr Speaker: With this second reading it will be convenient to discuss the following new clause 6 - *Sound-proofing of buildings affected by aerodrome use* [as paraphrased below – Ed.]

1 The Secretary of State shall, no later than one year after the passing of this Act, make regulations under section 20(1) of the Land Compensation Act 1973 (c. 26) (sound-proofing of buildings affected by public works) imposing a duty on responsible authorities to insulate buildings against noise caused, or expected to be caused, by the use of aerodromes for the taking off and landing of aircraft.
2 In making provision as to the level of noise giving rise to a duty under subsection (1) in respect of a building or class of buildings, and the area in which a building must be situated if the duty is to arise in respect of it, the regulations must make reference to the noise attenuation of individual rooms in buildings, having ensured that sufficient notice has been given prior to the introduction of the proposed charges.
2A Any aerodrome authorities, making charges under subsections (1) for the purposes set out in subsection (2) shall be under a duty to:
(a) monitor emissions and noise levels on an annual basis publishing annual figures for pollution and noise levels; and
(b) publish a statement of intent as to what levels of emissions and noise can be expected for the following twelve month period and to what extent it has and will achieve the purposes laid out in subsection (2).
2B An airline may appeal to the Secretary of State against any charge made by an aerodrome authority under subsection (1).
3A The Secretary of State shall report on the effectiveness of any charges made under subsection (1) for those purposes laid out in subsection (2), every twelve months after the passing of this Act and shall specify the sources of information used in its compilation, and publish each such report in such manner as he thinks fit.
3B The Secretary of State shall, by regulation, following the publication of each report made under subsection (3A), set targets for emissions and noise related to aerodrome authorities for the following twelve month period and report on the systems and means for monitoring noise and emissions in relation to aerodromes and those areas along flight paths and whether they shall be subject to change over the following twelve months.
Mr Duncan: I thank you for your guidance on the point of order, Mr Speaker. Perhaps in due course we might clarify whether it would be in order to discuss the issue on Third Reading, given the broader principles of the Bill and in order to wrap things up.
Mr Speaker: Yes, that would be in order.
Mr Duncan: I am grateful to you, Mr Speaker. Otherwise, I would not have had much of a Third Reading speech.
The group of amendments tabled in my name and by others addresses the heart of the Bill. Everyone, including the Secretary of State, accepts that this is to some extent a hotchpotch of a Bill. It has no great coherent form; it contains a group of half-concocted measures that do not quite come together into a serious regime. Following the deliberations in Committee, which were so ably conducted by my hon. Friend the Member for Canterbury (Mr Brazier), the amendments are an attempt to introduce more cogency.
The amendments largely define the way in which the Bill will work in practice in terms of noise and emissions, turning it from a simple enabling Bill into something more focused. The amendments also cover the growing problem of consumer concern about the monitoring of flights at night and the wall of silence faced by many people on the ground when investigating the problem of noise above them, particularly at night.
Amendment No.1 is a rather sly wolf in sheep's clothing. It would remove clause 2(2), thus specifically removing from the Secretary of State's duties the stipulation to determine the number of flights at designated airports that may or may not take place at night, and replaces the number of flights with various other stipulations, particularly concerning noise and emissions. At first sight that seems logical, and the argument will be that as noise and emissions improve, the number of flights will become less relevant. However, beneath that seeming logic lies a severe danger that those who live under the flight path of an airport will experience many more flights at night, which despite the noise and emissions stipulations will be no less disturbing.
Such an argument contains a fallacy of methodology. Decibels alone are not a measure of nuisance. Occasions of noise - undercarriages going down and the roar of engines that do not necessarily break the decibel limit - wake people up. We are facing, especially for designated airports and given the underlying concept perhaps for many other airports that are expanding at the moment, a depressing and unpoliced regime for the growth of flights at night.

continued from page 39

(which is a general noise assessment methodology) appropriate to wind farm noise assessment. ETSU-R-97 provides indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm developers.

