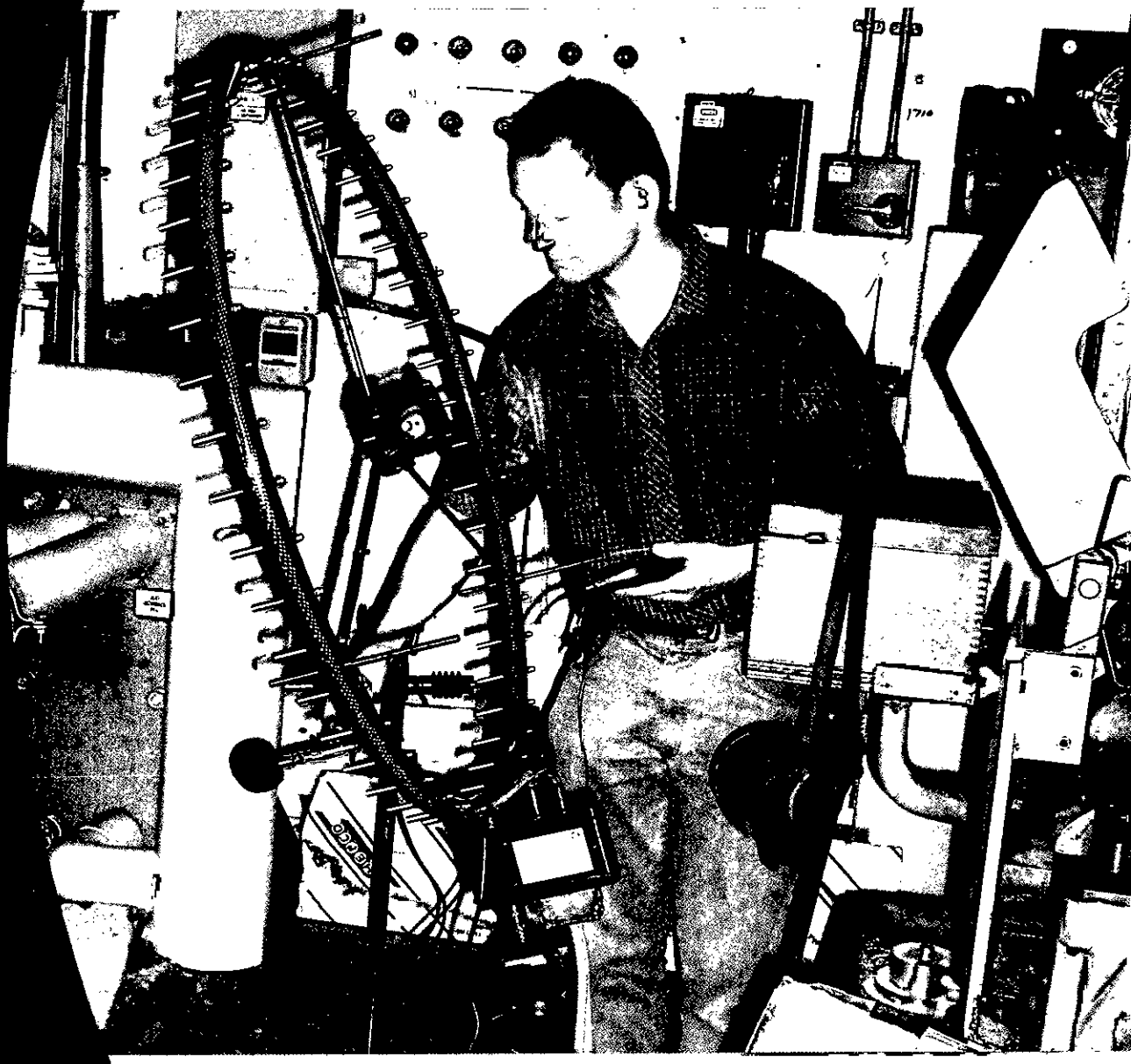
Vol 33 No 6 NOVEMBER/DECEMBER 2008

ACOUSTICS BULLETIN



in this issue...

The study of complex industrial noise fields

plus...

Acoustics of the Theatre Auditorium Poitiers (TAP)

Engineering Council UK Acoustician registrants

The art of being a consultant

Institute of Acoustics

ACOUSTICS BULLETIN

Vol 33 No 6 NOVEMBER/DECEMBER 2008

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Contents

Front cover photograph: The cover photo shows an acoustic camera being used to investigate the sound field around some noise-emitting equipment in the support systems room for NPL's acoustic pressure vessel. The acoustic camera is a beam forming device, one implementation being a circular array of microphones around a centrally placed video camera. The geometry and size of the array depends on the application and the frequency bands of interest. [Photo: NPL]

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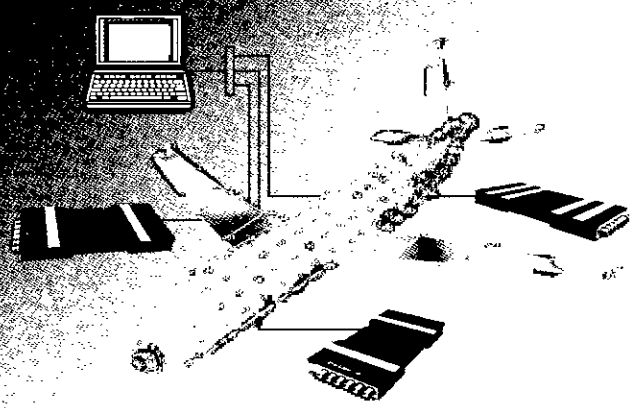

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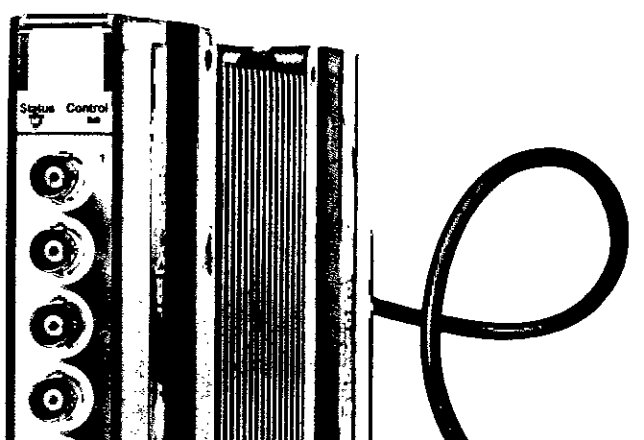

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LAN-XI

Brüel & Kjær

Dear Members

I have now attended my first conference as President. This was the Auditorium Acoustics Conference that was held in Oslo from 3 to 5 October. The event, which was organised by the Institute in collaboration with the Norwegian Acoustical Society (NAS) and the European Acoustics Association, attracted 194 delegates from 23 countries and was a great success. My thanks are offered to all involved in the organisation of the conference, and in particular to the President of the NAS, Svein Arne Nordby, who managed to rescue vital documents including the conference information packs from the clutches of the Norwegian Customs Office in Oslo!

In my first letter as President I mentioned the importance of responding to public consultation documents, and said that one of the reasons why we are often short of time, or even unable to respond, is that the Institute is not always on consultation lists. I have recently written to the Rt Hon Hilary Benn MP, Secretary of State for Environment, Food and Rural Affairs, requesting a meeting to discuss this issue and also how the Institute might be able to provide more assistance in the development of noise policy.

A recent consultation document to which we were able to respond was the Welsh Assembly Government Action Planning Guidance Consultation. A copy of the response is provided in this issue of the Bulletin. I offer my thanks to Gwyn Mapp who did all the hard work.

At our last meeting, Council discussed the important issue of Continuous Professional Development (CPD). May I take this opportunity to remind you that under the Institute's Code of Conduct all members, at all levels, are expected to maintain and extend their professional knowledge and competencies. However, this is certainly not a 'one size fits all' arrangement, and members have varying needs at different stages of their careers. This is why the Institute does not set mandatory structured requirements for its CPD scheme, such as an hours-based system. Our professional development web site page provides further guidance and downloadable documents. Our Membership committee and Engineering Division committee always look for appropriate CPD evidence from candidates when considering applications and the Institute encourages all its members to consider and address their CPD needs. The Institute can provide help and support, for example through our local Branch networks and our meetings programme, and members may also draw on our library resources.

Earlier this year the landlord of our headquarters premises in St Albans served notice to end our lease in March 2009 to allow for the redevelopment of the site. However, after a worrying period of uncertainty, particularly for our staff based at headquarters, and a search for alternative accommodation, I am pleased to tell you that in mid-September we were informed that the proposed redevelopment had not come to fruition. A new ten-year lease is now under negotiation.

Finally, by the time you read this letter there will not be many shopping days left until Christmas. So, may I be amongst the first to wish you all a happy and peaceful Christmas and a happy and healthy New Year.

John Hinton

John Hinton OBE

PRESIDENT

Recent CEng and IEng registrants

Chartered and Incorporated Engineers qualified through IOA scheme

Since the early 1990s, the Institute of Acoustics has been able to offer a route to Engineering Council registration, as an EC[UK] Licensed Institution. Registering with EC[UK] as a Chartered Engineer, Incorporated Engineer or Engineering Technician identifies you as having competences that employers value, indicates that your competence and commitment to professionalism have been assessed by other engineering professionals, demonstrates that your competence may be compared with standards applicable in other parts of the world, and confirms that your commitment to professionalism is underwritten by the support of a national engineering institution licensed by the Engineering Council.

As a result, registrants often find that it is easier to gain promotion, or a new job: their pay compares favourably with unregistered engineers and increasingly against other qualified professionals. They are more likely to be listened to, and, whether in the boardroom or the law court, their engineering credentials are respected in most parts of the world. Registrants have access to a network of similarly qualified and experienced experts in their field through their Institute. The IOA has been assessed by EC[UK] as being capable of carrying out the process of assessment for professional registration and providing comprehensive professional development guidance and support, with many opportunities to network.

There are in all more than 300 Chartered or Incorporated Engineers who are Members or Fellows of the Institute of Acoustics, and some 40 successful registrants have passed through the IOA's scheme since 2002. Brief pen-portraits of some of them are reproduced below.

Nick Antonio


Nick Antonio

Nick started his career with Arup Acoustics in 1986, with his degree in applied physics. He joined the (then) Building Research Establishment (BRE) in 1992 to work in building and environmental noise research, and also managed the BRE test laboratories for commercial work. In 1996 he rejoined Arup Acoustics in Hong Kong, where he contributed to a number of large-scale projects, stimulated by a different culture, approach and practices. He returned to the UK to help start the Arup Acoustics Manchester office in 1999 and is now in Arup Los Angeles.

Jeremy Butt


Jeremy Butt

Jeremy Butt has an MPhil research degree investigating regenerated noise in ducted systems, is a member of the Institute of Acoustics and a Chartered Engineer. He works as an Associate with Hoare Lea Acoustics dealing with building acoustics, building services noise and industrial noise.

He has been involved with BBC studio facilities, the conversion of listed and historic buildings to mixed uses, and the acoustical engineering of specialised building services including low-noise generator installations. He was previously with Acoustic Air Technology where he worked as Technical Director providing design, supply and installation for complex noise control schemes.

Rachel Canham


Rachel Canham

Rachel graduated from Salford University in 1993 with BEng in electroacoustics. After a short contract with Environmental Resources Management Ltd in Oxford, she spent five highly informative years as an acoustic consultant with Bickerdike Allen Partners, London, during which she gained an MSc in environmental acoustics from South Bank University. In 1999 she joined Walker Beak Mason, an independent acoustic consultancy, and is now based at the Langley office, working mainly in the fields of architectural, entertainment and environmental acoustics.

Since joining WBM she has worked on a variety of projects all over the country, including new and refurbished cinemas, nightclubs, bingo and casino venues, domestic sound insulation, environmental noise, housing developments, airfields, and other transportation noise projects.

David Clarke


David Clarke

David joined Sound Research Laboratories Ltd in 1989 straight from Southampton University. In his eighteen years with the company he has progressed from a lowly acoustical engineer through the ranks of consultant and senior consultant, and was promoted in 1996 to manager of the consultancy department at the company's head office at Holbrook Hall, Suffolk. By this time he was responsible for running SRL's largest and most complex projects. He was elected to the board in 2002, and as operations director he is now responsible for the technical success of his own projects and for the performance of the company as a whole.

Stuart Colam


Stuart Colam

Stuart joined Arup Acoustics in 2002, having completed MSc and PhD degrees at the ISVR. He started in the Cambridge office and was seconded to the Manchester office after a couple of years. Stuart started the Arup Acoustics 'midlands' team in September 2005, and it has since grown to five members. Projects include the new Birmingham Conservatoire, ongoing advice to the International Convention Centre, Docklands Light Railway, various large education buildings, high profile offices and environmental acoustical consultancy for Rolls Royce. His CEng application was via the non-standard route and the IOA provided valuable support and guidance during the process: he achieved his chartered status in November 2005. As the recognised qualification of a professional engineer, his CEng signifies to clients and colleagues an appropriate depth of technical knowledge, together with the associated 'soft skills' that include project management, communication and leadership.

Neil Ferguson


Neil Ferguson

Neil graduated as a mathematician in 1980, and then joined ISVR to study for a PhD under Bob White. Apart from a brief spell (1984-85) at University College, Swansea, he has never really been away! Primarily a mathematician and theoretician, his

structural dynamics research is very wide ranging and includes the study of trains, aircraft and brains, to name just a few. In between his research activities, he has spent the last ten years as the undergraduate programme organiser, and, as an academic at ISVR, also juggling his time to organise conferences on 'Recent advances in structural dynamics' on three occasions. Now, having relinquished his administrative role, he has finally found time to join the IOA and pursue CEng status. His present research includes activities in uncertainty in structural dynamics, vibration control for shock, nonlinear dynamics and applications of wave motion for structural response predictions.

Mark Gaudet


Mark Gaudet

Mark Gaudet studied at the Institute of Sound and Vibration Research, Southampton University, and gained his BSc in 1984. The first step on his career path took him to the continent where he worked as an engineer for BrÜel and Kjær in Denmark, learning the tools of the trade. On return to the UK in 1991, Mark joined London Borough of Barnet as a noise specialist in the Environmental Health Department, dealing with noise-related complaint work and planning issues. He then joined Ecomax Acoustics in 1996, carrying out research and development in areas of domestic and industrial noise control. In 1998, Mark joined Acoustic Design Consultants in Suffolk, where he successfully managed the noise and vibration design input for the new facilities at the National Physical Laboratories in Teddington, Middlesex. Since joining Bickerdike Allen Partners in 2002, he has played a key role in the design of radio and television studios in the redevelopment of Broadcasting House for the BBC in London W1. Mark has presented papers at Institute meetings in which he discussed the many technical challenges associated with the attainment of high acoustic standards in the refurbishment of the Grade II*-listed Broadcasting House building.

Simon Hancock


Simon Hancock

Simon graduated from the Institute of Sound and Vibration Research at the University of Southampton in 1989 with an honours degree in engineering acoustics and vibration. He joined Hann Tucker Associates in 1990 and became managing director at the beginning of 2008. His experience covers the company's main fields of architectural, planning, mechanical services, transportation and environmental acoustics and vibration. He also has significant experience as an expert witness in court, at public inquiries and planning appeals.

Greg Hassell


Greg Hassell

Greg is the technical assurance manager, acoustics, within TES Qinetiq, and is responsible for all technical matters relating to the measurement of platform acoustic signatures, including the development of new processing methods and instrumentation. He is also a consultant to the MoD on acoustic and sonar projects, and adviser within QinetiQ on major investment projects. Previously he was a project manager and technical leader within the Sonar department for contracts on new sonar technology. He has links with many overseas experts in the fields of acoustic ranging techniques, instrumentation, and sonar systems. He participates in several international exchange groups.

Between 1972 and August 1996 he was employed at Thomson Marconi Sonar at Templecombe, formerly Plessey Naval Systems. His work covered primarily sonar self-noise, sonar development and radiated noise, including projects for foreign navies. At the time of leaving TMSL he was group leader for the applied acoustics group, and manager of the Vobster test facility.

Ian Hooper


Ian Hooper

Ian has had varied careers in engineering. His first was in civil engineering, starting with the Department of the Environment on naval shore facilities. Here he undertook a four-year studentship and pursued part time study for ONC and then HNC civil engineering over five years. Following this he took various positions in private consultancy working on harbour works, including breakwaters, wave walls, revetments and armour. Ian then turned to the mining industry and spent eight years with Seltrust Engineering under contract working on various ore and metal processing plants including copper, cobalt and aluminium refining. He was also involved in the design and fatigue analysis of shaft set steelwork and foundation design for rotating plant. When BP Minerals bought the company he moved on, working for a number of civil and structural consultancies on Middle East projects and in the UK, including Thames Water's sewage pumping facilities and commercial property developments. The early nineties forced a change of tack and Ian completed a full-time HNC in environmental monitoring and control at NESCOT, which had a significant acoustics content. At this time some months was spent with Matthew Hall Engineering working on noise control offshore. His next employment was in environmental health at Wycombe District Council, with a return to NESCOT to study for the IOA Diploma. This was followed directly by the MSc degree in acoustics. His dissertation was on the location of low-frequency noise using time delay functions of dual channel analysis. He presented a paper at InterNoise 96 Liverpool on this work.

Ian is now specialist noise officer at the Royal Borough of Kensington and Chelsea where his main role is in planning and noise.

Kirill Horoshenkov


Kirill Horoshenkov

Kirill Horoshenkov is Professor of acoustics in the School of Engineering, Design and Technology at the University of Bradford. He holds an MSc in engineering physics from Moscow Institute of Radio Engineering and Automatics (USSR, 1989) and a PhD in noise control from the University of Bradford (UK, 1997). During his career he has worked on problems of underwater acoustics, outdoor sound propagation, noise control and acoustic materials. His current interests mainly relate to the areas of acoustic materials and methods of their characterisation. Over the past 13 years at Bradford, Kirill's research has received a considerable support from the industry, EPSRC and from the DTI. In 2003 he took a six-month industrial secondment supported by the Royal Academy of Engineering. He is in receipt of a personal research sponsorship from Armacell UK Ltd. He is a technical director of the university spin-off company, Acoutechs Ltd. Having published over sixty refereed journal and conference papers, he is a co-author of three British and international patent applications. He is a Fellow of the Institute of Acoustics, and in recognition of his contribution to acoustics he was awarded the Tyndall Medal of the Institute in December 2004.

Rodney Ip

Rodney C W Ip graduated from Hong Kong University of Science and

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Recent CEng and IEng registrants - *continued from page 7*


Rodney Ip

Technology (HKUST) in 1999, with a bachelor's degree in mechanical engineering. After that, he continued his postgraduate research studies in the following two years in the same department. Research majored in the analysis of traffic noise characteristics in densely populated urban areas of Hong Kong. Postgraduate studies were completed in 2001, and he was awarded a Master of Philosophy (MPhil) in mechanical engineering. He joined Allied Environmental Consultants Ltd (AEC) as an acoustical consultant, and was later promoted to a senior consultant and project manager.

Seb Jouan


Seb Jouan

Since joining Arup Acoustics in 1997, Seb has been involved in many projects (performing arts, education, and public spaces) and has been taking part in the development of auralisation techniques as a design tool within Arup Acoustics. In 2003, he spent three months in the Arup New York office working on the recently opened first ArupSoundLab USA. He built the second one on his return to London. ArupSoundLab UK has been running successfully since and he is the frontman for organisation in the UK. In 2006, he started Arup Acoustics Scotland, which is now a team of three people working on projects ranging from performing arts centres, educational, healthcare, offices, retail and public buildings, as well as sonic arts and soundscape design projects. In 2007 he also created the new Arup DDS SoundLab, a new SoundLab based in Glasgow in collaboration with the Digital Design Studio of the Glasgow School of Art. The new Arup DDS SoundLab is the first of its kind to combine 3D visualisation and 3D sound.

His main interests are acoustical projects involving art and culture, education, soundscaping design, auralisation and visualisation, and projects in an international context.