20 October 2005

Civil aircraft noise

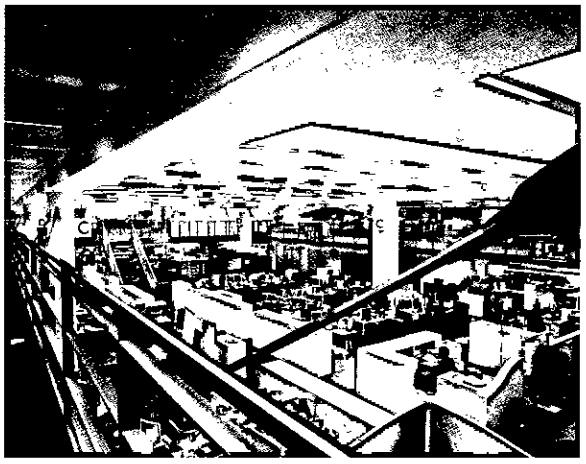
Mr Lidington: To ask the Secretary of State for Transport what his policy is on the monitoring of the compliance of civil aircraft noise levels with international noise certification standards.
Ms Buck: Aircraft operating into the UK have to comply with noise standards agreed through the International Civil Aviation Organisation. Compliance for those aircraft on the UK register will be verified by the Civil Aviation Authority; for non-UK aircraft it will be by the state of registry. Airports may seek information from airlines on the noise certification status of aircraft in the event of uncertainty.

Lords Written Answers

13 October 2005

Noise pollution

Lord Beaumont of Whitley asked Her Majesty's Government what measures they are taking to combat noise pollution.
The Parliamentary Under-Secretary of State, Department for Environment, Food and Rural Affairs (Lord Bach): The Government is taking numerous measures to combat noise pollution, ranging from the international to the national to the local level. At the national part of the spectrum, the Government is currently implementing an EU directive on environmental noise pollution (2002149/EC) that will lead, in 2007, to transport noise being mapped in agglomerations of more than 250,000 inhabitants as well as at major roads, railways and airports throughout the country. Action plans to tackle problems that are identified will follow in 2008 and then at five-yearly intervals.
The Government's *Planning Policy Guidance: Planning and Noise* gives national guidance to planning authorities and others on how potential noise pollution should be addressed through development. The Government is currently reviewing this guidance to bring it up to date with, among other things, the UK's sustainable development strategy of 2005. The Government is also committed to developing a national ambient noise strategy by the end of 2007.
At the local level, the Clean Neighbourhoods and Environment Act 2005 will give local authorities further powers for dealing with neighbourhood noise once they come into force in spring 2006. The new measures include powers for local authorities to deal with misfiring intruder alarms and the extension of the Noise Act 1996 to enable local authorities to issue fixed penalty notices of £500 to licensed premises causing excessive noise.
The Government is also developing a neighbourhood noise strategy for launch in 2007. This will review existing legislation for dealing with noise nuisance, including the statutory nuisance regime under the Environmental Protection Act 1990, as well as any gaps that existing legislation does not address. A draft scope for the Strategy will be consulted on later this year.



Winning designs in urban renewal

BBC Mailbox - BCO 'best of the best'

For its BBC Mailbox, Birmingham, project the Building Design Partnership took the *Best of the Best Award* in the British Council for Offices Awards. It also won the Regional and the National Award in the Fit-out of Workplace - large projects category. The BCO Awards, which were announced on 4 October, recognise top quality design and functionality, providing a benchmark for excellence in office space.

When the BBC in Birmingham moved from Pebble Mill to The Mailbox - a large, city-centre, mixed use development which was formerly a 1960s sorting office - BDP was appointed to create a distinctive presence which would attract and welcome the public while providing the best possible accommodation for BBC programme makers.

The jury commented: '*The Mailbox's base space was far from usual and the BBC made a courageous stand to go to this mixed use wonder. Designers BDP's success can be measured against the challenge they faced from Mailbox's mail sorting office ancestry. The standard of fit-out is very high; all elements display imagination. It could have been frightful; instead it is great. The building is full of dynamism and light.*'

The 100,000 sq ft project includes integrated broadcasting (radio and television), technical, support and general office activities, with a public atrium space creating a focus and providing views into 'live' broadcasting studios. BDP's design solution was to create a dramatic four-storey entrance space at the heart of the plan linking the entrance, located in the main shopping concourse of The Mailbox, with the broadcasting accommodation at all levels.

While BDP's involvement within this existing building was mainly internal, the opportunity was taken to modify the façade to increase the areas of glazing and, in particular, to provide a major 'picture window'. This is designed to both 'sign' the BBC presence and to provide an open aspect to the south-west, both improving the quality of internal natural light and reinforcing the visual link to the public canal-side space.

On entering through the BBC 'shop front' which features a coffee bar and shop, visitors can see through into the local radio studios at the lower level and the upper level drama studio, with activities of the open plan offices, TV studio and edit suites visible via a full-height glass screen beyond. The studios are designed to a very high acoustic standard.

The office accommodation is arranged over two levels, the higher of these is formed by suspended mezzanine floors or 'gondolas' floating within the double-height open plan space and thereby substantially increasing the available floor area. These also provide integrated and continuous service voids through which fresh air, power and data cabling can be distributed into the deep-plan office spaces and edit suites, with chilled panels forming their undersides.

The jury commented: '*The scheme exemplifies the BBC's willingness to promote change and increase efficiency while providing a stimulating workplace.*'

The cooling system is low energy, benefiting from the use of canal water for 'free cooling' and heat rejection when conditions permit. As the jury stated: '*The whole project is a good sustainability story. Although green options were restricted by the existing shell, increased natural lighting, passive chilled beams and solar shading acknowledge the green agenda.*'

The final citation reads: '*With notable civic responsibility, the achievement of this environment within an existing building is remarkable. A most worthy Best of the Best*'.

Leeds Round Foundry - RICS Project of the Year

The Round Foundry, Holbeck, Leeds has topped the RICS Awards 2005, being named *Project of the Year.* This award is given to one entry judged to have excelled in any or all of the four award categories: Building Conservation, Community Benefit, Regeneration and Sustainability.

The Round Foundry, which was also winner of the Regeneration Category, lies at the heart of Holbeck Urban Village in Leeds. Established over 200 years ago as a manufactory of steam engines, it is the only surviving first-generation engineering works anywhere. BDP's regeneration scheme involves selective demolition of recent structures, conservation and adaptive re-use of a number of buildings on the site, and the construction of new buildings.

The mixed use development, which comprises residential, offices and retail, has revitalised a previously run-down area of Leeds, becoming the impetus for further regeneration.

This award brings the tally won by Round Foundry to nine. Building Design Partnership are architects, landscape architects, lighting designers and acoustic consultants for developers CTP St James.

LETTER

Early rain simulation testing

I read the article about rainfall noise testing (*Acoustics Bulletin* vol.30 no.4) with great interest and have a few comments. I was reminded of the rain simulator made for Redland Tiles, part of the wind tunnel which I ran in the 1970s. We found that blunt hypodermic needles of different sizes could control drop sizes, although getting an even distribution over the array of 1200 was still tricky. My wife has reminded me that we also made much use of disposable nappies for catching and weighing any leaks. The expenses claims had to be carefully written!

I have since found that the surface treatment can be critical in rain noise reduction. I have a polycarbonate conservatory roof, now largely covered in bitumen felt. This is not heavy but has provided a remarkable sound level reduction inside.

Dick Hazelwood
R & V Hazelwood Associates LLP
Guildford

Acoustic safety conference alerts employers to call centre risks

Lord Hunt, Minister for Health and Safety, was the keynote speaker at the *Acoustic Safety Programme Conference*, held on November 7 at the National Physical Laboratory in Teddington, London. The conference briefed employers about the issues relating to acoustic safety, including acoustic shock, and offered some solutions to the problems.

With around 1.4 million people working in UK call centres, accounting for three per cent of the UK's total workforce, acoustic safety is an important issue for employers.

Acoustic shock is a major issue, with the Communication Worker's Union estimating that over 500 claims for damages have been filed in the UK associated with the symptoms of this problem, with a further 123 cases pending. Around 10-15 new cases are reported each month.

All claims have so far been resolved out of court with an estimated total of £3 million paid out by companies. However, the final bill could be much higher for companies like Eircom, who are facing mass litigation from over five hundred former workers, a figure that could rise to thousands.

Acoustic shock, or noise interference, is caused by repeated exposure to sharply rising noises in close proximity to the ear, usually through headphones without adequate protection. Symptoms include tinnitus, ear pain, dizziness and nausea, impaired hearing, and anxiety, and can also lead to headaches, depression, fear of work, and lethargy; all contributory factors to an annual £2.5 billion loss through call centre sickness, absenteeism and attrition.

An RNID study further highlighted the problem, finding that 30% of call centre workers surveyed suffered from tinnitus and 39% believed that their hearing had been damaged through work.

Selectaglaze goes on line with RIBA CPD

Secondary glazing specialist, Selectaglaze, has been approved by the Royal Institute of British Architects (RIBA) to provide Continuing Professional Development (CPD) to architects, specifiers and other professionals in the construction industry.

The 35-minute presentation, *Understanding and specifying secondary glazing for noise insulation/breakout, environmental controls and security against blast and physical attack*, previously offered to individual architectural practices, is now available online. It is designed to help specifiers identify the need for, and to understand where, why and how secondary glazing should be used.

Secondary glazing is a fully independent window system installed to the inside face or room side of the primary windows. It can be retrofitted into an existing building or installed as part of a 'new build' to provide triple glazing.