He is currently managing many projects for Arup Acoustics and is involved in the new Shetland Cinema and Music Venue, the new RSNO rehearsal facilities in Glasgow, the Greenock Theatre, Aberdeen Library, the Jesus College auditorium in Cambridge, Durango Station, the new London School of Economics Academic Building. He has also worked in the past on the new Florence Station with Foster and Partners, and on the Unicorn Theatre.

Jian Kang


Jian Kang

Jian Kang is Professor of acoustics at the School of Architecture, University of Sheffield. He obtained his BEngArch and MSc from Tsinghua University in Beijing, and his PhD from the University of Cambridge. Before coming to Sheffield, he worked as a senior research associate at the Martin Centre, University of Cambridge, as a Humboldt Fellow at the Fraunhofer Institute of Building Physics in Germany, and as a lecturer at Tsinghua University.

Prof Kang's research field is acoustics and noise control. His specialist areas include computer simulation, acoustic physical scale modelling, acoustics of long spaces (such as underground stations and urban streets), sound absorption (especially with non-fibrous materials), sound insulation (especially at low frequencies), auditorium and recording studio design, auralisation, industrial and environmental noise prediction and control, large scale noise mapping, soundscape and acoustic comfort, social and psychological aspects of sounds, and speech intelligibility.

He has published three books, and written over 70 refereed journal papers and book chapters, and over 150 conference papers and technical reports. He has been the principal investigator for over 30 funded research projects, and has been a consultant for over 30 major acoustics and noise control projects in the UK, Germany, Hong Kong and China.

Jian Kang teaches building science, particularly architectural and environmental acoustics, at both undergraduate and postgraduate levels. He is the director of postgraduate research, and leads the acoustics research group at the School of Architecture, University of Sheffield.

Andy Lambert


Andy Lambert

Andy graduated in 1993 from the Institute of Sound and Vibration Research, University of Southampton with an honours degree in engineering acoustics and vibration. He then worked as an assistant acoustical engineer with Acoustic Technology Ltd, working mainly in the petrochemical industry, before joining Arup Acoustics in 1995 to pursue building acoustics and electroacoustics projects. Initially, he worked on building acoustics projects specialising in HVAC system design. More recently, he has focused on building acoustics in the education and commercial office sectors, electroacoustic design in transportation and performing arts buildings and audio visual (AV) design in seminar / conference environments.

Adam Lawrence


Adam Lawrence

Adam Lawrence is a senior acoustician with Atkins Noise and Vibration. He has many years of experience in the assessment of railway and road traffic noise. This experience includes research and calculations for situations outside the procedures of the standard assessment methodologies. He has experience in modelling airborne and groundborne noise from railways with project experience on the Docklands Light Rail network and the MTR in Hong Kong. He has been involved with noise mapping projects including major UK motorways and the London Borough of Tower Hamlets. His role encompasses training staff and external clients in modelling techniques and quality assurance of noise maps. He has been involved with sound power level acceptance testing and noise mapping for a large liquefied natural gas plant in Nigeria, and has had experience in the acoustic design of schools. He is also involved in software design and database development, including internet based databases. His design experience includes project management, data and document management and processing, and calculation-based databases.

Timothy Leighton


Timothy Leighton

The son of an electrical engineer who trained via the apprenticeship route (rather than university) and went on to design nuclear power stations, Tim Leighton gained a double First in physics and theoretical physics at the University of Cambridge (1985), and then gained a PhD in physics from the Cavendish Laboratory (1988). After postdoctoral work at the Cavendish and in Switzerland, Tim joined ISVR as a lecturer in 1992, was promoted

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Recent CEng and IEng registrants - *continued from page 8*

to reader in 1997, and became Professor of ultrasonics and underwater acoustics in 1999.

A chartered physicist since 1990, Tim never abandoned his background in theoretical physics. He still today approaches a problem by reducing it to the basic physics, and then building a mathematical model, before designing experiments to test and thereby refine that model. However he has expanded his sphere of interest to include engineering. Hence, when an appropriate model has been validated, he uses it to design a finished article. This might consist of an algorithm (e.g. for processing sonar echoes), or it might be equipment for use in operating theatres (e.g. to assist in kidney surgery), factories (e.g. for the ultrasonic processing of pharmaceuticals), or for deployment at sea (e.g. to monitor the dissolution of greenhouse gases into the oceans). Such developments require not only application of mathematics, experimentation, design and testing, but also an appreciation of the socio-economic and ethical framework of a problem, and understanding of a broad range of disciplines. Tim is an internationally-recognised figure in several disparate communities, including biomedicine, physics, chemistry, oceanography, and zoology.

Tim has served as a member of the Council of the Institute of Acoustics, and serves on several national and international committees for acoustics, oceanography, biomedicine and defence. He has published over 250 articles and received several awards for his work.

Alistair Meachin


Alistair Meachin

Following a BSc in physics and an MSc in electronics, Alistair started a business in 1994 hiring PA systems for live bands. In 1995 he joined Glantre Engineering as assistant project engineer, then became project engineer, and finally principal audio engineer. Glantre specialised in entertainment systems for cruise liners, both consulting and in their installation.

Between 1999 and 2004 he was systems engineer for Mavco Inc. This Miami-based systems integrator works with many of the world's biggest cruise lines to install turnkey entertainment systems. He also worked on systems for theatres, hotel resorts and theme parks.

In 1999 he was awarded the IOA Diploma in acoustics and noise control, and was winner of the 1999 Diploma Prize. In 2003 he achieved registration as a chartered engineer. He recalls that the application process for Chartered Engineer status seemed quite daunting to start with, but it did prove to be a useful exercise. In gathering together the evidence to support his application, he was forced to take a good look at his career to date, and what his plans for the future might be. He had to assess his skills and experience, and gained useful insights into the gaps as well as acknowledging the areas in which he was stronger.

Alistair has since found that as a Chartered Engineer he is recognised as a serious professional, dedicated to high standards in all aspects of his work.

Samuel Miller


Samuel Miller

Samuel has been working solely in the field of acoustics and vibration for over 23 years. He has worked in the academic and local authority sectors and is currently working in the private sector where he is principal acoustic consultant heading the noise and vibration section within the Mouchel company.

He has worked on an array of schemes worth millions of pounds, providing specialist noise and vibration advice to the client. He is a family man and enjoys playing his double bass and piano, in styles ranging from classical to jazz, in his spare time.

Don Oeters

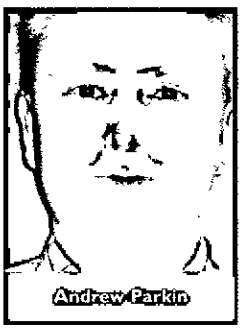

Don Oeters

Don Oeters is a senior acoustic consultant at Arup Acoustics, having joined the organisation in 1998. He specialises in educational buildings, architectural acoustics, and the acoustics of buildings for the performing arts, and leads the Arup Acoustics work in the education sector. He holds a BEng in Electroacoustics (Salford University) and an MSc in Sound andVibration (ISVR).

Before joining Arup he was a full-time musician and sound engineer and he has carried on this interest, mainly in the field of traditional (folk) music. He has performed, with various groups, in many venues including the Purcell Rooms, the Barbican Centre, the Kennedy Centre (Washington DC), the Anvil Basingstoke (itself an Arup Acoustics design) and many arts centres in the UK.

Projects on which he has worked include the Wales Millennium Centre, the Laban Centre, the Poole Arts Centre (the Lighthouse), Millfield Music School and Concert Hall, Bristol Schools PFI and many other schools and higher and further education projects.

Andrew Parkin


Andrew Parkin

Andrew Parkin graduated from the University of Salford in 1997 with a BEng in electroacoustics. On graduation, he joined R W Gregory and Partners (now RPS Gregory) in Birmingham as an acoustician, tasked with growing a team and client base almost from scratch. Eleven years on, Andrew is technical director in charge of a 7-strong acoustics team, part of the wider RPS Acoustics group.

He has been involved in the design and management of a wide variety of projects, including residential, education, environmental, healthcare, commercial, mixed-use and transportation. Andrew is on the review panel for BB93, was on the steering group for BB101, and sits on the BCSE's working groups for 'Acoustics and ventilation' and 'Post-occupancy evaluation'. Andrew is also chairman for a new office acoustic design guide, to be published by the AIS.

He considers that holding the title of Chartered Engineer is central to ongoing professional development, and a landmark in his professional career. It is widely recognised as a mark of engineering excellence and is respected accordingly. It is a reassurance to clients that work will be carried out in a professional, technically competent manner.

Adrian Passmore


Adrian Passmore

Adrian Passmore graduated from Salford University in 1992 with an honours degree in Electroacoustics. For the next five years he worked for a small consultancy that specialised in underwater acoustics research, with the main clients being in the defence and petrochemical industries. His desire to move into a more commercial consultancy role was fulfilled with his move to Sound Research Laboratories Ltd in 1997 and then Spectrum Acoustics Ltd, where he gained a wide experience in building acoustics over a six-year period.

In 2002 Adrian joined Arup Acoustics at their London office. He

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Recent CEng and IEng registrants - *continued from page 10*

continues to specialise in building acoustics and has had the opportunity to manage projects and advise on a number of prestigious projects in a variety of business sectors including commercial, education, residential and public buildings. Recent projects include the University of Bristol's new nanotechnology facility, the refurbishment of Unilever's London headquarters, and the St David's 2 retail development in Cardiff. In addition to his consultancy work, he is the CDM co-ordinator for Arup Acoustics.

Richard Perkins


Richard Perkins

Following a BEng degree in Electroacoustics at Salford University in 1994, Richard gained further business management experience before joining AAT Ltd as an acoustical engineer. Richard spent seven years dealing with the technical design of acoustic products, (attenuators, vibration isolators etc) and developed the role in later years to providing acoustical consultancy full-time on a wide range of projects.

In 2002, he joined Parsons Brinckerhoff Ltd (PB) to lead their noise team. PB is a large international consultancy specialising in the power, infrastructure and environmental disciplines. Supporting noise issues for such a diverse range of disciplines presents many interesting challenges. The team grew to four within the first twelve months, and recently PB has been appointed technical adviser and research manager to the noise and nuisance policy group within DEFRA.

The Chartered Engineer programme was very important to Richard personally, and participation was actively encouraged by his employer. Going through the application process helped him to see how acoustics fitted into the bigger picture. The application process was initially quite daunting, but was straightforward once he got to grips with the requirements. He now serves as a member of the Engineering Division Committee and is an professional review interviewer.

Adrian Popplewell


Adrian Popplewell

Adrian graduated from the Institute of Sound and Vibration Research, University of Southampton, with an honours degree in engineering acoustics and vibration in 1995. Having joined Arup Acoustics as an assistant consultant in March 1997, he is now a senior consultant with a wide range of project experience on both multi-disciplinary and specialist projects covering many areas of acoustics, and noise and vibration control.

Adrian has a particular interest in the design of healthcare facilities, and how the acoustic environment and hospitals and other clinical buildings affects the health and wellbeing of patients and staff. As well being part of the multi-disciplinary design teams for large hospital projects, he is currently involved in several academic research projects in the field of therapeutic environments with teams from leading universities. He is currently responsible for developing Arup Acoustics' healthcare business in the UK.

Adrian is a member of the IOA Building Acoustics group management committee.

Simon Stephenson


Simon Stephenson

Simon's original degree was in physics, and after he left university he took up employment with a company which was then called Acoustic Technology Ltd (and is now part of Bureau Veritas). After working in the laboratory for a year and seeing what other people were getting up to, he realised that he wanted to be an acoustical consultant - so he transferred. Owing to his background, he found himself taking on some of the rather unusual projects that other people felt were outside their comfort zone. He very quickly worked his way up through the grades and is now a principal consultant. Simon is engaged in a wide range of projects, from conducted environmental assessments for large industrial schemes to troubleshooting noise problems on existing plant. His job has taken him around the world and provided many challenges.

He considers becoming a Chartered Engineer to be a very important aspect of his career. In addition to providing additional standing when working on major projects such as public inquiries, it is also important that he is recognised by other engineering disciplines working alongside. Acoustics is often seen (wrongly) as a 'black art', so becoming a chartered engineer will demonstrate to engineers of other flavours that he has the necessary qualifications, experience and professionalism for a competent engineer. This is particularly important to Simon, as his degree was not in an engineering subject.

Mike Swanwick


Mike Swanwick

From joining Rolls-Royce Aerospace in 1976 as a technical apprentice, Mike has held various positions within the mechanical engineering, electronics and training roles. He became a senior engineer in 1993 and his work clearly was steering towards a domination of the vibration, dynamic rotor balancing and acoustics disciplines. He made a permanent career change into the noise department in 2000, gaining the IOA Diploma in 2001 and his MSc in applied acoustics from Derby University in 2003. He has since become the principal acoustical measurement specialist for the company.

Mike is responsible for all new noise measurement methods, leading the more unique and prestigious experiments, for measurement hardware development and acoustic facility commissioning for Rolls-Royce, on a global scale. The most recent is an outdoor noise test facility within the NASA John C Stennis Space Center in Mississippi. He is an active member of the measurement and instrumentation group committee and the Midlands Branch committee of the IOA. He also is involved with various 'outreach' projects with the Institute of Physics.

In 2006, Mike was very pleased and proud to become a Fellow of the Institute of Acoustics. The picture shows him at the Rolls-Royce North America facility, inspecting the microphones mounted on the Trent engine ready for acoustic testing.

When he has time, he is interested in valve amplification, restoring classic motorcycles and wood turning: these he calls his 'engineering replacement therapies', for alas (he says) his work has become mainly planning and analysis based, and he is not allowed out very much.

Jo Webb


Jo Webb

Jo stared work in consultancy with BDP Acoustics, after graduating from the University of Salford in 1987. Having established a grounding in building acoustics she expanded her knowledge of industrial, occupational, and environmental fields of acoustics with other firms in the north-west of England. During this time she also gained an MSc in acoustics. She spent three years working for Warrington Borough Council, which provided an invaluable insight into the workings of local government. Since the start of the new millennium Jo has worked for Arup Acoustics, where she manages both building and environmental acoustics projects. She is also actively involved with the Institute of Acoustics.

Ed Weston


Ed Weston

Between 1999 and 2003 Ed attended Clare College, Cambridge and read for an MA and MEng in engineering with professional experience. His final year of study included a major acoustics project. In 2003 he joined Bickerdike Allen Partners, and he became a corporate member of the IOA in October 2006.

He began serving as a co-opted member of the London Branch committee in July 2006, and was elected a full member at the 2007 AGM. He is the membership representative for the London Branch, and a member of the membership e-group. He also serves on the recently re-formed Speech and Hearing group committee.

Ed plays the piano and drums in a number of bands, and is involved in music production (both his own material, and that of other bands). He is currently learning Spanish, and enjoys cycling, swimming, and occasional roller skating

Caroline Williamson


Caroline Williamson

Caroline was awarded CEng status in Spring 2002. She graduated from Southampton University's ISVR in 1993, and following a short stint working for the MOD moved to Sound Research Laboratories Ltd, based in Suffolk. Since joining SRL, Caroline has had roles as a consultant and then senior consultant and team leader, and now has a strong marketing and project management role within the company.

Keen to continually develop and refine her skills, Caroline has completed qualifications in management and performance coaching for business, and is also a regular member of the local management network. In addition, the varied projects on which she works mean there is always something new to learn, or something to gain from the experiences of other consultants.

Caroline has led the acoustical consultancy work on many large multi-use development projects and feels that the CEng award is a highly-regarded recognition of competence throughout the world of acoustics and also in the building industry and associated trades.

Keith Woodburn


Keith Woodburn

Keith Woodburn lives in Ulverston, Cumbria and works for BAE Systems Submarine Solutions on submarine noise and vibration engineering and signature reduction. His hobbies include motor sport competition and mountain biking.

Further information

Chartered and Incorporated Engineers are as varied in character and career as the cameos above suggest: Every one was produced as the result of exactly the same request, but the individuality is obvious. However, all our IOA engineers seem to agree that the status achieved repays the effort involved in gaining the coveted title, so why not ask how your Institute can help? To find out more, a phone call to the St Albans office or an email to **acousticsengineering@ioa.org.uk** will set the ball rolling.

Meeting report: Central branch

Rachel Canham. Pop concerts: Both sides of the fence

Rob Peirce of Vanguardia Consulting gave an interesting (and well attended) presentation on 29 July 2008 about the control of noise from outdoor concerts. Starting with the Noise Council's *Code of Practice on Environmental Noise Control at Concerts* he provided a useful review of the guidance within the document, and presented examples where variations to the Code of Practice had been successfully adopted with few noise complaints. However, apparently it has been known for noise complaints to occur even when a concert is cancelled!

He outlined some areas of the Code of Practice that perhaps required further research, such as the use of higher noise limits for some urban and rural venues, the difference in noise limits where the number of events increases (especially when the number of events changes from three to four a year), and night-time noise limits.

Regarding low-frequency noise, Rob outlined the difficulties that could occur when inappropriate low-frequency noise limits were set. Some previous research by Defra had found that the best noise metric for the subjective rating of pop and rock music was the absolute $L_{Aeq,T}$ and he suggested that, in general, noise limits for outdoor concerts should be set in terms of $L_{Aeq,T}$. He considered that further research was required to determine appropriate low-frequency noise limits, cautioning against general application of the guidance notes on low-frequency noise discussed in the Code of Practice which relate to levels 2km from an event (Reference 8 of the Code).

Practical considerations on the best ways to control and monitor noise from outdoor concerts, before and during an event, were also discussed and included the revelation that a concert was often considered by the audience to be an ineffective form of entertainment if the noise level at the front of house mixer location was below 95dB(A). The overall conclusion was that the sound control at concerts works best when all parties involved with noise issues worked together.

Thanks are offered to Rob for an excellent presentation (and for standing in for Jim Griffiths at the last minute) and to NHBC for hosting the meeting.

Meeting report

Ian Bennett. North-west branch

The North-west branch of the Institute met on 24 September 2008 to conduct the Annual General Meeting, and to hear a talk by Bernard Berry on 'Environmental noise and health'. Before the evening began in earnest, around 40 members attending were treated to a guided tour of BDP's brand-new offices - sorry, that should read 'studio': BDP is, after all, an architectural practice - including the clever acoustic louvres for natural ventilation, the PTFE-covered light well, and the view of Piccadilly Basin on the Rochdale Canal. I cannot comment on the car parking, but there are moorings for anyone visiting the premises by boat. Interesting informal discussions on the conflict between architectural innovation and acoustical requirements ensued.

The AGM managed to fill a period of 2 minutes 28 seconds (according to the official record) before the main event. Unfortunately, Bernard was indisposed, so Dr Andy Moorhouse (Salford University) stepped into the breach at very short notice and presented the results of his *ad hoc* research in to the current state of noise and health. Andy does not claim to be a specialist in the subject area, but he began by presenting a series of questions to set out the background to his talk and the discussions that ensued. These included:

- What is 'noise', and how does it differ from 'sound'?
- How is 'noise' quantified?
- How are the effects of noise quantified?
- To what extent are people exposed to environmental noise in the UK?
- What are the main sources of noise, and what is their relative importance, given the general trend for the environment to become quieter, but increasing numbers of people were affected?
- What health aspects are already affected by environmental noise?

Andy shared some interesting (and perhaps counter-intuitive) findings, such as the fact that between 1990 and 2000, the tendency had been for the L_{A10} to decrease slightly, while the L_{A90} increased. In other words, by 2000 there was less 'noise' *and* less 'quiet'. The percentage of the population exposed to noise levels in excess of 55dB $L_{Aeq,16h}$ decreased, but the percentage of people who said they heard or were bothered by road traffic noise increased. This evidence that attitudes to noise were changing implied that the noise dose response curves may also be changing. In terms of health issues, the feelings of annoyance, anger, frustration and powerlessness all potentially impacted on the health and wellbeing of residents. There was little evidence for physical effects resulting from anger, although the release of stress hormones may be a factor. Investigations of the effects of noise on cardiovascular disease had been restricted to noise in occupational settings, but the HYENA study (specifically on hypertension) had suggested that a 10dB increase in night-time noise produced a small increase in risk. The levels of risk were assessed in relative terms, starting from a base level that was quite low. However, there was no conclusive evidence in other coronary risk factors.

In terms of community mental health, there was some evidence that occupational noise had an effect, but in terms of environmental noise there was conflicting evidence. Bridget Shield had led research into children's cognition, which found that more noise at school implied a lower level of performance.

Environmental noise legislation was directed towards the prevention of nuisance, which may be prejudicial to health, and the World Health Organisation guidelines sought to preserve living standards and prevent sleep disturbance.

There are also, of course, positive effects of sound immission: there is evidence that quietness (or the perception of quietness) increases satisfaction in life, and music can increase the wellbeing of patients and help people to 'unwind' in general. Positive soundscapes in the environment are another area of particular interest.

After Andy's talk the subject was thrown open to the floor and an interesting discussion developed on several of the points he had highlighted.

Thanks are due to Andy for his efforts, and to Duncan Templeton and BDP for their hospitality (and the excellent refreshments). The branch members look forward to their next invitation to Ducie Street.

Online networking

IOA on Facebook and Linkedin

Institute of Acoustics groups have recently been set up on the social networking websites **www.facebook.com** and **www.linkedin.com**. These groups have been set up to raise the profile of the institute, and to allow members to communicate with each other online. The aim is to provide another channel for promoting details of forthcoming meetings and events, and to encourage discussion. These groups are not intended for posting technical advice or adverts, and such content will be moderated. The Publications committee would welcome ideas, comments and feedback to **adam.lawrence@atkinsglobal.com**.

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IOA Consultancy Spotlight

Ed Clarke. The art of being a consultant

The IOA and ANC have been running a one day meeting with this title for several years now, attracting young acousticians in consultancy, and those looking to get involved. It is consistent with the ANC's 'mission statement'. Now mission statements can be difficult to take seriously. A GP I know recently moved his practice next to an out-of-town superstore, and printed a sign for his desk *'Mediocre healthcare, with great on-site shopping'*.

In recent years the ANC has worked more seriously at one of its stated objectives, which is to publicise the profession and further its reputation. Because there is no barrier for entry to the profession (there is no royal charter, so anyone can put 'acoustics consultant' above their door) there is a range of interpretations as to what is required to practise as an acoustics consultant (or acoustic consultant, or acoustical consultant, or noise consultant, etc).

None of them is necessarily right or wrong, of course, but the ANC has at least formed a consensus view of experienced professionals in the field who have observed, if not plunged headlong into, some of the pitfalls and tank traps along the way. The 'art of...' one-day meeting has drawn on the experience of seven acousticians in consultancy practice, which yields several hundred man-years of time served in the field.

The one-day event has been staged five times in the last four years so far, in London (twice), Manchester, Salford and most recently Southampton, and on each occasion was met with a refreshingly keen and engaging audience of young acousticians.

We are told that Salford University has a 100% recruitment record for acoustics graduates, about half of which go into consultancy. As an ISVR graduate, I am sure Southampton's record is at least as good. Unsurprisingly, then, there is a healthy interest from young IOA members in what consultancy entails.

As the meeting is very likely to be staged again, it would seem counterproductive to reproduce the papers in full here (in the same way that pre-publishing lecture notes tends to have an adverse affect on lecture attendance). However, the queries posed below provide a taster which might promote further thought and debate around some of the knottier issues we encounter in consultancy practice.

1 How far will you go ?

Your client asks to review a draft of a technical report

- He identifies a couple of typographical errors, and checks that these will be corrected
- He confirms the project is now being referred to by a different title, and asks this to be changed
- There are a few other standard references and terms he wants you to adopt for consistency
- The technical style does not really match other reports, so he suggests a few tweaks
- The stated conclusions are not very clear, and he suggests some rewording
- Although the facts support your client's case, this does not really come across in the conclusions, so the client suggests a little more re-wording...

... and so it continues, the client gradually writing the whole report for you, then asking you to sign it and underwrite it with your company's professional indemnity insurance.

2 Consultant-speak

Consultants are often criticised for writing prose which is loaded with conditional statements and caveats, whereas what the client needs is a clear statement about whether everything is going to be satisfactory, and exactly what practical measures will ensure that it is. So what is really so hard about that?

If the question is *'You have measured how noisy the trains are – now what do I need to build this new building out of?'*, how many factors outside the control of the acoustics consultant could result in a non-compliant building on completion of the project? (Hint: this is likely to be one more than your 'worst case' guess).

3 Cat-skinning alternatives

There are often a variety of interpretations or techniques for carrying out a measurement or analysis. Even ISO and British Standards are open to different interpretations to make them fit the realities encountered on site or in analysing the real world. In many cases we have a good idea of how different interpretations will affect the outcome, or at least, in which direction the outcome will move.

So, if our client is paying our fees, and they are more interested in one outcome than another, is there anything wrong with quite deliberately selecting the measurement technique and analysis methods which will give the client the most favourable possible result ? Discuss.

4 Pricing yourself out of the market

When really busy, it is not unusual for any commercial operation to control the workload while maintaining profits by increasing their prices. Some will dramatically overprice their quotations rather than turning work away, on the principle that they could always work extra hours (or pay overtime) if the price was right. This might be a practice you would discuss with the management of other consultancy firms, at a social function, say, and agree that it is a perfectly sensible business activity. It might transpire that you had in fact tendered for a number of similar projects. Or it may be the same project, and the tenders have to be in at the end of that week. You appear to have overpriced the project to a similar extent, and good luck to whichever of you gets the project. Perhaps you can help each other out over the workload on a sub-consultancy contract?

At what point in the above train of logic did you act unethically, and at which point illegally, and should there be a difference?

5 Competence - are you fit for work?

Establishing, maintaining and demonstrating competence can be a time-consuming business, but is essential in the current consulting marketplace. The ANC is developing more informative and accessible methods for providing potential clients with easy reference to members' specialist subject areas, and the IOA provides the required framework for continuing professional development.

As Prof Peter Wheeler puts it: *'As the UK's professional body for acousticians, IOA sets standards for the education, training and competence of those seeking membership. In the increasingly litigious world in which we practice as acousticians, it is important that we keep up to date with both regulatory and metrological developments. In other words – are you using the right measurement protocol, is your instrumentation calibrated and are your measured data reliable?*

The IOA Membership Committee expects to see detailed evidence of competence and commitment to CPD in applications for membership and upgrades. Guidance is provided on our website at www.ioa.org.uk'.

So these are the types of dilemma we grapple with as consultants, along with the comparatively simple (sometimes) manipulation of sound pressure levels, sound reduction indices and absorption coefficients. The recent expansion of the ANC has seen a number of applications from consultancy practices formed by competent, or even expert, acousticians without any significant experience of business and consultancy. Helping these firms through the process of membership application, through the Associate Member grade, as appropriate, has been a significant change in the role of the Association, and one we are looking to improve year on year.

We also hold events to share and debate the technical aspects of consultancy practice. By the time *Acoustics Bulletin* is published, there will have been a one-day technical conference in Birmingham (on 7 October) at which environmental noise measurement and assessment will be discussed along with a session on building acoustics and sound insulation testing. This was expected to be of specific interest to those in consultancy practice, but was not restricted to ANC members.

Finally, I am pleased to report that the ANC has made a commitment to renewing and strengthening its links with *Acoustics Bulletin*, with more frequent contributions to this *'Consultancy Spotlight'* section.

These articles will be peer-reviewed within the ANC for onward submission to and review by the editor. Anyone who missed previous pieces written in the past on the impact of disco noise on sharks, haunted refurbishment projects, and similar curiosities should contact the Institute for back issues !

Ed Clarke works for Alan Saunders Associates and is the immediate past chairman of the Association of Noise Consultants.

The ANC meets every other month to conduct the business of the association, and provide a valuable forum for networking and debate on issues relevant to practising acoustics consultants. Meeting dates set in the Association calendar are 19 January 2009, 16 March 2009, 18 May 2009, 20 July 2009, 21 September 2009 and 16 November 2009. Please contact the secretariat directly for any further information.

Meeting report: Midlands branch

Environmental Noise Barriers

The July 2008 Midlands branch evening meeting was held at the Arup Campus in Solihull, a new location for the branch. The excellent Nyquist Theatre was the venue for Harry Frew's presentation. Environmental Tree Services, based near Berwick upon Tweed, was set up in 2001 to market engineered products working with nature. The talk focussed on the 'Green Barrier' which is made from willow and can be installed simply as a visual screen or, when combined with a mineral wool wall, as an acoustic barrier.

The acoustic barrier has a core of 240mm or 120mm of RockDelta, which is a compressed rockwool, having a surface mass of more than 65kgm^{-2} for the 240mm barrier. The barrier is then faced with willow panels to present an attractive natural appearance. The panels can be in living willow, up to a height of about 2500mm, or in woven willow rods, up to a height of about 3500mm. The barriers provide a high level of sound absorption as well as the simple barrier attenuation. The barriers are the only vegetative barriers to be CE-approved as roadside noise barriers. The living willow requires maintenance similar to all living barriers, for example an annual 'trim'. The woven willow is almost maintenance free, but can be used as a frame for climbing plants. Compared with most noise barriers they provide a positive impact in both urban and rural locations and attract a variety of wildlife. Harry showed an impressive portfolio of barriers they have installed. Thanks are offered to Harry for a very interesting talk, and to Stuart Colam of Arup for hosting the meeting.

Encouraging Year 12 students towards acoustics

David Watts FIOA. through the Engineering Education Scheme (England)

In the autumn of 2007 and with the support of Acoustical Investigation and Research Organisation Ltd (AIRO), David Watts volunteered to be linked as an engineering mentor to a team of Year 12 students from Tring School for an acoustics-based project. This article describes the scheme and the project with a view to encouraging others to consider a similar role.

It is recognised that insufficient numbers of young people opt to study science and engineering, let alone acoustics, which may explain the difficulties in recruitment within the profession. Members of the Institute of Acoustics (IOA) are engaged on various fronts in promoting acoustics within schools, with one example being the Acoustics Ambassadors scheme run by SETPOINT Hertfordshire. Trained Ambassadors present relevant activities in schools, an example being Richard Collman's award-winning 'How to hold a band practice without disturbing the neighbours'. Having enjoyed this workshop, Tring School put forward four Year 12 students, who with the support of a teacher and an engineering mentor, chose an acoustics-based project and signed up for the Engineering Education Scheme (England), a major component of the Royal Academy of Engineering's Best Programme which aims to attract, retain and develop outstanding young engineers.

The scheme encourages students to work on real problems and to deliver solutions (sometimes highly innovative solutions) including tasks which are integral to engineering projects such as time planning, teamwork, record keeping and presenting findings both verbally and in a report. The students attend a scheme launch day, a three-day residential stay at a university, with access to the university's resources, and a celebration and assessment day where they present their work.

The students visit their engineering mentor's company (often it is the company that has set a real project for the students in the first place) and meet with the engineering mentor at regular intervals throughout the six months or so currency of the scheme.

The Desborough Hall at Tring School was selected for the Tring team's investigation which was given the title 'Improving the acoustical conditions in a school hall'. The hall, constructed in about 2005 as a multi-purpose large hall (3500m3) was one in which the usual array of assemblies, drama and music activities took place, as well as examinations. The anecdotal evidence of poor acoustical conditions was readily supported by the four students, Tom Doughty, Chris Fitzpatrick, Rob McVey and Sam Watson. The aims of the project were set out as:

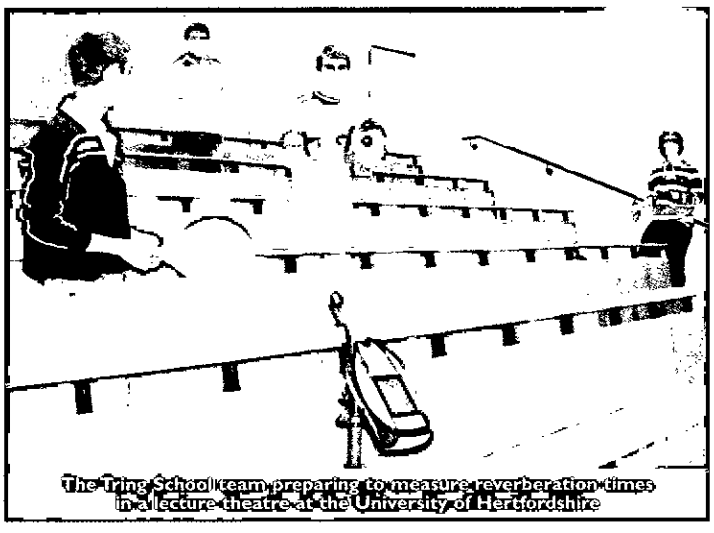
- To explore what an appropriate acoustical environment is;
- To consider techniques to quantify the acoustical environment;
- To identify and evaluate methods to change conditions in the hall to meet established objectives.

Starting with the question 'The acoustics of the hall are poor - says who?' the team explored the relationship between the subjective perceptions of human beings and the scientific methods of measuring acoustical parameters that makes acoustics such a fascinating subject. Environments with very different acoustical properties were demonstrated to the students by inviting the team to experience AIRO's anechoic chamber and one of AIRO's reverberation chambers. The students readily came to the view that 'somewhere in between' might be about right for their hall!

Having had the opportunity to appreciate the effects of different acoustical environments on the listening experience, this enabled the students to develop their own ideas about the important factors and how these might be measured in a scientific way. Having taken the opportunity to try out their own methods for measuring one of the most important parameters, reverberation time, the students made the same measurements using conventional acoustical instrumentation.

With early indications suggesting that the hall may in fact satisfy the more significant published acoustical design criteria, at least for music, the team designed an audience questionnaire to revisit the assertion that the acoustics of the hall were poor, learning the valuable engineering lesson of questioning assumptions as much as possible. In parallel, the team created a mathematical model of acoustical conditions in the hall by considering the sound absorption properties and areas of the various materials used in the construction and furnishing of the hall (including the sound absorption of the audience) from which reverberation times may be calculated and compared with the actual measurement data. This enabled the team to consider how the reverberation times in the hall might be engineered by using different materials to offer the potential to achieve a desired acoustical target.

During the workshops at the University of Hertfordshire the students investigated the acoustical conditions of various spaces intended for different uses such as lecture theatres, drama and music, together with the measurement techniques to determine the sound absorption coefficients of specific materials. Brüel & Kjær kindly provided the students with one of their type 2250 investigator sound level analysers complete with reverberation time software for the three days at the University, as well as ODEON 7836 auditorium edition software to enable a more detailed computer model to be constructed for comparison against the measurements and mathematical calculations. Commenting on the scheme, B&K's UK managing director William Egan said that it was great that the Government was encouraging schools to get involved in engineering projects, and his company was only too happy to provide Tring School's students with the opportunity to make acoustics come alive. He hoped to have inspired them to consider a career in this field.

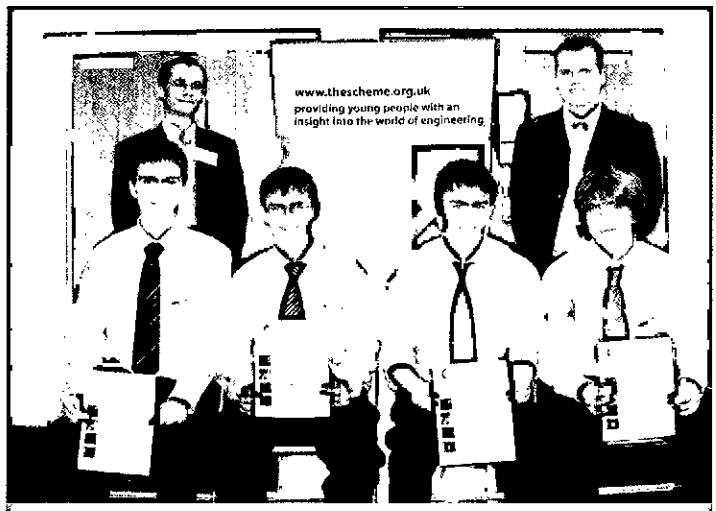


The Tring School team preparing to measure reverberation times in a lecture theatre at the University of Hertfordshire

The report was completed just after Easter and the scheme celebration and assessment day held at University of Hertfordshire on 23 April 2008, at which the students set up an exhibition stand of their work and gave a short presentation to the assessment team. Having visited the students' stand, Prof Mark Tracey (head of the micro-fluidics and micro-engineering research group of the Science and Technology Research Institute of the University of Hertfordshire) acknowledged that it was impossible to do too much to encourage students to study science and engineering to equip the country with the skills needed for the future. The Tring students had clearly had their imagination captured by the project and he had no doubt that they possessed the potential to become highly effective scientists or engineers. AIRO's managing director and former IOA President, Tony Jones, observed how gratifying it was to see a team of students thoroughly enjoying and enormously benefiting from their experience of participating in the Engineering Education Scheme. AIRO was delighted to have been of assistance in showcasing acoustics as a worthy engineering subject.

Whilst in the eyes of some the project would not appear to be engineering or innovative, nor was it a project for which any sort of prototype product was likely to emerge, what became clear was that the project fitted very well within the scheme. It enthused and challenged the students, for whom the project was highly unusual and innovative, and the assessment team voiced no concerns over any lack of 'engineering' content in the project, awarding the students the credit they deserved with very good marks.

The EESE scheme is a national scheme operated on a regional basis and provides an established mechanism through which acousticians can encourage the more able students towards further study and a future career in science or engineering. Although the time required of the mentor is not insignificant, it is a rewarding, positive experience working with highly motivated students who challenge conventional approaches with their own ideas, helping to sharpen up the mentor's own communication skills and pre-conceptions. IOA members are encouraged to take part in the scheme in the interests of encouraging students into our profession as well as serving their own professional development. Information about the scheme can be found at **www.thescheme.org.uk** .



The team with certificates at the celebration and assessment day

Welsh Assembly Government

Action Planning Guidance Consultation

John Hinton, President of the Institute, has written to Russell Lang in the Radioactivity and Pollution Prevention department of the Welsh Assembly Government to offer the Institute's comments on the proposed Action Planning Guidance. The department previously indicated through Gwyn Mapp that the IOA's comments would be accepted even though the consultation period had ended: owing to an administrative error the IOA was not originally on the list of consultees.

Gwyn Mapp has been in contact with most of the IOA members currently working on noise issues in Wales and he provided the basis of the response. The Institute's comments are as follows.

1) In paragraph 6.2.3, page 20 it is suggested that in order to achieve the objectives of the Environmental Noise (Wales) Regulations 2006 new noise policies may be formulated. The IOA would be very interested to learn if such policies would be funded from existing or new budgets.
2) In paragraph 6.3, page 22 it is indicated that those organisations mentioned in the action plans with the power to act to achieve the targets of the action plans will take the necessary steps to treat the action plans as policy. It is unclear how such a responsibility will be enforced.
3) The IOA is aware that the Planning Bill is currently passing through Parliament. It is unclear how the Action Planning Guidance would interact will the final requirements of this Bill and how any conflicts that may arise would be reconciled.

Diploma in Acoustics and Noise Control

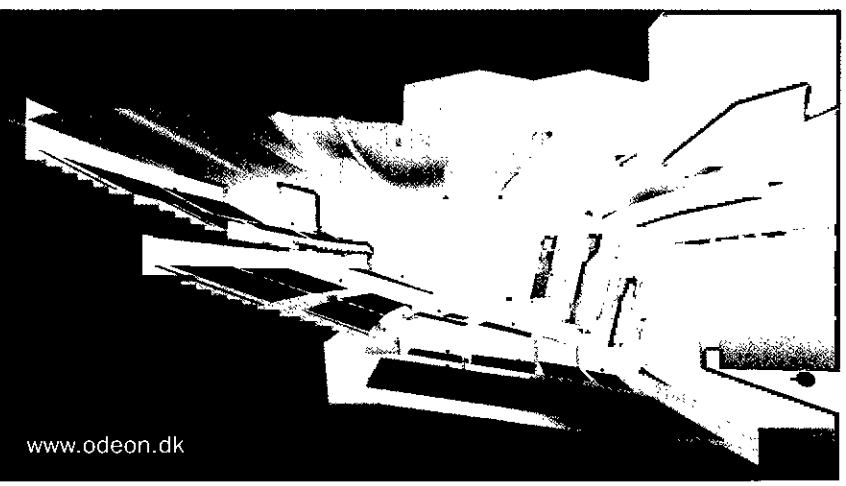
Important notice

Presentation of the new version of the Institute's Diploma in Acoustics and Noise Control has started at six higher education institutions and five distance learning centres, including Dublin for the first time, and Cornwall with only one student. Next June, Diploma registrants will be taking examinations based on the new syllabus. This means that they will have a choice of two specialist modules from four (rather than seven), and will be subject to new, more stringent, pass marks.