The key benefit and the reason for most people specifying secondary glazing is to provide very effective noise insulation, which is far superior to normal double glazing. However, the product also provides improved thermal insulation, draft proofing, a barrier to airborne dust, and can act as a UV light filter when laminated glass is specified.

More recently there have been significant developments to provide protection against blast and physical attack.

Founded in 1966, the company recognised the need for acoustic insulation to commercial properties in the vicinity of airports. It has subsequently built a position as a leading innovator in the field of secondary glazing through a process

of continuous design and development to meet the changing needs of buildings. A commitment to quality is recognised through certification to ISO9001 by LPCB and the granting of a Royal Warrant.

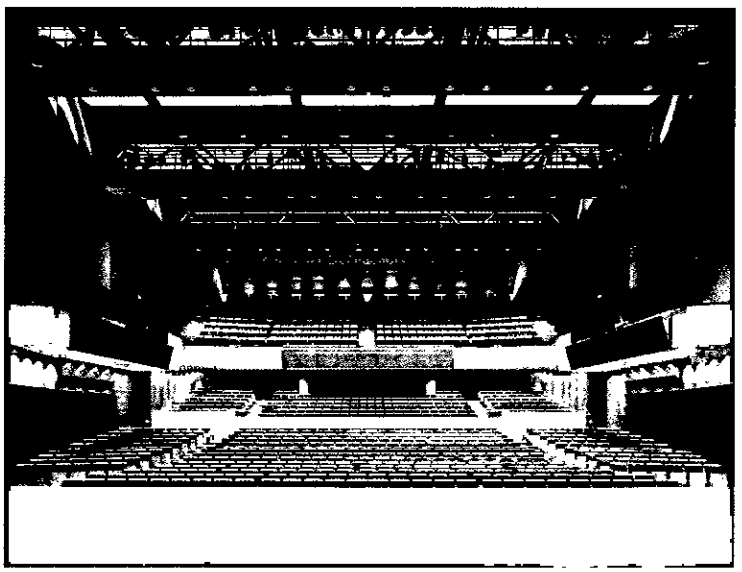
For more information: tel 01727 837271 e-mail enquiries@selectaglaze.co.uk www.selectaglaze.co.uk

Flexible acoustics for Perth's multi-use concert hall

Perth Concert Hall hosted a gala concert given by the Royal Scottish National Orchestra on 16 September to mark the public opening of the first full-scale purpose-built concert hall in Scotland since 1990. The £17 million building is the result of an international architectural competition, chaired by Eva Jiricna, and won by BDP's Glasgow office in 1998.

Located in Perth's historic Horsecross, once a thriving market area but more recently marginalised, Perth Concert Hall is viewed in the round and BDP's free form plan is a unifying response to the irregular edges of the urban fabric bounding the site. The area has already witnessed significant urban regeneration, ahead of the concert hall's impending opening, which also includes a streetscaping project by the local authority following its completion.

At the heart of the building is a fully flexible 1200 seat concert hall, the Gannochy Auditorium, which features uniquely configured floor lifts and movable seating wagons to provide both raked seating and a large-scale flat floor. The flexible format of the hall can also accommodate events such as conferences, sports, fashion shows, dinner dances and even a motor show.



BDP Acoustics modelled the main auditorium's natural acoustic for orchestral music, with flexibility for a range of acoustic environments provided by retractable acoustic banners and powerful electro-acoustic systems. Commissioning results confirm that the auditorium will be an excellent venue for music events or speech.

The design also provides a smaller, day-lit 150 seat multi-purpose hall, the Norrie Miller Studio, which has been acoustically modelled, can be fully blacked-out and sub-divided by a movable partition to form two smaller rooms.

A large-scale glazed open foyer, with café, bar and box office, forms a new civic space in Perth conceived as an extension of the new external public square which surrounds it.

BDP was architect, interior designer and acoustic consultant.

Ethics in Engineering

Academy launches Statement of Principles

The Royal Academy of Engineering, along with the Engineering Council (UK) and a number of leading professional engineering institutions, has launched a *Statement of Ethical Principles,* to which it believes all professional engineers and related bodies should subscribe. The RAE provides the leadership and expertise for engineering activities, which focus on the relationships between engineering, technology, and the quality of life. A national academy, it provides independent and impartial advice to Government, works to secure the next generation of engineers, and provides a voice for Britain's engineering community.

The statement is built around four fundamental principles: accuracy and veracity; honesty and integrity; respect for life, law and the public good; and responsible leadership: listening and informing.