However, at a recent meeting of the tutors and examiners sub-committee of Education Committee it was agreed to offer a 'one-off' opportunity to candidates needing to re-sit 'old' modules including those being discontinued (vibration control, sound reproduction and measurement). **This opportunity will only be available in June 2009.**

Any subsequent re-sit examinations (ie in 2010 and thereafter) will be based on the new syllabus, module options and thresholds.

It should also be noted that to ensure the currency of the Diploma as a professional qualification, the Education Committee has approved a requirement that the Diploma must be completed **within five years** of first registration.



Membership

The following have been elected to the membership grades shown.

Fellow (FIOA)

Bank, G

Members (MIOA)

Aied, H H
Aliberti, G
Botha, P C
Kemp, J
Meireles, A M G
Murano, S
Peplow, A T
Qin, Q
Senapati, U
Sepulveda, G A
von Hunerbein, S U M

Associate Members (AMIOA)

Baker, D T
Borak, C
Clark, D
Coston, M
Delikaris-Manias, S
Dufaud, J
Hill, P R
Kourik, A
Kuttan, S K P
Lee, J
Levet, T
Luckhurst, K
Mann, P
McBride, N
Pantziarides, A
Parfitt, E
Rickard, A
Rikse, L
Smith, J T
Taylor, V L
Vessey, C G H

Affiliates

Chan, J M L
Hammond, J
Iglehart, F
Jeffries, S
Muston, J
Soulier, D
Stringer, P
Strudwick, A G
Wintle, S P

Technician members

Tett, M
Turner, R
Witcher, M

Student member

Brooks, P N

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Upgraded memberships and reinstatements.

Fellows (FIOA)

Hepworth, P
James, A W

Members (MIOA)

Capstick, E R
Carter, R S
Cawley, D
Cope, R S
Critchlow, R A
Dadkhah, N
Dyson, P M
Faircloth, S M
Fairhall, D M
Fernleigh, D
Garritt, D S
Hardy, J
Hurst, C J
Jameson, A G
Kershaw, A
Lee, D M
Long, A
McLoughlin, M
McNeillie, C R
Muggleworth, S D
Nash, D J
Oldaker, D T M
Perry, S P
Rees, I D
Salter, G R
Sami, F
Sherwood, R D
Stevenson, G P
Varley, H L
Wigham, S

Associate Members (AMIOA)

Bracher, C R
Burgess, B
Kirkaldy, R
Mackinnon, G R
Mistry, P
Rice, G
Bows, R
O'Neill, C

Meeting notice

ICSV16

Members are warmly invited, together with accompanying persons, to participate in the 16th International Congress on Sound and Vibration (ICSV16) to be held in Krakow, Poland, between 5 and 9 July 2009. ICSV16 is expected to be one of the largest congresses in the world in the fields of acoustics, noise and vibration, with more than 1000 participants from over 60 countries. Therefore, it will be a major opportunity to present the latest scientific and experimental results, advertise companies and their products, and learn about the most advanced theories, technologies and applications. Abstracts for papers to be presented at the Congress are also invited.

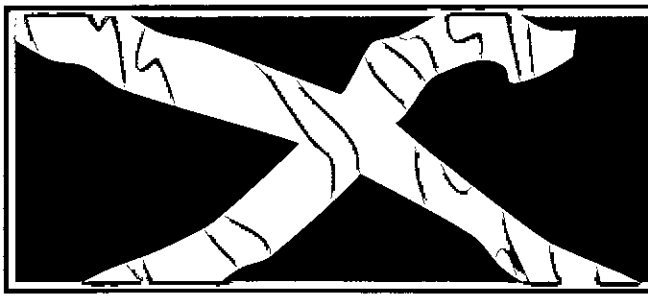
ICSV16 is organised under the auspices of the International Institute of Acoustics and Vibration (IIAV), the committee on acoustics of the Polish Academy of Sciences, Polish Acoustical Society (PTA), AGH University of Science and Technology, and the Silesian University of Technology, in cooperation with the International Union of Theoretical and Applied Mechanics (IUTAM), American Society of Mechanical Engineers International (ASME International), and the Institution of Mechanical Engineers (IMechE).

During ICSV16 rich social and tourist attractions are also on offer, and delegates will have the opportunity to experience Polish hospitality, culture, and famous food.

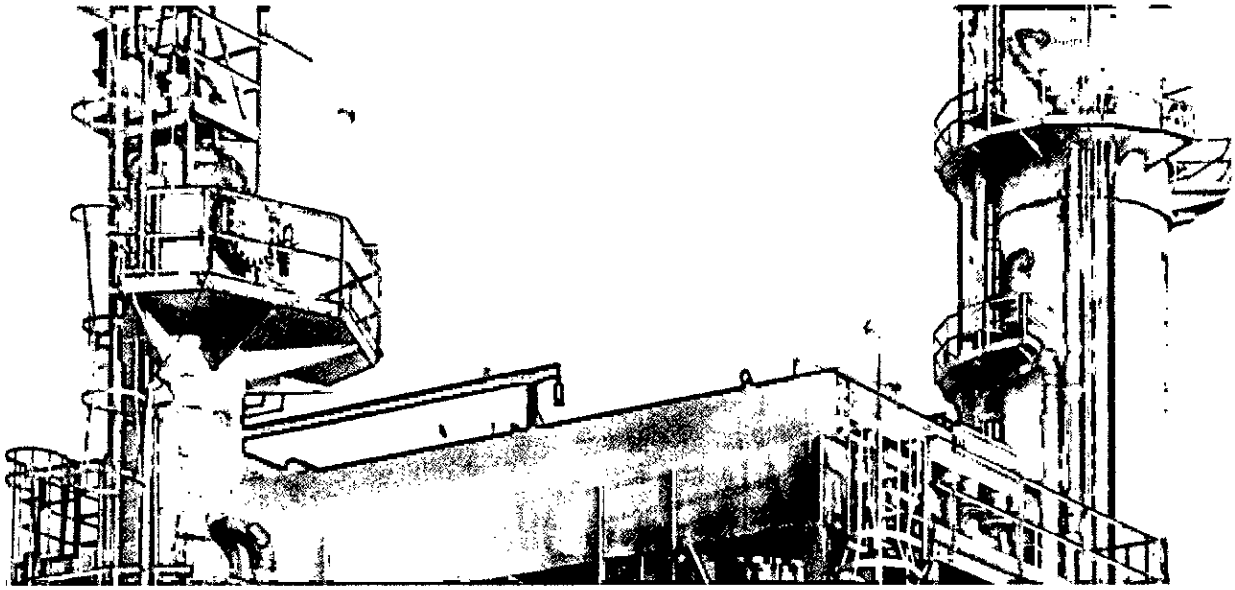
Krakow has traditionally been one of the leading centres of Polish scientific, cultural and artistic life. The intellectual potential of Krakow is created by 22 universities, nearly 20,000 academic lecturers and 190,000 students. As the former capital of Poland with a history encompassing over a thousand years, the city remains the spiritual heart of the country. It is a major attraction for local and international tourists and welcomes seven million visitors annually. In 1978, UNESCO added the historic centre of Krakow to the list of World Heritage Sites.

The deadline for submission of abstracts is 1 December, 2008, and the deadline for proposals for structured sessions is 1 November 2008.

Visit **www.icsv16.org** for information.



For a copy of the consultation on noise action plans in Scotland, contact IOA Head Office on: **01727 848195** or email: **ioa@ioa.org.uk**



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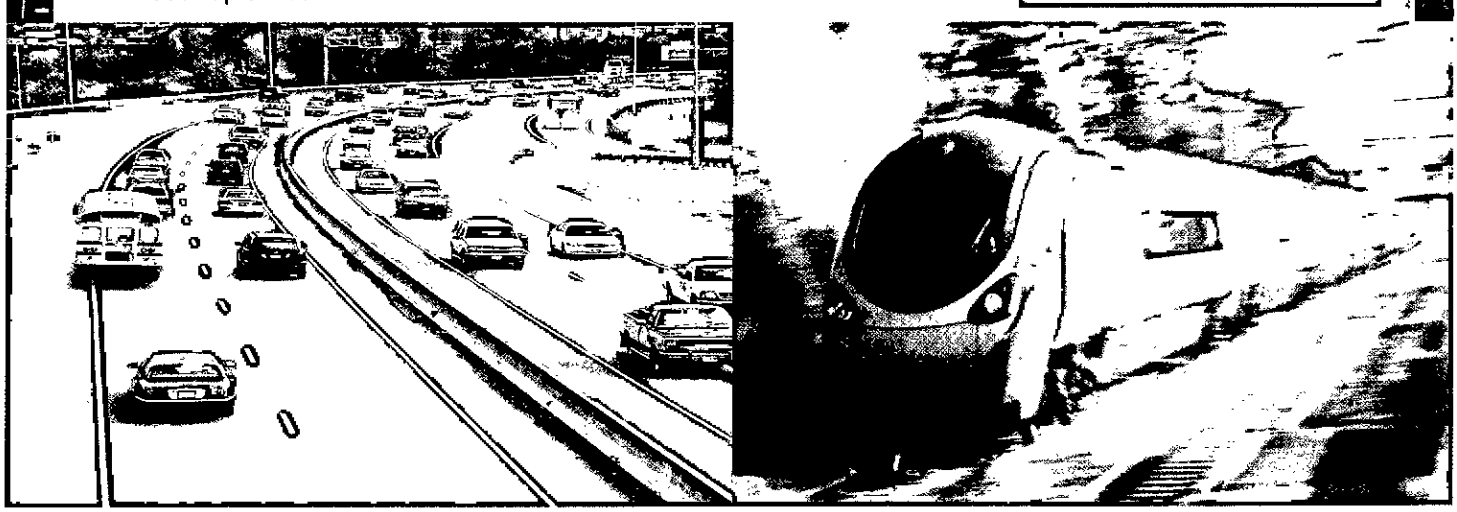

Young Persons' Award for Innovation in Acoustical Engineering 2009

Open for entries

The Institute of Acoustics is pleased to announce that the Young Persons' Award is now open for entries from acousticians in the first five years of their career. Entries can be accepted until 12 noon on 31 May 2009. IAC Ltd continues to act as corporate sponsor of the Award: the world-leading noise control company is keen once again to celebrate the contribution of young acoustical engineers across a huge range of British industry sectors. IAC has sponsored the Award since its inception in 2005.

Entry forms can be downloaded from the Awards section of **www.ioa.org.uk** and from the corporate sponsor's website at **www.industrialacoustics.com/uk** .

The 2007 winner, Dr Constantin-C Coussios, has said that is really important to get industry recognition for inventions and developments. It has been an action-packed year for him, a researcher at the Department of Engineering Science within the Oxford Institute of Biomedical Engineering, University of Oxford. His cancer therapy-enhancing technology uses high-intensity focused ultrasound (HIFU) to reduce heat damage to the 'good' cells lying around a tumour under treatment. His innovation has been attracting a great deal of international attention over the past year.

Recent NHS funding has allowed the commencement of clinical trials this autumn, to test the development on real patients. It will be a year before results are available, but Constantin hopes that patents will result from the work, and so lay the foundation for commercial application in the future.

Since winning the Award, Constantin has also become a father, and in May 2008 he and his wife Niki took their 6-month-old son on their winning weekend in Barcelona, generously provided by IAC. Here is his account.

'We were delighted to be able to take our weekend trip in May, having had to put it off a number of times for small baby reasons. Our thanks are owed to Colette at IAC for changing the dates several times and for choosing the Regina Hotel in Barcelona which was an ideal location for us, being right in the middle of things.

'We had a wonderful dinner on the Friday evening on the Plaza Real, and strolled through the old city and awoke on Saturday to sunshine and blue skies. It was my wife's, and of course, Dimitri's, first visit to Barcelona so we walked Las Ramblas in the morning and saw various stunning landmarks by Catalan's architectural genius Antoni Gaudi, including the Sagrada Familia church. We made it uphill - just about - with the pram to the Park Guell by early evening: it gives a fabulous view out over the city.

'Later on we were treated to a first-class dinner at Casa Calvet Restaurant - thanks again to IAC. Casa Calvet is in a stunning building created for a textile manufacturer by Gaudi. It was a marvellous evening - the food, the ambience - and other than our dear screaming baby, was such a romantic occasion!

'The next day we took in the sights including the Palau de la Música Catalana and the Santa Eulalia Cathedral in the old town, and then we went to the Zoo. Dimitri was most impressed by the size of the giraffes! We eked out every last minute and left it rather late to find a taxi and made it to the airport by the skin of our teeth. I was thrilled to be able to take my family away to such a lovely location for a few days. It was a great prize and we really made the most of it'.

Immediate Past President Colin English expressed his delight that Constantin enjoyed the weekend part of his prize and the Institute was most grateful that he had donated his £500 cash prize provided by IAC as a prize for the best paper presented by a young medical acoustician in our Spring 2009 conference.

Around the same time as the Award ceremony last autumn, the BBC carried a piece on Constantin's invention on the BBC Science website which brought a flood of journalists' enquiries. Constantin has since been made a Reader of Oxford University, which is a huge honour, especially at such a young age. This recognition of distinction is for contributions to science that are of benefit to mankind. Congratulations are offered from all the Institute's members on this excellent achievement.

Look out for more from Constantin and his encouragement to our younger members to enter for the Young Persons' Award in future issues of *Acoustics Bulletin*.

Constantin and Dimitri

Constantin, Niki and Dimitri

Meeting report

Richard Cowell. Sustainable acoustic materials

This thought-provoking meeting at ***CIBSE, London, on 11 September 2008*** was introduced by **Peter Rogers** on behalf of the Building Acoustic Group, as, unfortunately, **Prof Jian Kang**, the planned chairman, had been delayed by problems (on the Northern Line!). Peter reminded delegates of the Institute's increasing reinforcement of education in sustainability and its implications for research, material supply and acoustic consulting. Materials play a key part in the battle against climate change and Peter asked that delegates should take away as much new thinking on sustainable applications as possible to improve performance.

Peter also drew attention to the proposed discussion at the end of the afternoon, intended to develop suggested actions for participants and for the Institute, including proposals for future meetings to develop knowledge in this area.

Suzy Edwards (previously with BRE, now director of Embercombe) began the presentations with *'Beyond benchmarks - the behavioural challenge'*, a challenge to delegates to respond vigorously to the threats we face. Delegates were asked to imagine the reactions of the world's population to the news of a large meteorite threatening the world and dangerous consequences of failed experiences with nano-robots. Would the fatalistic response be the same as we have seen for climate change? Would we see solution seeking thought processes? Effective responses would necessarily need multi-tasking. This was clearly what is needed to combat climate change and resource depletion. We need to address these issues in a committed way, or 'we might as well go off and play golf!'.

From Suzy's time as leader of the materials team at BRE, addressing the Green Guide, she identified headline elements in responsible material selection - in particular, food security, bio-diversity and life cycle analysis. Solutions needed to be thought through carefully. The current developments in biomass and use of palm oil are already showing deleterious side effects.

The cycle of blame for unsustainable material selection must be broken. A learning culture needs to be at the centre of solutions and we needed to measure our progress. Suzy recommended that we watch out for the film 'The Age of Stupid', soon to be released, to help us 'get it'.

Are acousticians prepared to stick their neck out and object next time unsustainable material is selected? Even 'name and shame'? The results of the Kingsnorth 6 power station case (favouring the protesters) and the removal by the Norwegian government of major investment in RTZ were cited as evidence of the wheel turning steadily in favour of more concern over sustainability.

Suzy then explained her journey from BRE to her new role at Embercombe, dismissing any suggestion that we were being introduced to 'hippies on the hill'. The broad human benefits of the charity, focussed on sustainable human response, were described.

Suzy invited delegates to read Peter Rogers' paper 'Acoustics and the UK's approach: Towards sustainable acoustics' as a good overview. This paper was presented to the ICA Madrid 2007, and is available for download in full from **www.colejarman.com**. She asked delegates to take what they learned from the day, get behind the lead offered by

continued on page 24

Meeting report - Sustainable acoustic materials - *continued from page 23*

Peter, and act positively to help colleagues achieve better sustainable material selection.

Peter Fisher (Bennetts Associates, Architects) introduced the work of his practice and explained that, for them, sustainable design had been developed principally through aspects that impinged on global warning and CO2 emissions. Having been part of the development of the M4I sustainability indicator, headlines from that (although at the time it had been under-developed) had been applied.

Peter used two particular projects to illustrate the approach of the practice. For the Wessex Water building in Bath, an evaluation had been made of impacts of material selection and use for the roof, the envelope and the floors. For example, hybrid concrete/steel elements were developed, being thinner than those normally used, retaining sufficient thermal mass, but using less energy to form and to locate. Transport patterns for material deliveries were carefully considered. A closed local quarry was re-opened, economically and to local benefit, to service the project.

At the Hampshire County Council offices in Winchester, an uninspiring existing office was being renovated and modified. The project included several major design measures to control CO2 emissions. On a very noisy site (with busy roads on three sides), natural ventilation had been used. Impact comparisons for four-pipe fan coil and natural ventilation resulted in the latter being selected. Displacement ventilation would have been preferred, but proved unrealistic owing to the form of the existing building. A wind driven vent strategy was developed using wind towers (bringing much needed vertical elements to the façade) to create negative pressure and so drive the air movement. It was noted, in terms of sustainable design, that attention to so-called acoustic materials might be less important than attention to major structural elements which are influenced by acoustic design eg weight being needed for sound insulation. Energy issues for structural elements were highly significant.

Peter suggested that trying to include natural ventilation into building designs should be a high priority, and this was an area in which the acoustics discipline could provide help in dealing with the problems faced. Overall, he felt that the integration of design team commitment was the most important direction for sustainable design.

Prof Kirill Horoshenkov (University of Bradford) reported studies of *'Sound absorption from recycled materials'*, carried out with Amir Khan and Hadj Benkreira. The disgraceful EC waste statistics were noted. Legislation, and opportunities to recycle waste as thermal and acoustic products, were identified as drivers.

The cold extrusion process as developed at the University of Bradford was described. After pre-processing by granulation or cyclone separation, the recycled resin material is set in a hopper and with low energy screw compression is combined with binder, metered and shaped. Control is available over pore size distribution, porosity, dynamic stiffness and flammability. Material microstructure allows a wide range of performance characteristics. For sound absorption the recycled materials stand up well against more conventionally used materials and a wide range of potential uses are envisaged. They are seeking to make this commercially available as the next step.

Prof Francesco Asdrubali (University of Perigia) introduced his paper *'Sustainable materials for acoustic design'* with emphasis on the importance of 'green' building, a reminder on the definition of sustainability and the importance of environmental assessment. There was a reminder that 'green' materials did not necessarily need less energy than traditional ones. Benchmarks and lifecycle tools included Ecoinvent (CH), BRE Ecoprofiles and Eco Indicators (NL), also Natureplus for high quality building products, construction materials and home furnishings. EC eco-labelling is a further influence now playing a part in identifying how to make a better choice.

The focus is now on natural and re-cycled materials. Natural absorbers include kenaf, flax, sisal, hemp, sheepwool, bamboo, and coconut fibres. The good performance of expanded clay, perlite, vermiculite and pumice was compromised by high energy requirements for production. Cellulose had potential as a spray. Metal shavings, textile agglomerates and rubber crumbs offered potential when mixed with various other products. Cold extrusion of carpet waste and recycled plastic bottles was another avenue which referred back to Kirill Horoshenkov's work at Bradford. Performance of natural and recycled materials could be good compared with traditionally used materials eg for impact isolation, and components of airborne sound insulation.

Comparable costs in Italy were noted and a broad description of the laboratory in the University of Perugia was given. The need to evaluate sustainability credentials was emphasised, particularly for standardising product performance.

Roger Kelly (CDM and member of the Building Acoustics committee) presented *'Using recyclable materials for acoustics'*, and reminded the meeting of the powerful role of money in driving changes, and cited pressures on material suppliers. These included the Code for Sustainable Homes and its possible extension to make buildings adaptable for different stages of life; Landfill Tax; Approved Document E; and O&M documents requiring recycling on demolition.

He raised concern over the durability and performance lifetime of products against the lifecycle requirements of the buildings they are placed in. He did not see why all materials should not be as durable as the rubber bearings used under 'floating' buildings for example. BS6177 called for rigorous checks on creep, and ozone resistance, among others. He identified the merits of cork: stripping the tree prolongs the tree's life. Uses had included acoustic isolation, although the material was somewhat stiff, and providing air in elastomer manufacture. Recycled tyres had many uses - for ballast mats, embedded rail, booted sleepers, and many others. 'Second generation' uses included playground surfaces and traffic calming devices. Roger cited an example of temporary installation of under-sleeper mats for the Channel Tunnel Rail Link. Here the material was used to protect sleepers against damage from construction traffic. The material was later taken back and re-used to make traffic-calming strips.

Apparently, the many uses of recycled materials included the manufacture of 'comfort mats for cows'! Other materials for recycling included foams, nappy elastic offcuts, horse hair, and mineral fibres. Mixtures of materials may suffer excessive creep and some materials could not be recycled.

Finally, Roger predicted vertical integration *ie* companies carrying out all of the processes, from initial purchase to retrieving and re-using, for recycling to be commercially realistic. This would provide the necessary 'cradle to cradle' approach to make the supply and manufacture of future materials as sustainable a process as possible.

After lunch, **Graham Dodd** (Arup Materials Consulting) reviewed a number of materials around the title 'Glazing for the ecological age'. The concepts of 'cradle to cradle' and 'biomimicry' were highlighted for environmental effectiveness. He pointed out that 'less bad' was not good enough and spoke up for elimination of waste. A key consideration in tackling waste and recycling was the separation of 'technical' and biological' waste. Re-use of building materials and the use of assemblies of available parts (*ref* Lego) offers opportunities. Two particular examples cited from nature were the abalone shell, famously strong, built slowly with a low energy filtration process, and nature's use of the same materials in different forms, helping the recycling of material. As an example of the latter, the colour of butterfly wings was varied by adjustment of perforation patterns in the same material. He challenged delegates and acousticians to consider more widely how this principle might provide an acoustic performance and lead to development of new controls. Perforated glass absorbers might be one such example to ponder on.

Graham reviewed a range of interesting advances in use of materials, including vibratory welding of timber. He suggested that despite initial cost, stainless steel might prove sustainable through low maintenance and durability. Building facades acted as filters for eg air, sound, heat and light and, from a different perspective, provided signals about place, function and values. Trends in design would perhaps lead to less transparency, more translucency, more colour and more texture.

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Meeting report - Sustainable acoustic materials - *continued from page 24*

Thermo-setting resins could not be re-used. More thermoplastic materials should be expected. The energy consuming elements of cement were being replaced by better substitutes. New timber treatments could render the material indigestible to pests without continuous unsustainable treatments.

Wood and plastic composites should be avoided - these were 'wrecked' for future economic separation. Flat glass had less embodied energy than clear plastic of the same thickness. Sealed units were currently formed from materials that could contaminate the glass. Perhaps solar powered pumping of moisture out of cavities between glass would develop. Watch out for developments in electrochromics, colour filters, phase change materials and the conversion of light into electricity. Could sound be used to keep facades clean?

It is likely that façades will become owned by the producer. Graham concluded by commending the coat of the polar bear for its remarkable cladding, which consisted of hollow fibres that gave a white appearance although the skin beneath was black. He suggested that closer ties between materials specialists and acousticians offered real opportunity for the creation of new, effective, sustainable materials.

Gerry Mitchell (Isover UK) described the large scale of his company's operation and returned to the fundamental intent of sustainability. He highlighted the highly variable qualities of different claims and the proliferation of 'greenwash'. As an example, carbon neutrality proclaimed on the back of a petroleum delivery lorry raised uncertainty in the reader's mind.

Gerry suggested that sustainability was a bigger problem than climate change, expressing the view that evolution and adaptation of species may well avert disaster. He described 'a minefield out there' since the variety of guidance and standards could be bewildering. Building Regulations Part E, Robust Details and the 2006 Code for Sustainable Homes were driving residential acoustic requests, with BREEAM and the Green Guide also applied elsewhere. Life-cycle analysis and environmental profiles were dominant features.

A comparison of Green Guide ratings for glass wool alone or within wall constructions indicated wide variations. Gerry was concerned over glass wool eg in an external wall configuration, this had an A+ rating, and in an internal wall of similar build-up, it had D and E ratings.

He also asked whether glass wool should not be considered a 'natural' material, since it was formed from 20% silica sand and 80% recycled glass. Recycling percentages in gypsum board, and in internal metal stud partitions and dry linings, were described as high.

Elements of sustainable production of glass wool were described. Gerry summarised the reasons why glass wool could be used in sustainable design. He challenged the meeting 'not to believe everything they read', and to check that the information on which they were forming their judgements was valid.

In questions that followed, Suzy Edwards pointed out that the ratings in the Green Guide were comparative and give a steer for a lifecycle comparison. However an A+ did not necessarily suggest absolute excellence.

Prof David Oldham (University of Liverpool) presented *'An experimental investigation of the sound absorption characteristics of reed configurations'*. He described work carried out within project HOLIWOOD, supported by EC funding, and centred on thermally treated hardwoods from managed European sources. The component in focus was the traffic noise barrier and achievement of sound absorbent lining targeting the range 500-2kHz. Materials considered were bio-mass, plant or animal products, recycled materials, crumbed rubber and sintered glass particles. Required performance characteristics were compared with properties of wool, cotton, flax, hemp, sisal, strawboard, timber based fibreboards, whole reed and straw mats.

Reed mats and bundles were tested in various configurations in impedance tube and reverberation chamber and the comparative performances studied. Reeds with longitudinal axis parallel to the backing surface were also tested with and without blocked ends. As might be expected, without perimeter frames, higher absorption was measured. Reed and hemp (eg 5 or 10 cm reed + 7cm hemp) were tested and achieved very high performance, with coefficients close to unity and above, over a wide frequency range. It was suggested that natural fibres were best in terms of absorptive properties. For assessment of durability, more work was needed. Reeds, when positioned so that water runs off them, could be very durable (as in thatched roofs). Fire retardants could be used to counter the risk of burning. Aligned reeds had good structural stiffness. Binders may be needed for natural fibres, but not for reeds.

Prof Jian Kang (School of Architecture, University of Sheffield) presented *'Lifecycle analysis on common acoustic materials'* reporting on studies carried out with C Yu and J Joynt. Using a simplification of Envest software and an assessment of Ecopoints, various residential building forms and noise barriers were assessed. Embodied and operational Ecopoints per square metre of building area were reported and rankings explored. Brick and stone were compared, with different findings for toxicity and operational Ecopoints. Pitched roofs came out well on embodied Ecopoints, less dominantly for operation. Varying storey heights were considered with small differences in results reported. Living rooms were examined in more detail and subtle differences noted.

For noise barriers, several criteria including BRE weighting were applied, but location of use was a complication. Maintenance and recycling were addressed and a simplified index for life cycle analysis proposed. Examples of 'cradle to gate' and 'gate to grave' analysis for design, manufacture, transportation, maintenance and recycling potential were examined. Typical costs were compared. The conclusions reinforced the importance of comparative study and being careful about selection.

Discussion

Following the key points raised by speakers, Peter Rogers posted headlines as prompts for discussion. An early suggestion from Prof Horoshenkov was a link-up with civil and structural engineers, because so much energy use, derived from acoustic design, was caught up with structural elements. There was a suggestion that the Institute might focus on providing guidance for members on selected aspects of sustainable design - perhaps waste reduction, provision of reliable data, and holistic clarity determined from comparisons, made in collaboration with other institutes.

Graham Dodd wondered where in sustainable design the influence of acoustic design may be strongest, and suggested that the main areas need to be identified to assist work in the field and across disciplines. Suzy Edwards suggested that a little time should be taken by the Institute to form its priorities for sustainability.

Another suggestion was action by the Institute to help find funds for research in the field. A sustainability network stretching across Institute groups with and beyond building acoustics was proposed.

Several actions were proposed.

(1) Form a discussion group from different disciplines and sectors.

(2) Form a working group to approach relevant government bodies to integrate acoustics and sustainability. This would involve representatives from each of the other groups of the IOA, to provide a common response.

(3) Explore the possibility of applying for finance from research and development funding bodies such as EPSRC and DTI.

(4) Produce a booklet for best practice to assist members to have the confidence to take forward 'Sustainable acoustics' as part of their work.

Peter thanked presenters and delegates, and undertook to develop actions, within the Building Acoustics group and the Institute more widely, from these suggestions. He called on delegates to play their part in improving practice in the research, use and care for sustainable acoustic materials.

Richard Cowell

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RAIN NOISE TESTING ON LIGHTWEIGHT ROOFING

The combined acoustic benefits of Rockwool 4 in 1 insulation & Rockfon ceilings

By Tim Spencer

FIGURE 01 *A Rockwool roofing system being installed*

Introduction

To be (as we believe) the first organisation in the UK to complete testing in accordance with the published version of ISO Standard BSEN ISO 140–18:2006 Measurement of rain noise on building elements [1] was quite an achievement for Rockwool Ltd.

BS EN ISO 140-8 describes a laboratory method for the measurement of sound generated by rainfall on building elements, using artificial raindrops produced by a water tank. Ideally, test specimens should be exposed to real rain for such measurements. But real rain is neither steady nor continuous with respect to time. Furthermore, raindrops can vary in diameter owing to several factors, including the geographical location, which introduces variability in measured values.

Artificial raindrop generation systems (other than the water tank used in this part of ISO 140) do exist, hydraulic spray nozzles being one example. However, nozzles corresponding to the specifications given in this part of the standard are not, so far, commercially available. Indeed, their flow rate is too high when the drop diameter is correct, and the drop diameter is too small when the flow rate is correct. Only the water tank method appears in the standard.

An alternative to real rain or artificial raindrops is the dry mechanical excitation of the test specimen. Researchers have used different methods, such as excitation by an impact hammer or other mechanical impacting simulators with the aim of simulating the noise of real rain. These methods invariably suffer from the drawback that the noise source generates sound levels and sound spectra that taken together, do not compare well with corresponding values generated by the real rain on various types of test specimens. Further research work is encouraged to develop mechanical methods of rain noise generation that can match both the sound levels and spectra of real rain.

With increasing focus on noise issues and the need for proven, sustainable, good whole life value-for-money and safe building solutions, Rockwool Ltd and sister company Rockwool Rockfon Ceilings got on with the task of roof rain noise testing.

The testing, carried out at the end of 2007 at the Building Research Establishment, is believed to have been the first to be completed in the UK, and probably internationally, in accordance with the recently published International ISO 'rain noise' standard.

The tests demonstrated that Rockwool insulated roofs with the addition of a straightforward Rockfon low-weight stone wool suspended ceiling can ensure that rain noise resistance, reverberation time and speech intelligibility criteria, together with all the other necessary performance requirements in terms of fire safety, thermal performance, light reflection and sustainability are fully satisfied for all sectors. The testing further confirmed the superior performance, enhanced practicality and peace of mind when using Rockwool insulated roofs compared with foam insulated varieties.

Test Programme

The comprehensive test programme was completed at the BRE acoustics laboratory within the extensive Building Research Establishment at Garston, Watford in November and December 2007. BRE Acoustics specifically configured one of their existing laboratories to allow for the construction of roofs and ceiling elements together with the 'rain' water tank and all of its necessary supports allowing for easy tank movement so that measurements could be made in different roof positions. The rig also included water run-off and collection systems, water collection and recycling being particularly important to minimise the amount of water being used. Because the tests took place indoors, the 'rain' water was fed from and collected in a separate supply and recycling tank on the ground floor.

Testing indoors proved to be a great benefit compared with the outdoor option, because ironically the use of a test rig built outside would be weather dependent. In other words, tests would only be possible when the weather conditions allowed, and the ambient sound level was sufficiently low. Tests would certainly be impossible when...it was really raining! Everyone is well aware how much rainfall there can be in the UK, and the past 12 months have been exceptionally wet. Programme predictability, and completion of the tests as quickly and as efficiently as possible were key factors in laboratory design and choice. In a nutshell, the testing was completed indoors in accordance with the published International Standard (as opposed to the previous drafts) in a closely controlled laboratory environment with very low background noise levels and very high flanking limits, all as required by the new ISO standard.

The results obtained on the straightforward, economical, fire-safe and easily built roof and ceiling constructions were impressive, with the samples performing well, and demonstrating their ability to achieve results well within 'best practice' target values and the guidelines for resistance to rain noise.

Designers can be confident in the use of this data and the constructions used, compared with any other previously obtained data and any subsequent predictions in accordance with previous draft or ad hoc standards and laboratory set-ups. When looking for data and making comparisons for designs to resist the negative effects of rain noise, it is prudent to ensure that the test results are current and obtained in accordance with the published standard. The solution put forward should be straightforward and easy to construct. A BRE report from January 2008 contains all the test data and results. Further details are available from Rockwool Rockfon.

FIGURE 02 *Rockwool Hardrock being laid on vapour control layer*

Why do the tests?

Appropriate background sound pressure levels and the need for appropriate levels of resistance to noise generated by rain are 'must haves' in modern buildings. In any built environment, an appropriate background sound level should not be exceeded no matter what the weather conditions. In design work the sound pressure level due to rainfall in the room beneath the roof element should be of considerable interest.

In some buildings the background noise levels created by rain on the roof are unacceptable - the rain is simply too loud. The noise can be disruptive to learning and concentration in the education and commercial sectors, and is not conducive to health, wellbeing and efficient healing in the healthcare sector. The problem is becoming more recognised in various best-practice codes and guidelines.

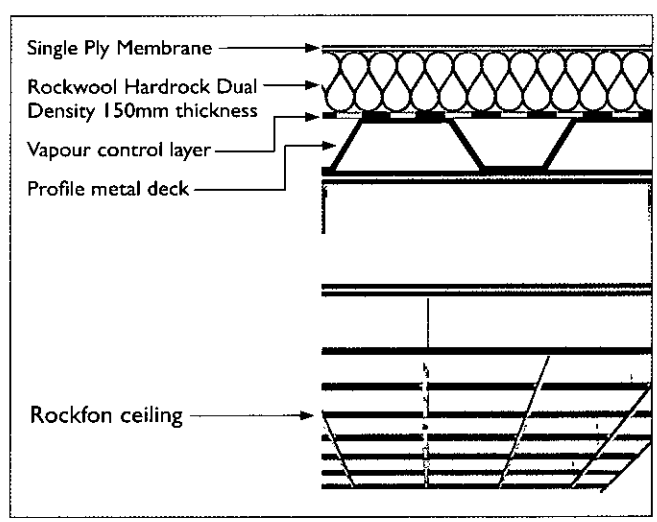
To date, some installations have used complex and costly multi-layer ceilings to provide appropriate room acoustics (speech intelligibility and reverberation times) and to combat the high level of rain noise generated by lightweight foam insulated roofs. Our goal was to prove that by using a Rockwool insulated roof and a single layer Rockfon ceiling there would be no need for complex multi-layer ceilings with overlays or other devices.

The focus was on exploiting the damping and acoustical performance of Rockwool Hardrock insulation as well as reducing reverberation times and enhancing speech intelligibility. The sound absorption and sound insulation characteristics of Rockfon ceilings were known to be excellent. Of course, the programme was also intended to add peace of mind for acousticians, particularly as they are nowadays being pressed by architects and main contractors for solutions that reduce risk to their indemnities by providing good, upto-the-minute data and reliable, safe value-for-money solutions for all.

Benchmarks for acceptable performance

Building Bulletin 93 **[2]** sets out the performance standards for the acoustics of new school buildings, and one of these performance standards is the indoor ambient noise level in unoccupied spaces. This noise level excludes contributions from rain noise, but the guidance states that it is essential that rain noise is considered in the design of lightweight roofs as it can significantly increase the indoor ambient noise level. When BB93 was published in 2004 the international standard for measuring rain noise was still being developed. The intention is that in the future, consideration will be given to including a performance standard for rain noise in BB93. Until this time, it is appropriate for design teams to provide evidence to Building Control that the roof has been designed to minimise rain noise.

In the meantime some specific benchmarking is available in the form of BREEAM for schools. The values stated in BREEAM for schools are likely to become the norm in future editions of BB93. BREEAM provides credits for roof designs that can demonstrate in the event of heavy rain that the ambient sound pressure level will not exceed normal allowable ambient sound levels by more than 20dB. Reference needs to be made to Table 1.1 of BB93 to determine the maximum levels allowable in the many different room types in educational buildings. Predictions for rain noise can then be accurately made based on test data and formulas in accordance with BS EN ISO 140-18:2006. Resistance to rain noise and its importance will also be covered in HTM 08-01 Healthcare premises - acoustics (soon to be published as a replacement for HTM 2045).



For more information on fire safety legislation and Rockwool's range of dual density roofing boards visit www.rockwool.co.uk or call 01443 828815

Results

TABLE 01

Room Type	Area(m)	Height(m)	Ceiling	Upper Limit (DB)	Internal (DB)
Primary classroom	56	2.4	none	55	59
Primary classroom	56	2.4	Rockfon 20mm Scholar	55	**51**
Secondary classroom	63	2.7	none	55	60
Secondary classroom	63	2.7	Rockfon 20mm Scholar	55	**51**
Lecture room large	180	3	none	50	61
Lecture room large	180	3	Rockfon 50mm Sonar 44 dB'sandwich'	50	**45**
as above	180	3	Rockfon 20mm Scholar	50	52
'Inclusive' classroom for use by hearing impaired	56	2.4	none	50	58
as above	56	2.4	Rockfon 50mm Sonar 44 dB 'sandwich'	50	**42**
as above	56	2.4	Rockfon 50mm Sonar 44 dB 'sandwich'	50	**49**

Sample performances in schools

Note: Lower values of internal sound pressure level indicate a better performance. All ceilings consisted of Rockfon tiles in 600mmx600mm modules and a RockLink 24 exposed grid.

The roof construction without a suspended ceiling performed well, achieving 59dB $L_{Aeq,30min}$ (based on probable use in a typical classroom with a T_{mf} of around 0.6 seconds). This was certainly an impressive result, but as expected it was found to fall short of the target values when calculations were made for other types of spaces. By adding a straightforward and widely used Rockfon Scholar sound absorbing ceiling, installed using a RockLink 24 exposed T-grid to create a 600mm square module, an improved performance was achieved, meaning that in a typical classroom with dimensions 8m x 7m x 2.4m the sound pressure level from rain noise would be 51 dB $L_{Aeq,30min}$ and therefore well within the target value of 35 + 20 = 55dB. Table 1 shows some examples of the performance achievable based on the data obtained from the test roof with and without Rockfon Scholar 20mm and Rockfon Sonar 44dB 50mm lightweight suspended ceiling tiles. The Rockwool insulated roof provides a high level of rain noise resistance and the addition of a Rockfon ceiling provides a significant improvement owing to its pure stone wool construction (it is made from resin bonded mineral wool). The weighted sound absorption coefficient of both the fronts and the backs of the tiles exceeds 0.9, giving them a Class A (the highest) rating. This high performance is a feature of resin bonded mineral wool ceilings, which are superior to the traditional wet felted mineral fibre ceilings. The use of the Rockfon ceiling and the Rockwool Hardrock insulated roof is enough to meet the rain noise target: there is also a performance and cost-savings benefit because the Rockfon ceiling makes a significant contribution to achieving the reverberation time and speech intelligibility requirements of many areas, specifically those covered in BB93. The tests proved there to be no need for additional intermediate dense ceilings or overlays, thereby maintaining simplicity and reducing the installation time and cost.

The tests proved there to be no need for additional intermediate dense ceilings or overlays, thereby maintaining simplicity and reducing the installation time and cost.