In a related activity, the Academy and the Engineering Professors' Council has produced a 'curriculum map' for the teaching of ethics in undergraduate courses. This, together with the Statement of Ethical Principles, was launched during a recent conference at the British Library. The event represented the culmination of the work, which involved a range of disciplines outside engineering, including medicine and philosophy.

As RAE President, Lord Broers FREng FRS, said: "Engineers have a profound impact on the world in which we live. To ensure that this is always directed towards the public good, it is essential that we operate with a real commitment to honesty and integrity. We can only be proud of our profession if we behave, and are seen to behave, ethically."

For more information: Jane Sutton
tel 020 7227 0536,
e-mail jane.sutton@raeng.org.uk

PEOPLE

Tim Leighton wins IOP Paterson medal

Prof Tim Leighton FIOA has been awarded the *2006 Paterson Medal and Prize* of the Institute of Physics for his work in 'the field of acoustics in liquids, particularly to biomedical ultrasonics, acoustic oceanography, cavitation and industrial ultrasonics'. Tim gave his inaugural address in the Turner Simms Concert Hall at Southampton University on 19 October 2005.

This award is made 'for outstanding contributions to the utilisation and applications of physics, particularly in the development, invention or discovery of new systems, processes or devices'. The 2005 award was in the field of positron emission and laser speckle interferometry, and in 2004 it was in nanotechnology for the analysis of molecules at surfaces.

Sound and Vibration

13th International Congress, Vienna, 2 - 6 July 2006

A Special Session on Nonlinear Acoustics and Vibration is being organised at the 13th International Congress on Sound and Vibration(ICSV13). The congress will take place on 2 to 6 July 2006 in Vienna, Austria. The closing date for 300-word abstracts is 1 December 2005, and acceptance of the contribution will be notified by 28 February 2006. The full-length papers (8 pages) should be submitted by 31 March 2006, which is also the deadline date for early registration.

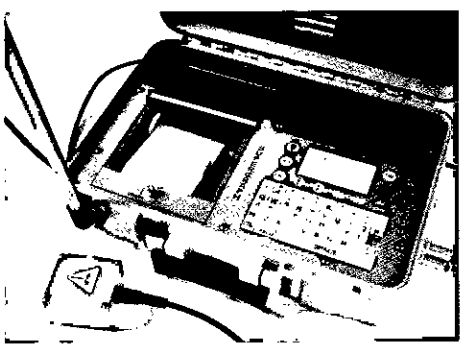
For more information see the congress web site at http://icsv13.tuwien.ac. Would-be contributors should e-mail or fax their 300-word abstracts to W S Gan by 1 December 2005. His e-mail address is wsgan@acousticaltechnologies.com and his fax number is 0065 6791 3665.

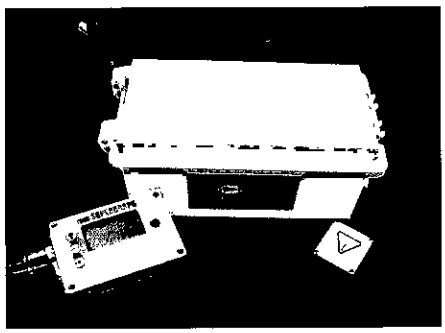
Accudata

Monitoring ground-borne vibration

The *SuperGraph* ground vibration monitor, recently launched by Nomis, one of the world's two largest seismograph manufacturers, is available for purchase or hire through UK distributor, **Accudata Ltd**.
The robustly constructed instrument is designed for monitoring ground-borne vibration from civil engineering activities, such as piling and compaction, as well as for measuring during quarry blasting and demolition. Two versions are available, SuperGraph, with integral high speed printer, and mini-SuperGraph, a much smaller unit without a printer.
Menu-driven, the monitors are intuitive to use to the extent that the operator manual is almost unnecessary. After switching on, just two key depressions are required to begin monitoring. Greatly increased accuracy is achieved by monitoring vibration using a sampling rate eight times higher than that of most other seismographs.
Data from the tri-axial geophone sensors are stored in memory and, on the SuperGraph, printed out as each event occurs. After download to a computer, the data are presented in an easily understood report with a single page per event.
The mini-SuperGraph is believed to be the most competitively-priced seismograph currently available in the UK.
Full details are available on Accudata's web site www.accudata.co.uk