Test Programme

TABLE 02

Rainfall Type	Rainfall Rate mm/h	Typical Drop Diameter mm	Fall Velocity ms
moderate	up to 4	0.5 to 1	1 to 2
intense	up to 15	1 to 2	2 to 4
heavy	up to 40	2 to 5	5 to 7
cloudburst	greater than 100	>3	>6

Classification of rain type according to IEC 60721-2-2

A tank positioned above the test roof is filled with water and constantly recharged. The flow rate is calibrated and monitored to ensure a correct rainfall. Sound pressure level measurements are taken below each roof or roof/ceiling construction in the frequency range 100Hz to 5kHz. The rain noise standard describes various types of artificial rainfall that can be used, as shown in Table 2. Real rain can be classified in terms of rainfall rate, typical drop diameters and fall velocities. The artificial rainfall parameters that affect the noise generated by roof elements are controlled in the laboratory. At present, the intention is that 'heavy' rainfall shall be mandatory for the comparison of products and solutions.

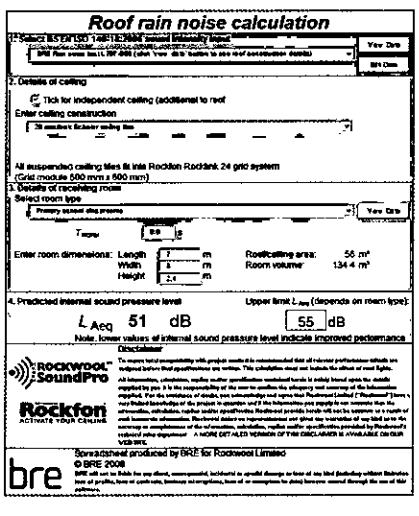


FIGURE 07
Screenshot of the BRE/Rockwool rain noise prediction programme

Using the laboratory data to calculate the sound pressure level in rooms based on the results of the test programme the BRE has produced an easy-to-use calculator to predict roof rain noise in a wide variety of spaces. This is based around the spaces and reverberation time limits set by Building Bulletin 93, but it can also be set to user-defined requirements.

The calculator can be made available to acousticians on loan: contact Rockwool Rockfon for details. An example calculation is shown in the panel (see Figure 07). Rockwool and Rockfon would like to thank Dr Robin Hall and the team at BRE Acoustics for their assistance and involvement in the completion of the tests on which this article is based.

Sustainability

Finally, a word on sustainability, understandably a subject of increasing popularity and one that is quite rightly entering into and becoming part of an ever-increasing holistic approach by acousticians. The diabase rock from which Rockwool insulation and Rockfon ceilings are manufactured possesses a rare quality among the many types of raw materials used to manufacture insulation. The natural process by which diabase is formed is taking place continuously all over the world. Volcanic activity and plate tectonics mean that mother nature creates new reserves of diabase rock every year - around 38,000 times more than is extracted by Rockwool. This unique process of natural renewal completes the rock cycle and delivers sustainability. Not only does Rockwool enhance the environment for all, but it can continue to do so for thousands of years to come. Rockwool and Rockfon ceiling tile offcuts have for many years been recycled at the large and long-established Rockwool UK manufacturing facility just west of Cardiff. Tim Spencer is with Rockwool UK Ltd, Bridgend.

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[1] International Standards Organisation BSEN ISO 140 Acoustics – Measurement of sound insulation in buildings and of building elements – Part 18: Laboratory measurement of sound generated by rainfall on building elements.

[2] Department for Education and Skills. Acoustic design of schools. DfES Building Bulletin 93. London, The Stationery Office, 2004.

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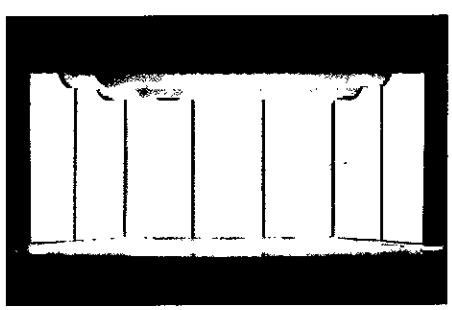

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The study of complex industrial noise fields

Mike Goldsmith, Tony Shepperson, John Shelton, Dan Simmons, Pete Theobald, Graham Beamiss.

A comparison of different measurement instruments

Introduction

In response to reports from industry that current measurement standards are often inapplicable to, or inadequate for, the solution of industrial noise problems which involve complex (multi-element or multi-medium) noise fields, DTI contracted the National Physical Laboratory (NPL) to investigate problematic areas and suggest solutions. As a result NPL investigated the potential of some newer measurement technologies, in part through field trials of devices in a real, but controlled, industrial environment.

Until recently, the only type of acoustical measuring instrument available for the investigation of noise emissions in industrial environments was the sound level meter (SLM), and these are still very widely used in such environments.

However, a number of other devices are now commercially available and, while more expensive than SLMs, have potential advantages over them. Discussions with industry indicated that optical techniques seemed particularly promising, and led to the acquisition and use of examples of instruments to assess features of a noise field arising from a representative environment.

In order to test the suitability of a range of acoustical measurement systems to the analysis of real complex noise issues, it was decided to simulate a fault-based noise in a system of water-filled pipes in a real industrial environment. Ideally, the selected environment would contain significant background noise in a reverberant space.

The room containing the support systems for NPL's acoustic pressure vessel (Figure 1) was selected as very suitable for these tests. This shares the following characteristics with environments which contain challenging noise sources:

1. A network of water-filled pipes which can transmit and radiate noise;
2. Multiple noise sources;
3. A reverberant space;
4. A space which is somewhat cramped and restricted and which contains immovable obstructions, such that, for example, the setting up of enveloping surfaces would not be practical;
5. A real working space, with airborne dust and draughts.

The environment is particularly convenient for comparing different measurement approaches since the background noise sources operate continuously.

The approach adopted was to simulate a pipe blockage by gradually closing a pipe along which water was pumped. The effect of this is gradually to increase the load on the pump.

Measurements were taken with (a) the pump off, (b) the pump on and unrestricted, and (c) the pump on and gradually restricted. The restriction was increased in stages by setting the butterfly valve handle at one of six positions. The handle was notched, so the settings were repeatable.

By ear, it seemed that the first four notch positions had no effect on the sound field. There was a slight change in sound at position 5, and a drastic effect at position 6, with a substantial increase in noise. In addition to the repeatable and realistic nature of the simulated fault, this range of effects, from inaudible to obvious, made it suitable for both sensitive and insensitive measuring systems.

The questions which this approach is intended to answer are as follows.

1. How long does a typical measurement (of the sort selected for this study) take?
2. How easy is it to deploy the equipment in a real environment?
3. How easily could the equipment be used to identify the source of a new and unexpected noise within a complex sound field?
4. Can extraneous noise sources be removed?
5. Is the equipment able to identify the onset of a gradual physical change before that change is sufficient to be noticeable by ear (and hence, would it be a suitable 'early warning' system)?
6. Can lower-energy components be isolated from the noise field for separate investigation?
7. How appropriate is the approach for use in a reverberant space?

Measurement systems

Three types of measuring equipment were employed: a sound level meter, an acoustic camera, and a scanning laser vibrometer.

Sound level meter

SLMs are the traditional measuring instruments used for the investigation of environmental noise and on-site machinery noise issues. Their major advantages include the speed with which measurements can be made. The major disadvantage with their use is that they are non-directional and hence not designed for the spatial location of noise sources. This also makes them highly susceptible to background noise levels.

The instrument used was a Norsonic NOR140 sound analyser with a NOR1209 preamp and a NOR1225 free-field microphone. This device has a dynamic range of 120dB. The analyser was calibrated using a Brüel and Kjær 4231 electronic calibrator.

Acoustic camera

The acoustic camera is a beam forming device which combines an array of microphones with a centrally positioned video camera. The geometry and size of the arrays depend on the application and frequency bands of interest, the most general array being the ring array. Time-delay-and-sum beam forming is used to generate visual representations of sound fields overlaid on a photograph image of the location.

Acoustic cameras are designed to allow the user to 'see what they can hear' and should therefore be highly useful for the fast and easy location of noise sources. Their main disadvantage is that they are not very usable at lower frequencies owing to their beam forming approach. They are also not primarily designed as analytical tools, so the quantitative comparison of states of a sound field (eg with and without the presence of a new noise) is not a simple matter.

The camera used in this work (Figure 2) was loaned by AcSoft Ltd, who sell and lease these devices. The model used had a 75cm diameter carbon fibre ring of 48 microphones. It had a dynamic range of 35 to 130 dB and a useful frequency range of 400Hz to 20kHz (other microphone arrays can go down to 100Hz). The 75cm ring array measures over distances of between 1 and 3 metres, though it can be readily adapted for used over longer distances. The acoustic camera web site is at [3].

The main limitation of any beam forming approach is that it is impossible to distinguish direct signals from reverberations, so applications in reverberant environments are rather limited. A number of research projects are seeking to increase the applicability of beam forming techniques to reverberant spaces, in particular to vehicle cabins.

A useful review of acoustic beam forming techniques is [1], and [2] describes the application of beam forming techniques to industrial noise source identification.

Scanning laser vibrometer

A literature review suggests that vibrometry is the optical technique most frequently used for the analysis of noise problems. Advantages of vibrometry are:

- It provides both rapid and accurate single-point velocity measurements

Figure 1

NPL test environment

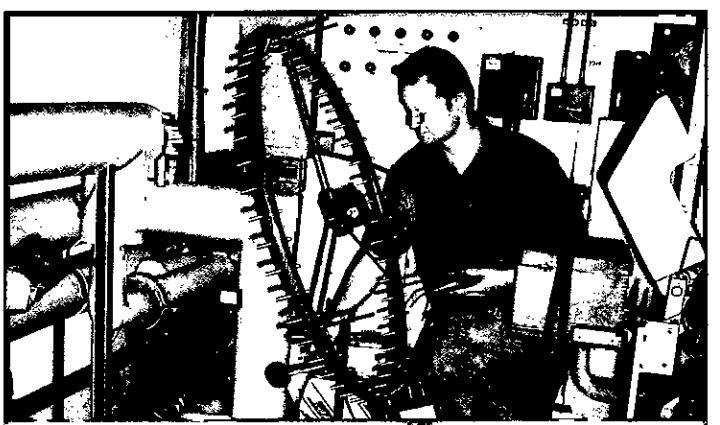

Figure 2

Acoustic camera

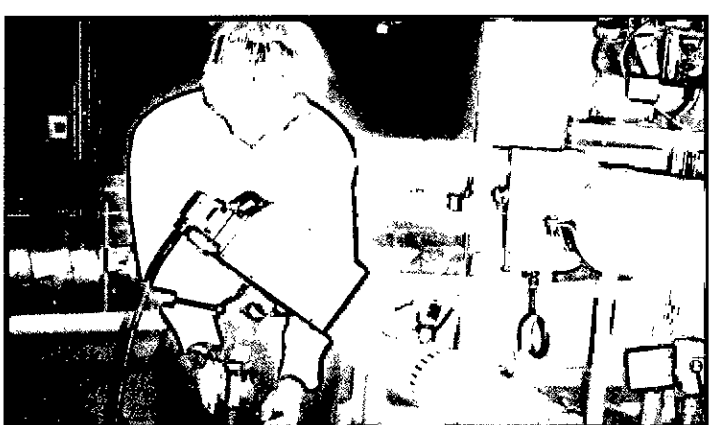

Figure 3

Vibrometer laser head

and also images of surface vibration fields of structures;

- It should be unaffected by airborne noise fields and hence should allow the characteristics of sources to be determined in isolation;
- An extremely wide range of frequencies is accessible, beyond the audio range.
- The laser spot size is approximately 0.3mm so high spatial resolution is available.

The primary disadvantages of the use of vibrometry to investigate noise sources are:

- In the absence of an external trigger signal, meaningful velocity maps are difficult to obtain due to non-coherent phase between measurement points;
- The sound power of a noise source will not necessarily be proportional to the amplitude of its vibration, due to interference effects;
- Some noise sources do not visibly vibrate (eg aerodynamic noise, thermal oscillation).

A Polytec PSV-400 laser scanning vibrometer was used for the project (Figure 3). This is a heterodyne laser doppler interferometer which measures surface velocity components inline with the laser beam. It is capable of measuring surface velocities ranging from a few μms-1 to several ms-1, at frequencies from 1.5MHz down to DC.

In the tests carried out here, the vibrometer was used only as a single point accelerometer. A more powerful, though less straightforward, technique involves the extraction of operational deflection shapes (ODS) which can be used both for preliminary location of strong acoustics and, following post-processing, for prediction of the acoustic field by boundary element methods. The ODS-based approach has the advantage of applicability in reverberant environments.

A review of LDA techniques is [4], and [5] exemplifies its use for structural health monitoring. The use of ODS is described in [6], and a range of vibration-based condition monitoring techniques is reviewed in [7].

Results and analysis

Sound level meter

The sound level meter rapidly captured detailed information over a wide frequency range (Figure 4). A number of features can be clearly seen in all traces and are consistent with acoustic camera data. Smoothing the data (Figure 5) makes changes of frequency distribution with notch number more apparent. Here it can be seen that changes to the frequency distribution become obvious only when there is an audible change - that is, at the 5th and 6th notch positions. This is borne out by reducing the data to A-weighted form, which one would expect to correlate closely with auditory impressions (Figure 6):

Acoustic camera

The camera revealed very clearly the dominant noise source in the visual field (Figure 7). It took only a few seconds to capture the data and under two minutes to identify the noise source.

In addition to a range of visual tools (for example, to convert standard background views to outline views by means of edge-recognition, and to visualise moving noise sources), a number of algorithms are available to

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The study of complex industrial noise fields - *continued from page 29*

extract quantitative data from the samples, though errors introduced by reverberant fields need to be carefully assessed. Figure 8, for example, displays the range of voltages from each of the microphones in the array.

Spectrograms can also be displayed. The notch 6 spectrogram in Figure 9 shows a feature at around 5kHz and suggests another at around 8kHz, with a band of noise extending downwards in frequency from around 3kHz.

Time-averaged displays of sound pressure against frequency are also available, and can be used to identify noise sources within selected frequency ranges. Images of the spatial distributions of those ranges can then be displayed. In the example in Figure 10 the source of a lower frequency component of the noise field (1.60 to 1.685 kHz) is identified as the lower section of the pump assembly (Figure 11). Such displays make good diagnostic tools, but there is a tendency that the more reverberant the environment, the lower the accuracy of the values displayed.

Vibrometer

Directing the vibrometer at the casing of the pump revealed a 725Hz feature which declined as the restriction increased (Figure 12). The change in level of this feature becomes evident at the fourth notch position (plotted in Figure 13). At this position, no audible change in the sound field is apparent.

However, the low-frequency region of the SLM data (Figure 14) reveals no such clear feature in the sound field, so apparently this is a vibration mode which does not generate a sound field, presumably owing to cancellation effects.

The pump casing was also scanned in the absence of any flow (Figure 15). A notable sharp 425Hz feature disappeared when air conditioning fans in the room were turned off. This indicates, as might be expected, that the pump casing was subject to vibration caused by extraneous noise-sources. However, the extraneous signal level here is more than two orders of magnitude lower than the target signal.

This 425Hz feature can be seen in the low-frequency SLM results in Figure 14.

Measurement system comparison

Table 1 summarises the advantages and advantages of the three types of measurement equipment used.

Advantages and disadvantages

It is clear that the choice of system depends both on the type of problem to be solved, and on the time and funding available.

Sound level meters are most suitable where the problematic noise source is readily identifiable. They are quick to use, easy to deploy, equipped with software to produce acoustical parameters of interest, and are fairly cheap. They are of limited use in reverberant environments.

Acoustic cameras are highly effective at identifying the locations of noise sources and in revealing gross changes in the fields or locations of those sources. Data can be viewed and analysed in many ways by the software systems that accompany them, but they are not suitable for determining accurate parameter values in reverberant environments.

When used as single-point accelerometers, vibrometers are of most use when investigating the characteristics of equipment which has already been identified as a noise source. They can reveal changes in the source characteristics before the onset of audible changes in them. They are particularly useful for low-frequency work. When used to carry out ODS-based investigations, they can be used to derive accurate values of acoustic parameters, though such approaches are time-consuming.

Conclusions

The comparison demonstrated that each system has clear benefits for

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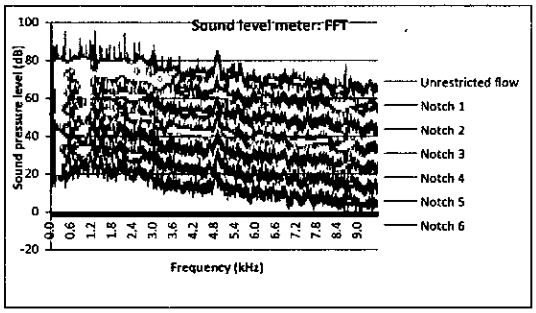

Figure 4

Sound level meter results (traces have been offset vertically so that they can be distinguished)

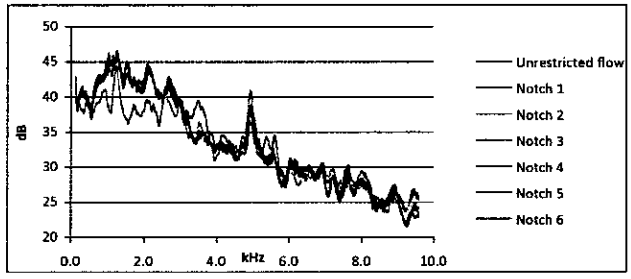

Figure 5

Sound level meter data after 100-point rolling average smoothing

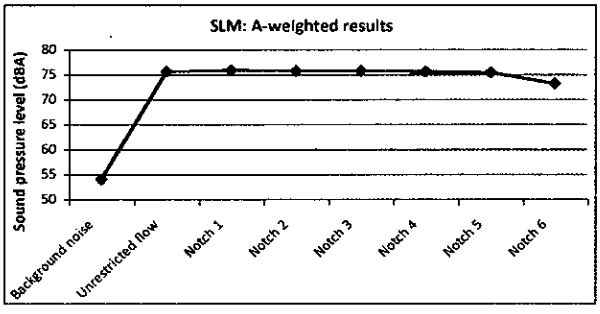

Figure 6

A-weighted data

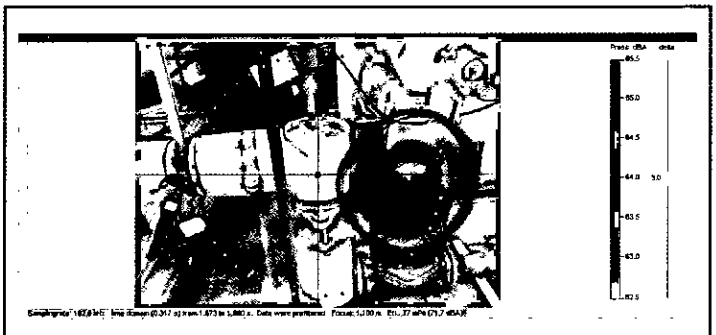

Figure 7

Acoustic camera output

Issue	sound level meter	acoustic camera	vibrometer
What is the practical frequency range of the equipment?	20Hz – 20kHz	400Hz – 20kHz (down to 100Hz using larger array)	DC – 1.5MHz
How long does a typical measurement (of the sort selected for this study) take, once equipment is set up?	under 1 minute	a few minutes	about 20 minutes
Is there any scope for determining sound power level?	no	no	no
Can level changes over time readily be captured?	no	yes	no
Can frequency information be obtained?	yes	yes	yes
Can common acoustic parameters be readily calculated?	yes	no	no
Is the equipment suitable for use in reverberant spaces?	qualitatively	qualitatively	qualitatively, or quantitatively if an ODS-based approach adopted
Typical purchase price	up to £6000	£70 000	from £50 000
Typical hire cost per day	£30	£600	£1000
How easy is it to deploy the equipment in a real environment?	very easy (hand-held)	fairly easy	fairly difficult: the system is heavy and large.
How easily could the equipment be used to identify the source of a new and unexpected noise within a complex sound field?	of little help as the user has to track down changes by ear	very easily	of little help, as the user has to track down changes by ear
Can extraneous noise elements be removed without switching off their sources?	no	yes	yes
Is the equipment able to identify the onset of a gradual physical change before that change is sufficient to be noticeable by ear (so would it be a suitable 'early warning' system)?	not in this test	not in this test	some evidence in this test
Can lower-level components be isolated from the noise field for separate investigation, without switching off the dominant source?	no	yes	yes

Table 1

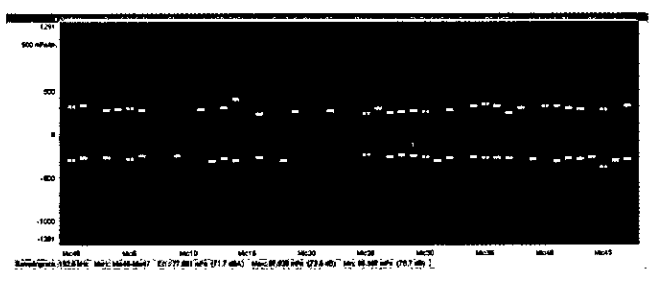

Figure 8

Separated data from acoustic camera microphones

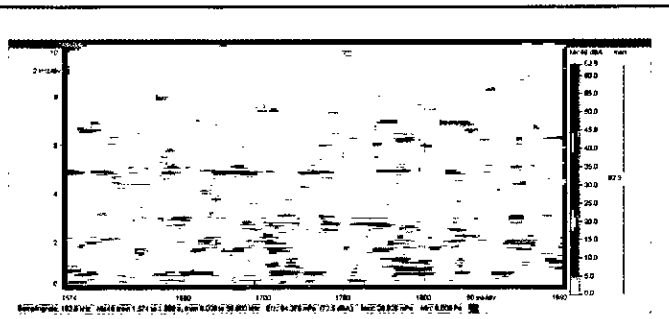

Figure 9

Acoustic camera spectrogram

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certain types of noise problem. While sound level meters remain unsurpassed for the rapid acquisition of ambient noise data and its conversion to common acoustic quantities, acoustic cameras are powerful tools for rapidly tracking down the physical locations of high-level sound sources within an ambient noise field and monitoring changes in them. Vibrometers are useful for the study of the nature of vibratory sound sources, once those sources have been located, and give results even at the lowest frequencies. Only vibrometers can give accurate values of acoustic parameters in a reverberant environment, and then only through the use of operational deflection shapes.