Supergraph





Mini-supergraph

Casella CEL

Easy-to-use noise monitors launched

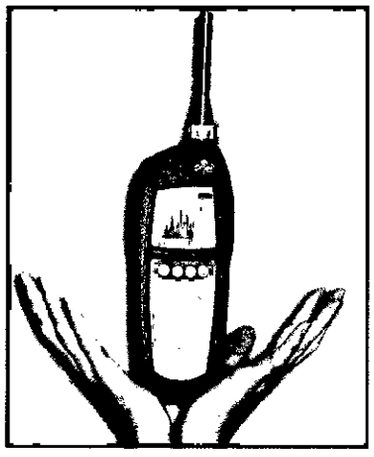
To coincide with the pending launch of new Control of Noise at Work Regulations in all EU member states next year, **Casella CEL**, one of the UK's largest manufacturers of noise monitoring equipment for occupational and environmental measurement, has recently released two new noise monitors.
The *CEL-430* integrating sound level meter is designed for any industry or business wanting to monitor the amount of noise emitted from machines and other work applications in order to assess workforce noise exposure. It can accurately measure all types of sound level including impact noise.
A new Intrinsically Safe (IS) version of Casella's market-leading *CEL-320* and *CEL-360* series noise dosimeters allows individuals to carry out personal noise dosimetry in potentially explosive atmospheres. Rugged and simple to use, this instrument is compliant with ATEX standards, making it the first UK-manufactured noise dosimeter to be granted this approval.
Tim Turney, product manager for noise instrumentation, says that the company has listened to what its customers want while also meeting required parameters for the new Regulations. For example, the CEL-430 integrating sound level meter had been designed and developed for users new to workplace noise monitoring. It was very easy to operate, met all regulatory requirements and was cost effective.
In addition, the changes to the noise dosimeter range provided a noise monitor for employees who were highly mobile or worked in dangerous environments.
Further details: e-mail info@casellameasurement.com or visit www.casellameasurement.com

Castle Group

New real-time noise meter

In the advertising business, the word 'new' is used very often, but not infrequently inaccurately. **Castle Group Ltd** of Scarborough has launched its new *Pro-DX Vocis* hand held sound level meter, in which every component is new, and nothing has been used from the company's other meters - in this case 'new' does mean 'new'.

The Vocis meter comes in three variations: one for industrial noise; another for environmental noise; and the third being a multi-functional unit. All are weatherproof, dust-proof and feature measurement templates for simple set-up and data logging. With capability of up to half a gigabyte of memory and A-HPD (advanced hearing protector database), the system has plenty of power. The range includes real-time octave and third-octave band measurements, multiple parameters and great flexibility.



For noise at work risk assessments the Vocis will simultaneously measure 'A' and 'C' weighted L_{eq}, L_{Cpeak} and unweighted octave band levels. This means that one measurement will give all the information needed for the assessment and hearing protection selection or noise control prediction. The built-in hearing protection database then enables the user to display instantly the predicted noise level for just about any available ear defender. The feature can also be used for noise control solutions.

Further details: Nicole Allen tel 01753 858063 or visit www.castlegroup.co.uk

Rolec

Fire protection caps provide noise insulation solution

When downlights are installed, they can impair the acoustic rating properties of a ceiling, causing unwanted noise to travel through them between floors. Installer **Rolec** recently helped to solve this problem for its clients with the aid of *Firecap* fire protection covers from Aico.

Based in Milton Keynes, the domestic installer offers a full electrical package, including security systems, CCTV and lighting control across southern England. Earlier this year, Banner Homes awarded the company a contract for electrical work at 18 new luxury apartments in Radlett. The developers were aware that the use of general purpose downlights could lead to sound insulation issues, and turned to Rolec to provide a solution under Part E of the Building Regulations.

"We chose Aico's Firecap fire protection covers specifically because of their acoustic rating," says Rolec's managing director, Dean Barrett. "We'd read a lot about it in the trade press and were more aware of its fire protection applications than acoustic uses. In fact, we'd used Firecaps before to protect properties where flats were essentially in the ceiling void.

"However, we knew it was also capable of doing an acoustic attenuation job too and was the only one on the market at a reasonable price. By fitting Firecap above the downlights we could effectively block any noise leakage through the edges around the downlight."

According to independent tests carried out by BRE the product effectively reinstates the original sound properties, when correctly fitted. Rolec purchased some 600 Firecaps through Midshires Electrical of Northamptonshire and installed them above the downlights. It was estimated that each unit only took about four minutes to install.

The apartment block is now occupied and no acoustic problems have been reported.

"Responsible developers take Part E of Building Regulations very seriously," says Dean Barrett. "We can now confidently offer a simple and cost-effective sound attenuation solution when fitting downlights."