The authors are all with NPL.

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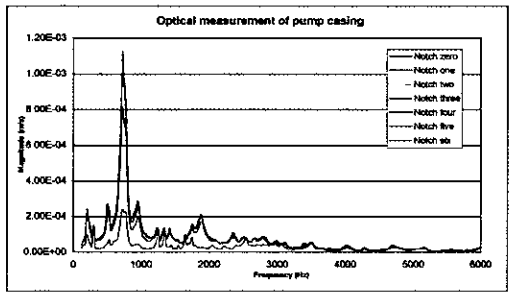

Figure 12

Vibrometer traces for different notch positions

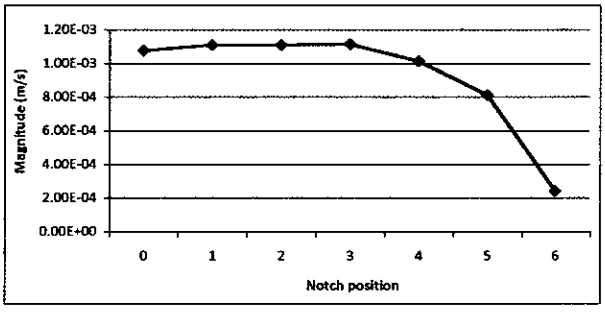

Figure 13

Declining level of 725Hz feature

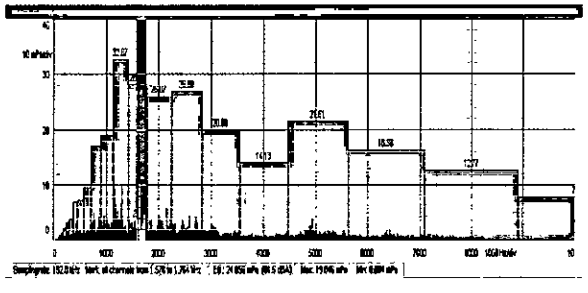

Figure 10

Isolation of frequency component

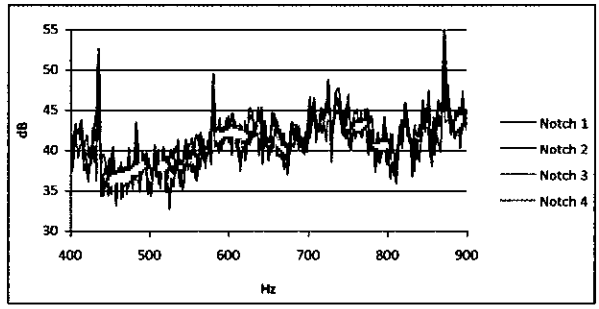

Figure 14

Low-frequency sound level meter data

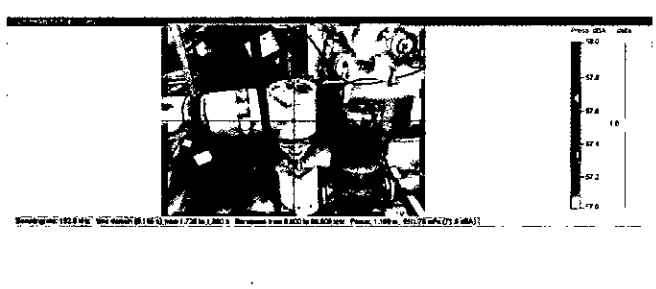

Figure 11

Image corresponding to data selection in previous figure

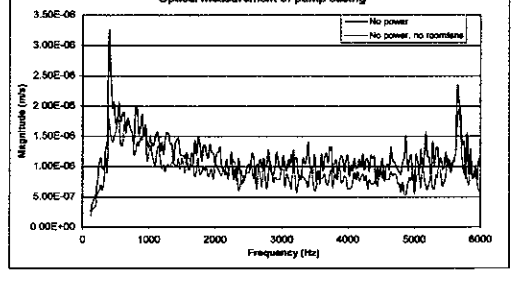

Figure 15

Vibrometer results with no flow through test pipe assembly

Acoustics of the New Theatre Auditorium (TAP) in Poitiers

D E Commins. Concert hall and opera theatre

Introduction

A new cultural centre, now called Théâtre Auditorium de Poitiers or TAP, was inaugurated on 6 September 2008. It is the home of one of the most active and prestigious French "Scènes Nationales" with a complete cultural programme which includes classical and contemporary music, opera, theatre, dance, variety and jazz. In 2000, an international competition awarded the project to the team of Portuguese architect Joao Luis Carrilho da Graça, including commins acoustics workshop as the acoustical consultant and Hervé Beaudouin as executive architect.

The building is close to the city centre on a promontory overlooking a deep valley. The Poitiers TAP includes a symphony hall with 1020 seats, a theatre and opera house with 700 seats, a foyer designed for informal concerts, and a large orchestra and opera rehearsal room.

The fact that the 2000 competition brief included two halls with distinct functions gave the architects and engineers a rare opportunity: the creation of two major rooms with different architectural and acoustical signatures.

The main elements of the programme

The architectural programme was quite detailed and some excerpts are summarised next.

Opera theatre

capacity	700 seats
uses	theatre, opera, musical theatre
mobile orchestra pit	70 m², 40 to 50 musicians
stage opening	mobile, width from 14 to 18 m, height 7 to 9 m
Volume	4500 to 5000 m³
reverberation time	1.3 to 1.4 seconds
clarity	$0 < C_{80} < 2$ dB
computer simulation	all configurations using an approved computer programme
noise level	NR20

Concert hall

capacity	900 to1100 seats, 100 to 120 musicians, chorus 120
uses	symphony, lyric, variety
stage height	0.90 m above stalls
orchestra platforms	1,20-m width, percussions 2 to 2,20-m
rigging	through the ceiling for lights, speakers and curtains
volume	11000 to 12000 m³
configurations	variable from 1100 to 600 seats, recordings
seats	row-to-row 900mm, width 550mm
morphology	intimacy between public and musicians; diffusive, non-absorptive, orchestra 'shell'; possibility of chorus 1.2m above percussion; some seats behind the orchestra; no deep balconies; good visibility for unobstructed direct sound
reverberation time	1.8 to 2.2 seconds, variability 15 to 20 %
clarity	$-2 < C_{80} < 2$ dB
computer simulation	all configurations using an approved computer program
noise levels	NR20

continued on page 34

Acoustics of the New Theatre Auditorium... - *continued from page 33*

Design and construction

The design team proposed for the competition two radically different rooms: a very sober theatre and a more spectacular concert hall. The building itself is a typical example of pure contemporary Portuguese architecture with very simple lines and generous interior volumes. A digital system projects full-size pictures and information on cultural events on whole glass façades.

Theatre opera house

The elements of the design programme, from the point of view of the acoustician, corresponded with an ideal opera house with a reasonable capacity of 700, close to the Galli-Bibiena theatres, a 4500m³ volume, a genuine orchestra pit, and up-to-date stage equipment.

The 20m width, the tilted walls, a diffusive ceiling and an absorptive back wall generate a relatively long reverberation time with good clarity. The wooden floor of the stalls is built on sleepers. The mobile 90m² orchestra pit is entirely built from timber, with some fixed and removable absorptive components: its wood floor is built on a damped resonant cavity. The design was tuned on a computer model at the competition stage.

Concert hall

The general trend today is to design multi-purpose halls with complex shapes and sloped floors to guarantee, among other things, good visibility of the stage floor - for example for dance presentations. The Poitiers concert hall would give priority to music, and so did not necessarily need inclined stalls. Looking back, it is often seen that the 'best' concert halls had horizontal floors.

The effects of the angle of slope of the stalls, and the characteristics of the ceiling, on several classical acoustical criteria were tested in various rooms: the models attempted to take into account the seat-dependent and audience-angle-dependent diffraction and absorption. An example of the results for a 'shoebox' hall with fixed volume and width appears below.

criterion	shoe-box with horizontal floor and ceiling	shoebox with tilted floor, horizontal ceiling	shoe-box with tilted floor, tilted ceiling
TR_{Eyring}	1.78s	1.77s	1.58s
EDT	2.06s	4.85s	4.70s
D_{50}	31.8%	79.4%	83.0%
C_{80}	-0.2dB	6.1	7.0dB
LEF	36.2%	3.7%	13.5%
T_s	137ms	87.1ms	72.5ms
SPL	65.8dB	57.2	57.1dB
G_{10}	6.8dB	-1.8dB	1.9dB

Since the simulation showed a better combination of values for a horizontal floor and ceiling, this principle was adopted and, once the usual general parameters such as specific volume, acoustical width, height and length were set, the design concentrated on the detailed shape and on the location and nature of the diffusive components. For such a prestigious concert hall, these could not be picked 'off the shelf'.

The optimisation of the model led to the following decisions:

- maximum width: 21m
- maximum distance between stage and seat: 33m
- average height: 13m
- acoustical volume: 10500m³
- diffusive ceiling, hidden rigging, transverse mobile bridge over full length
- diffusive and tilted sides
- trapezoidal diffusive stage
- continuous wood floor on a damped plenum, from stage to last row
- flat stalls, except for the last four rows
- concert seats, removable
- large number of diffusive lateral doors

continued on page 36

Figure 1

General view of TAP

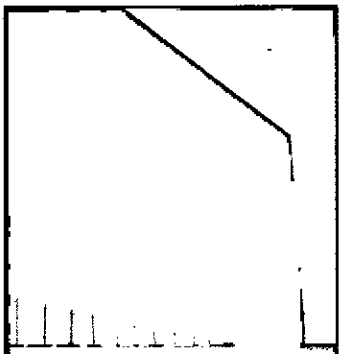

Figure 2

Facade screens

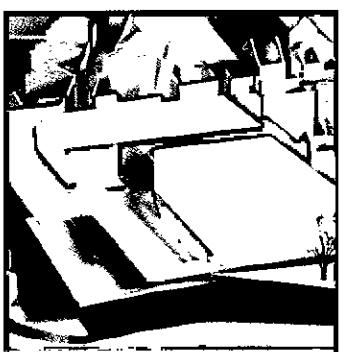

Figure 3

Architectural model

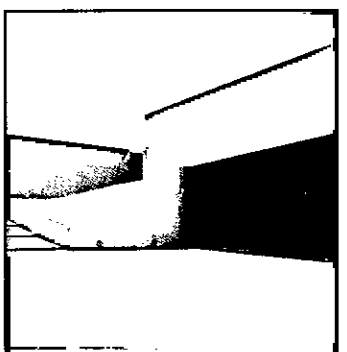

Figure 4

Lateral view

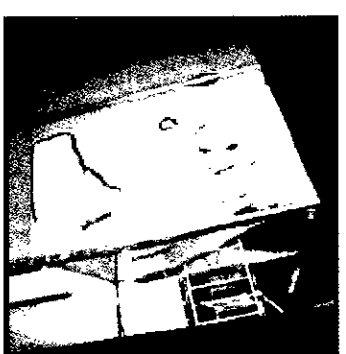

Figure 5

Projection on façade

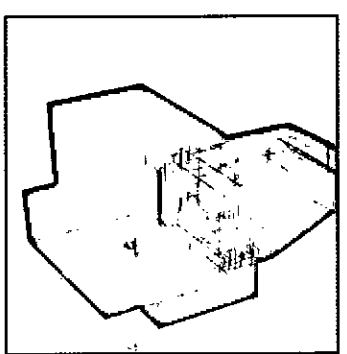

Figure 6

Computer model

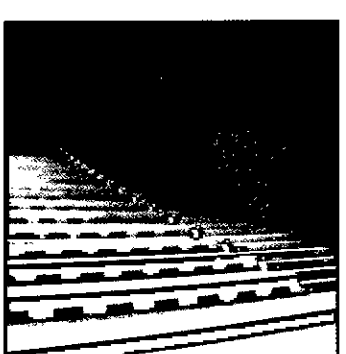

Figure 7

Interior views (under construction)

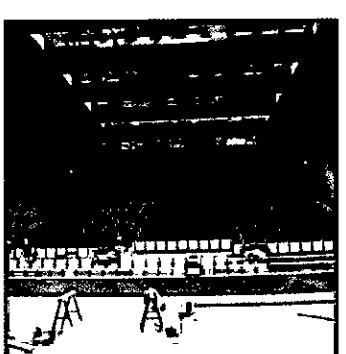

Figure 8

Interior views (under construction)

"Silence is always more profound where there was once noise"

Alfred Wainwright

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BUREAU VERITAS 1828

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Move Forward with Confidence

Acoustics of the New Theatre Auditorium... - *continued from page 34*

To optimise diffusion, to limit absorption and to avoid classical diffuser patterns, experiments were conducted on the design of innovative diffusers. The diffusers were built from wood of various thickness and damping characteristics: the lights, rigging, fire detectors and the rails of the movable bridge are inserted in gaps to minimise the acoustical and architectural impact of the metallic components.

The lower side walls have similar diffusers, with different dimensions and the upper side walls are mostly reflective.

The numerous side doors can be opened simultaneously allowing the entire audience to evacuate the hall in less than one minute. Since the seats can be removed, stand-up concerts may also be staged: with the doors opened, a large informal concert space can be created.

The shape of the room, the lack of rake to the stalls, and the multiple door system makes it possible to reduce the room capacity by hanging a transverse curtain or gauze from the movable bridge. Since this bridge can be positioned anywhere, the number of seats can actually vary from 0 to 1021. This same system can be used to transform the concert hall into a genuine recording studio with the orchestra on stage or at the centre of the main floor. For variety programmes, additional absorptive curtains can be hung from the ceiling. Figure 16 shows some results for a 600-seat configuration.

Objective results for the concert hall

Measurements were performed at the end of the construction phase in the empty hall with about 80% of the seats in place, in the 'symphony' configuration. The objective results were as expected.

The main results are given in Figure 18.

Intelligibility is fair, as expected, with STI and RASTI at 0.50 and ALC at 11%. The bass ratio BR is 0.9. The average reverberation time curve is reproduced in Figure 19.

The response and associated parameter values vary little across the room. Figure 20 shows superposed and shifted responses for the first and last rows.

"Concert" foyer

The foyer is designed as an 'open' concert hall with its adequate asymmetrical shape, dimensions and materials, a wooden floor on a plenum, a continuous absorptive ceiling, and minimal rigging equipment. It can therefore be used as a normal foyer but also as an informal performance space.

Rehearsal rooms

The building includes a number of rehearsal spaces including a large orchestral and operatic rehearsal room.

Since in the main rehearsal room (called 'Grand Plateau de Travail') some low-cost acoustical flexibility was required, in order that the reverberation time and intelligibility could be adjustable, the plan is slightly asymmetrical, the ceiling is diffusive and two of the side walls have wood panels with a 0.5m plenum, that can rotate 360° on a vertical axis.

The thick, double-sided panels, reflective on one side, absorptive on the other, can be adjusted by hand to any position.

The reverberation time can be adjusted at will from 1.8 to 1.1 seconds over a wide frequency range.