Further details: tel 01908 210677 or visit www.rolec.co.uk

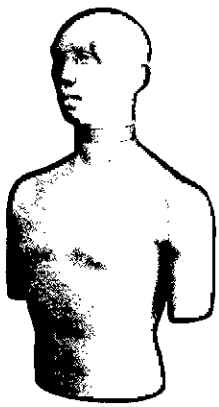
Firecaps are manufactured by Aico, tel 0870 758 4000, www.aico.co.uk

GRAS Sound & Vibration

New head and torso simulator for accurate sound field measurement

The human body has a complex effect on sound fields and must, therefore, be taken into account when measurements are made to determine the performance of audio equipment such as telephones, hearing aids and hi-fi. Although the basic requirements for such a manikin were specified some 20 years ago technology has moved on, and both human ear and voice simulators have seen a number of improvements that have been reflected in new standards.

To accommodate these changes **GRAS Sound & Vibration** of Denmark has taken over the future technical development of the *Knowles Kemar* manikin and is in the process of making adaptions which will



allow it to accept the company's range of human ear and voice simulators. These include simulators and couplers for both insert and behind-the-ear devices complying with a range of National and International Standards. To ensure compatibility with earlier systems, the original Kemar ears will remain available. The first developed version of the ear simulator is the GRAS-RA0045 complying with the International Standard IEC 60711. This will be followed in the new year with a new artificial voice based on the International Standards IEEE 269, 661 and ITU-T Rec. P51. These will be followed later in the year by couplers to suit telecommunications applications.

CMS Acoustics

Impacting on Part E with 7210C

As a leading provider of acoustic solutions, **CMS Acoustics** aims to deliver a fast, reliable and cost-competitive service to architects, acoustic consultants and building contractors. Through an exclusive partnership with the manufacturer, BSW, the company offers the complete *Regupol*® range as well as CMS-manufactured acoustic materials.

In specifying a wide range of solutions, CMS can meet the acoustic needs of all types of development, including refurbishments, new-build developments, and bespoke architectural projects. It has played a leading role in high profile acoustic projects such as The Nanosecond laboratory, Cambridge University and The Young Vic Theatre, London.

The company has now extended its range of Part E compliant solutions for developers by launching *Regupol 7210C*, a high-performance under-screed product designed for new-build apartments. Designed to isolate floors from impact sound, the product offers a competitive acoustic solution that is quick and easy to install. The guaranteed material thickness of 5mm ensures that construction height can be minimised and controlled.

Managing director, Lee Hackett, emphasises the importance of offering a range of acoustic solutions to ensure that the most appropriate product could be selected for a particular development. Regupol 7210C is targeted primarily at homebuilders and contractors looking for a high quality, low cost solution for new-build apartment developments. An average sound transmission value of 46dB (L_{nTw}) has been achieved in independent tests on site, and this easily meets the maximum permissible 62dB specified by Approved Document E.

The entire Regupol range is manufactured in Germany from recycled materials.

Further details: Louise Matthews tel 07921 970 894/0845 345 5606 e-mail: louise.matthews@b2bnative.com

ProsCon Environmental

New SINUS Soundbook multi-channel systems launched

The new *Soundbook* from Sinus has been released by **ProsCon Environmental Ltd**. Available with up to eight channels, this light-weight, robust, portable analyser offers great flexibility in noise and vibration measurement. Based on the rugged and miniaturised industrial Panasonic CF-18 notebook this is an extremely compact and powerful analyser. It features the ability to measure environmental noise and vibration, pass-by and flyover noise and vibration, sound intensity, building acoustics parameters, modal analysis, order tracking, and human vibration exposure. The unit has an IP54 protection rating.

Further details: (Bishops Waltham) tel 01489 891853, e-mail info@proscon.co.uk or (Scone) tel 01738 550176, e-mail dneil@proscon.com

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3-4 April 2006
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Southampton

5-7 May 2006
The Sixth International Conference on Auditorium Acoustics
Copenhagen, Denmark

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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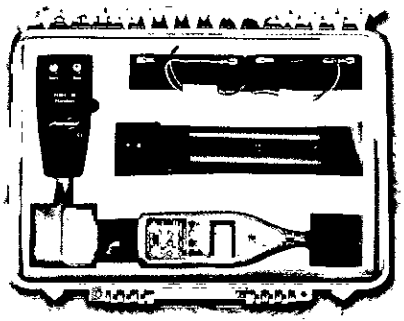
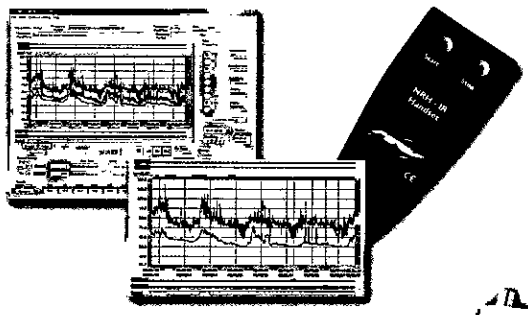
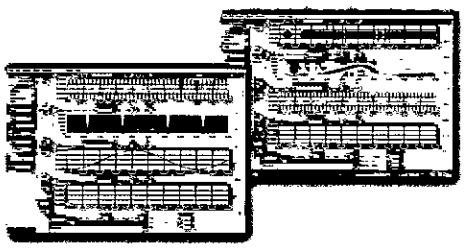


The Nuisance Recorder

Quick and Easy to Use

Data and audio synchronised in meter
Fast data transfer using compact flash
Software displays synchronised audio and data
Click on file icons for instant audio replay

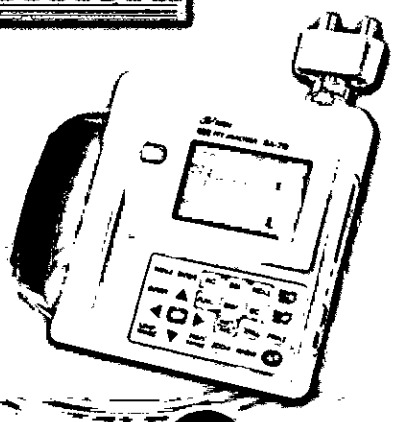


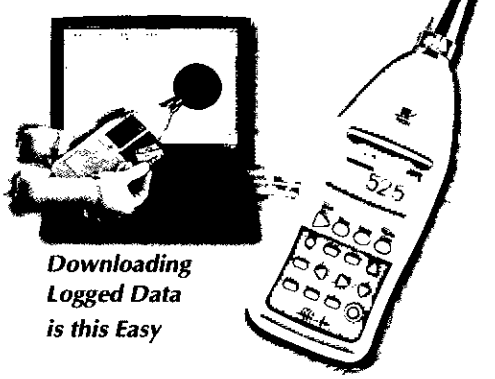


RION SA-78

Dual Channel Sound & Vibration Analyser

FFT, Octaves & Third Octaves
Correlation & Transfer Function Analysis





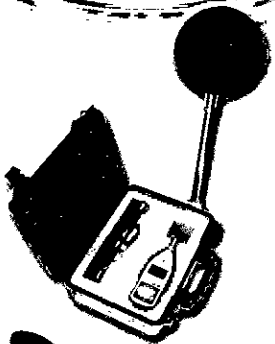
Downloading Logged Data is this Easy

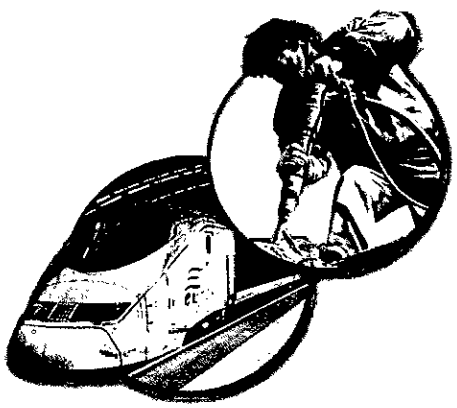
RION NL Series

Integrating Sound Level Meters

The Simplest Solution for Environmental, Workplace or Product Noise

Class 1 & 2 with these options:
Simple Data Logging; Audio Recording
Real Time Octaves & Third Octaves
FFT Narrow Band Analysis





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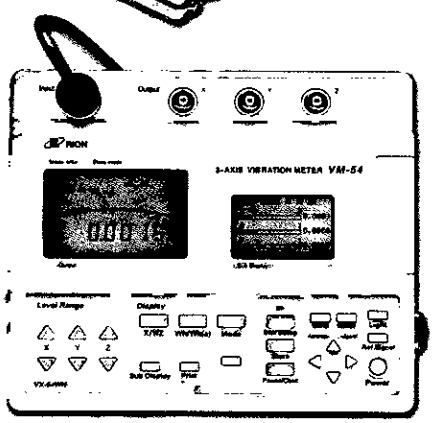
Easy to use Tri-Axial Vibration Meter for Occupational and Environmental Vibration

VX-54 WH Hand-Arm Vibration Program Card
VX-54 WB Whole-Body Vibration Program Card
Complies with Vibration at Work Regulations 2005
Complies with BS 6472 and ISO 2631: Parts 1, 2 & 4



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