Openning programme

Open-door multi-disciplinary festivities took place on 6 September 2008. The programme included dance, theatre and classical music with, among others, Philippe Herreweghe and l'Orchestre des Champs-Elysées, 'contemporary' classical music with Ars Nova, variety, and jazz.

continued on page 38

concert hall	total number of seats (number in stalls)	horizontal length of stalls, m	height of stage above stalls, m	comments
Amsterdam, Concertgebouw	2206 (1366)	26	1.40	orchestra risers
Basel, Stadt Casino	1400 (990)	22	1	orchestra risers
Berlin, Konzerthaus	1575 (768 + chorus 116)	22.5	0.90	orchestra risers
Bonn, Beethovenhalle	1407 (1030)	29	1.2	no risers
Boston Symphony Hall	2631 (1486)	35 (+ 9m sloped)	1.1	few risers
Glasgow, St.Andrew's Hall	2133 (1060)	27	1.5	no risers
Leipzig, Neues Gewandhaus	1560 (966)	33	1	destroyed in WWII
München, Herkules Saal	1287 (853)	31	1	orchestra risers
Paris, Cité de la Musique	1100 (variable)	20	1	orchestra risers
Stuttgart, Liederhalle	2000 (1175)	43	1	orchestra risers
Wien, Musikvereinsaal	1680 (1032)	24.5 (+ 4.5 m sloped)	1.20	orchestra risers
Zurich, Tonhalle	1546 (925)	30	0.90	horizontal ceiling

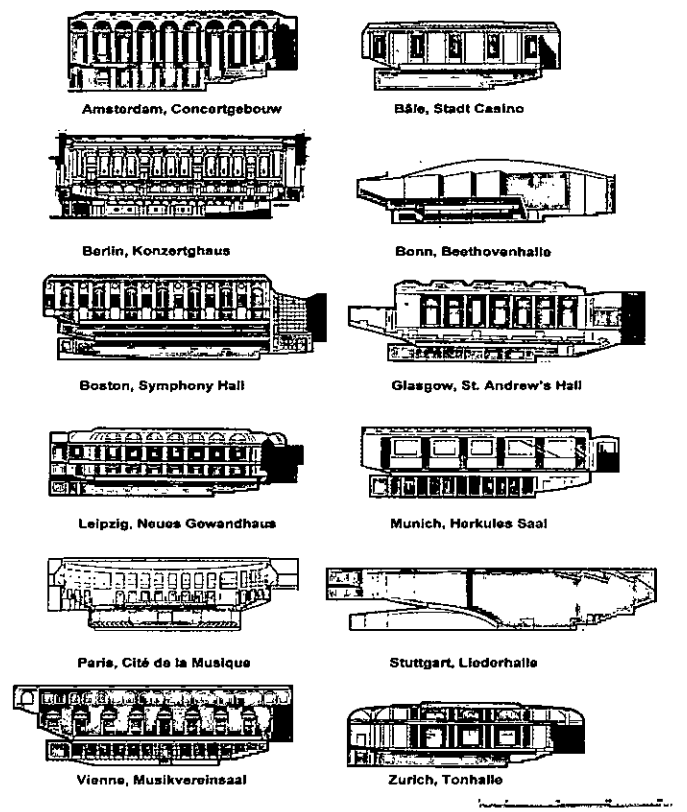


Figure 9

Longitudinal sections of 'horizontal' halls

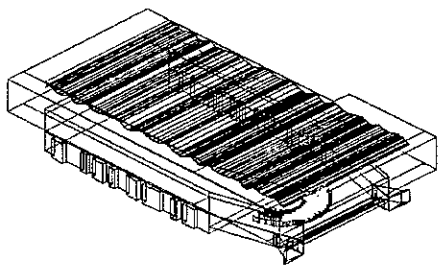


Figure 10

3D view of computer model

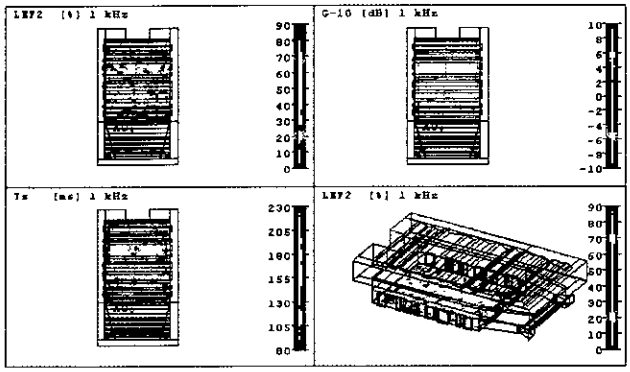


Figure 11

Example of computer output

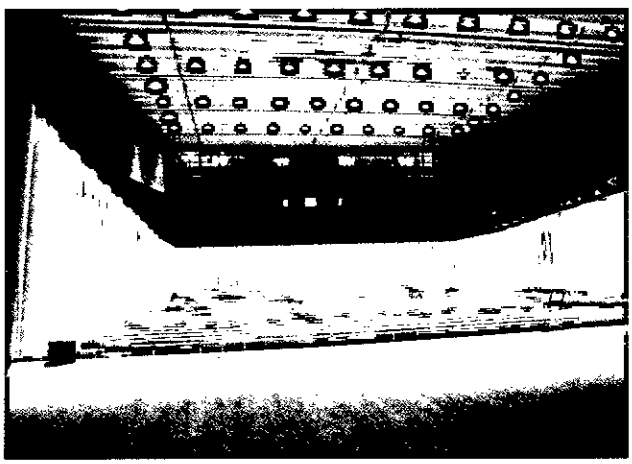


Figure 12

View from stage

Figure 13

Views of stage, ceiling and diffusive doors at end of construction

Figure 14

Views of stage and side diffusers (under construction)

Figure 15

View of side wall with diffusive doors opened

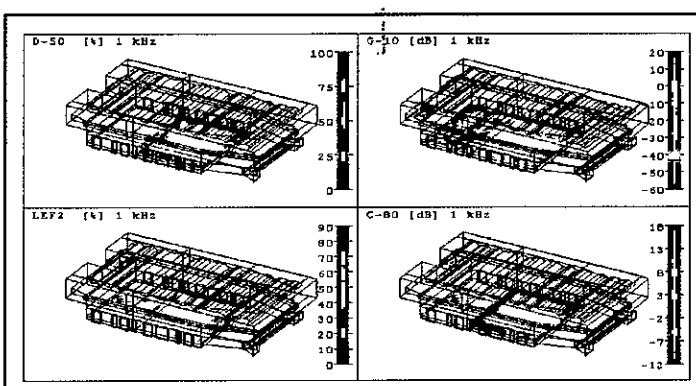


Figure 16

Computer simulation in the chamber music configuration for 600-seats

Acoustics of the New Theatre Auditorium... - *continued from page 36*

The programme was designed as a test for the main performance spaces but also to demonstrate that cultural events of all types could be held throughout the building.

Comments on the acoustics of the concert hall have been very positive: 'It is a formidable concert hall' (Ministry of Culture); 'Pure and fluid sound without any distortion, always perfectly audible, without excess from high to low frequencies. Excellence in acoustics!' (Sacem); 'This exceptional concert hall is the best in France and, most likely, the best in Europe; I wish we could have such concert halls in Belgium and elsewhere in Europe' (Philippe Herreweghe); 'Unparalleled acoustics' (Agence France Presse).

The rich and diversified music programs will moderate or confirm these early assessments.

D E Commins is with commins acoustics workshop, Paris, France, email d.commins@comminsacoustics.com

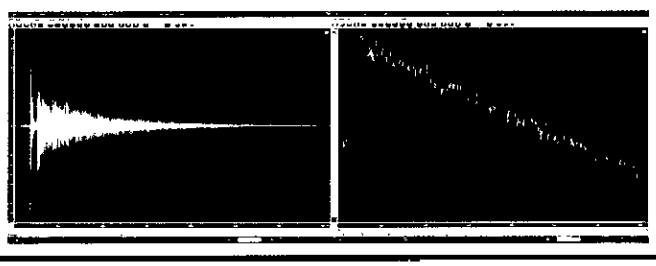


Figure 17

Typical impulse response and energy-time curve

Frequency Octave bands (Hz)	125	250	500	1000	2000	4000	8000
EDT [s]	2.205	2.197	2.054	2.015	1.675	1.622	1.329
T20 [s]	1.761	1.705	1.858	2.017	1.910	1.650	1.392
T30 [s]	1.864	1.667	1.990	2.040	1.821	1.664	1.441
RT [s]	1.761	1.667	1.990	2.040	1.910	1.664	1.441
Ts [ms]	184.2	153.8	158.5	150.5	87.7	83.5	83.7
C80 [dB]	-3.53	-2.32	-1.52	-1.54	2.22	2.14	3.35
D50	0.21	0.30	0.26	0.29	0.56	0.53	0.55
MTI	0.40	0.44	0.42	0.41	0.55	0.56	0.56
LF	0.17	0.27	0.33	0.32	0.18	0.25	0.48

Figure 18

Main acoustical results for hall in 'symphony' configuration

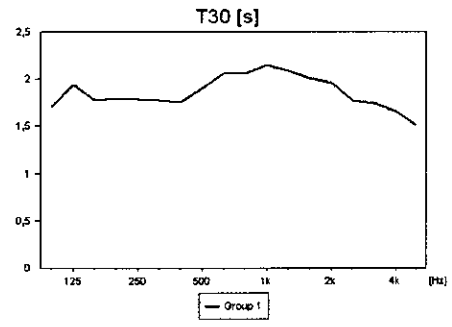


Figure 19

Average reverberation time in third-octave bands: stalls with 80% of seats in place and hall empty

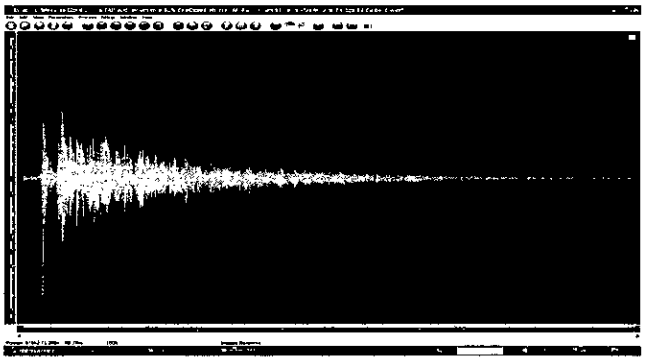


Figure 20

Shifted impulse response overlay for first row (yellow) and last row (blue)

Figure 21

Foyer (under construction)

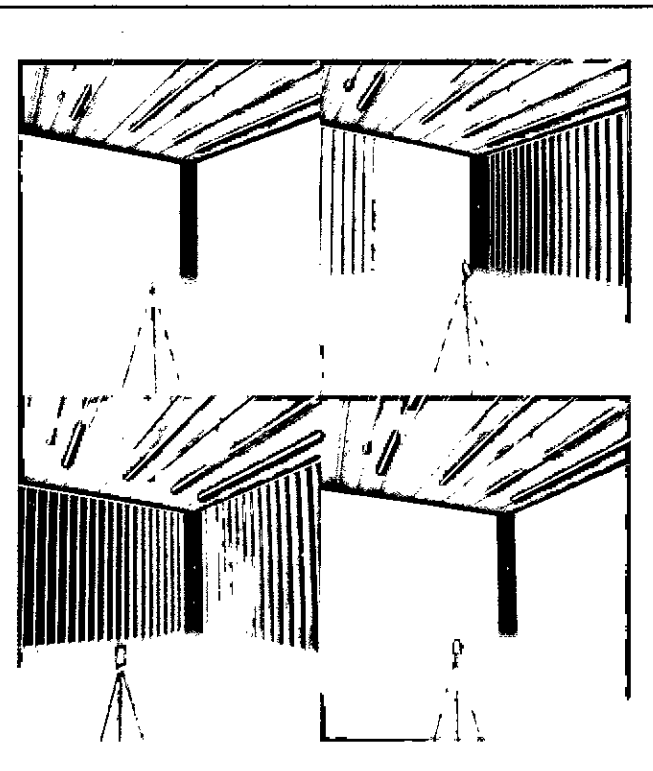


Figure 22

Grand Plateau de Travail with panel angles of 0°(reflective), 22.5°, 90°, and 180° (absorptive)

Gas pipeline noise control

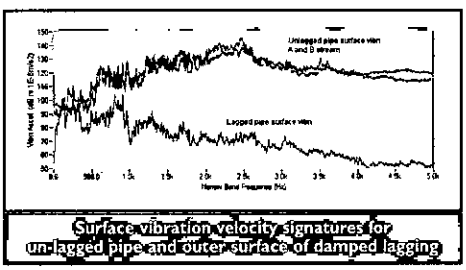
Sound Dead Steel reduced A-weighted noise level by 16dB

The noise levels from a power station were considered to be too close to the maximum allowed under their environmental noise planning conditions. Detailed diagnosis by the Industrial Noise and Vibration Centre (INVC) proved that the dominant contribution at most off-site locations was high frequency noise (above 500Hz) radiated by the gas reception facility. Vibration measurements narrowed down the source to the reducer, expander and associated valve section of the facility. The main pipework was 400mm diameter, with a reduction to 150mm at the metering section. Measurements with a microphone close to the pipework indicated levels as high as 110dB(A).

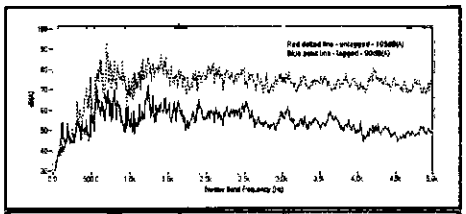
Sound Dead Steel was brought in to assist with a noise reduction programme, including the fabrication of a high-performance acoustic lagging, incorporating an outer skin constructed from the highly damped Sonphonon sound dead steel, and including split boxes over valves. This design is very tolerant of installation practicalities as it ensures that any short circuits between vibrating components and the outer skin have a minimal effect on the attenuation. Consequently, this design provides a more reliable acoustic performance than conventional lagging.

The effect of the treatment was to reduce the A-weighted levels from this source by 16dB adjacent to the metering flow meter area, and occupational noise levels in the GRF compound were reduced by an average of 8dB. It was noted that noise from adjacent cooling fans disguised the full benefit of the Sound Dead Steel equipment.

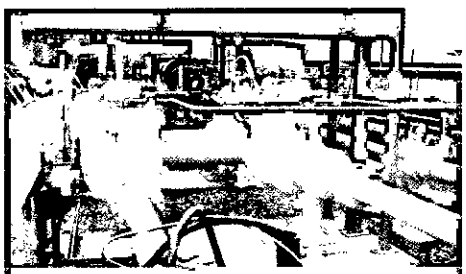
Sound Dead Steel is a division of Renown Engineering Ltd, Cramlington, Northumberland, NE23 7RH
tel **0191 250 0900**.



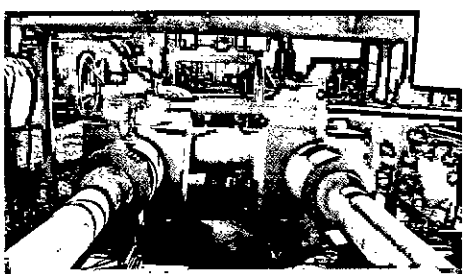
Surface vibration velocity signatures for un-lagged pipe and outer surface of damped lagging



Close microphone signatures on lagged and un-lagged pipework



Facility before lagging treatment



Facility after lagging treatment

Market traders hit with shout ban

Shouting traders in Northumberland told to 'keep the noise down'

Market traders in Northumberland have been told to keep the noise down.

Stallholders have gathered in Hexham since 1239 to sell their wares at traditional open markets.

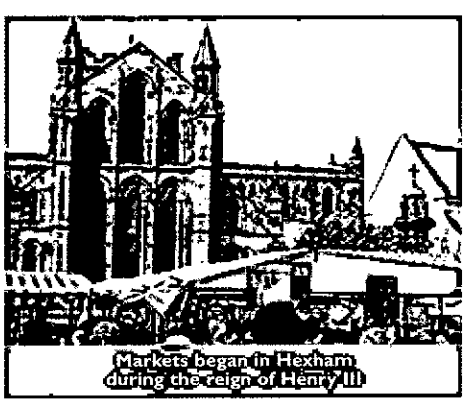
But Tynedale Council has told traders to turn down the volume after complaints from some town centre firms. Stallholders have condemned the move as 'absolutely ridiculous' and warned that their takings may suffer.

Council officials acted after three firms in Hexham's market square clamed they could not conduct meetings because of the shouts of sellers. Markets are held in the town six days a week, with the most popular days being Tuesdays and Saturdays. Philip Hindmarsh, head of waste and transport management at Tynedale Council, said that after receiving complaints from nearby businesses about the level of noise from market traders at particular times, it was felt that the operators had to officially asked if they would tone this down. It should be stressed that calling out was, of course, part of the standard practice on markets, but the council agreed with people working in the area that on some occasions it had gone beyond what was felt to be reasonable.

The traders were spoken to directly on a number of occasions before the letter went out to them. Nobody was being asked to stop calling, but they were requested to reduce the volume and frequency of the calling.

Carolyn Ridley runs a fish stall in the market and claimed that the stance was 'absolutely ridiculous'. She pointed out that shouting was part of the colour and vibrancy of markets and created a great deal of jollity and banter. It was not an offensive activity and perhaps the complainant firms should have thought about the location of their premises before it was too late.

[Isn't it part of the soundscape? – Ed.]



Markets began in Hexham during the reign of Henry III

Lorient

Lead role at the Young Vic theatre

A combination of Lorient's acoustic, smoke and fire seals has been installed in one of London's most loved and unique theatrical venues, the Young Vic. Theatre specialists Hawarth Tompkins completed the rebuilding project 2007, creating an informal, unique space while maintaining its *ad hoc* ambience.

The Young Vic required the doors to achieve an acoustical rating of 35dB R_w, both to enable the sound in the auditorium to be amplified without disturbing the rest of the building, and also to prevent noise from the outside disturbing performances. The high-performance acoustic doors were fitted with an integrated sealing system, incorporating Lorient's acoustic and smoke perimeter seal - the curved fin batwing® - a plain fire seal and the IS8010 si automatic threshold seal. This selection of Lorient seals was also installed throughout the rehearsal areas, changing rooms and around the public spaces, pproviding an effective, practical solution for acoustic insulation, smoke control and fire containment, to meet the requirements of Approved Documents E and B.

However, the need for access for all, covered by Approved Document M, demands that many doors have minimum operating forces to enable doors to be easily used. With 100,000 people, young and old, passing through the Young Vic each year, it was vital to fit a sealing system that did not impede the door's smooth operation. The Lorient seals provide exceptionally low frictional resistance to everyday opening and closing forces to help the doors meet Document M requirements.

Lorient's integrated approach, which the company calls its Threedom® concept, provides a straightforward solution to enable the requirements of all three Approved Documents to be met, and offers complete peace of mind for specifiers, installers and clients.

Lorient Polyproducts Ltd, Newton Abbot TQ12 6UD
Tel: **01626 834252** email: **abinmore@lorientuk.com**

The Young Vic's front doors are designed for an R_w of 35dB

Soundguard Acoustics Ltd

NoiseMeters Equipment at Notting Hill Carnival 2008

Soundguard Acoustics Ltd was contracted to undertake the first Control of Noise at Work risk assessment for this year's London Notting Hill Carnival and selected NoiseMeters Ltd to provide the noise monitoring instruments.

London Notting Hill Carnival has existed since 1965 and now, in its 44th year, has grown to become the largest street festival in Europe. Carnival provides an annual reminder that music, good times and dancing will bring over 1.5 million people together in a defining moment of multiculturism. The traditional Caribbean roots of the Trinidadian and Barbadian communities is voiced by the music of steelpan and drums, sitting alongside the Jamaican sound systems which arrived in the 1970s. Stacks of battered speakers and amplifiers have become one of the quintessential images of Notting Hill Carnival, the noise levels of which are possibly only outdone by the parade route and the thousands of masquerades.

NoiseMeters provided 30 Cirrus CR:110A Dosebadges, two RC:110A Dosebadge readers, and three Cirrus Type 1 integrating sound level meters to support the Cirrus equipment already in use by Soundguard. Rob Shaddick is director of Soundguard Acoustics and said that because the company already used Cirrus equipment, they were confident in hiring further units to fulfil this contract. NoiseMeters was able to provide the quantity of equipment required and was very supportive. The correspondence was professional, the equipment arrived on time and the whole service represented excellent value for money.

Working with the London Notting Hill Carnival Ltd, the London Metropolitan Police and the Royal Borough of Kensington and Chelsea, the Soundguard consultants formulated a plan that would reveal the likely noise doses of carnival marshals, judges, security and traders as well as the levels of noise at policing locations, first aid points, and entry points to the carnival route. In addition the sound level outputs of the passing floats, background levels, noise mapping and a complete assessment of all 40 static sound systems were studied.

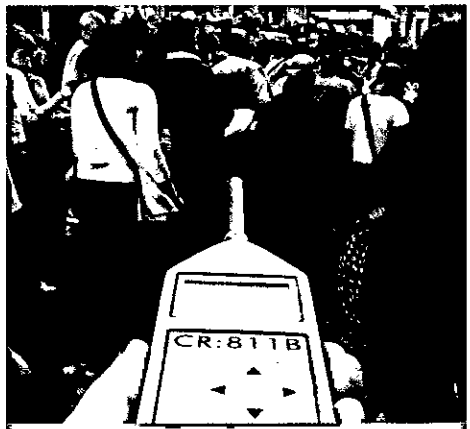
After the contract Rob Shaddick reported that the Dosebadges and sound level meters had been terrific, and the consultants had been happy and confident in using the equipment. The way in which the equipment was arranged and delivered in a short time scale had been excellent. The approach from the outset had been to maintain the vibrant and noisy tradition of Carnival, whilst reducing the noise exposure risk of those working on it, a challenge in itself. The same team and methods would be fundamental in the planning of next year's Notting Hill Carnival.

Contact details

NoiseMeters: Andrew Snell
Tel: 0845 680 0312
Email: ams@noisemeters.co.uk
www.noisemeters.co.uk
Soundguard Acoustics: Rob Shaddick
Tel: 01237 478142
Email: info@soundguard.co.uk
www.soundguard.co.uk

The team prepares the sound level meters

Dosebadges ready for deployment



Yes, it is switched on - it's just the camera angle!

IAC

Donates acoustic louvres to charity hospital ship

World leader in noise and acoustic control products IAC has donated six Noishield acoustic louvres for the children's play area onboard the *Africa Mercy*, the world's largest charity ship. Currently in Liberia, the ship provides free health care to the people of Africa. Young patients, as well as the children of the volunteer crew, will benefit from IAC's generous donation.

Being a global company, founded in 1949, IAC offers solutions to a wide range of noise pollution and sound quality problems. A number of naval fleets, besides the Queen Mary 2, have been supplied with noise control silencers and louvres.

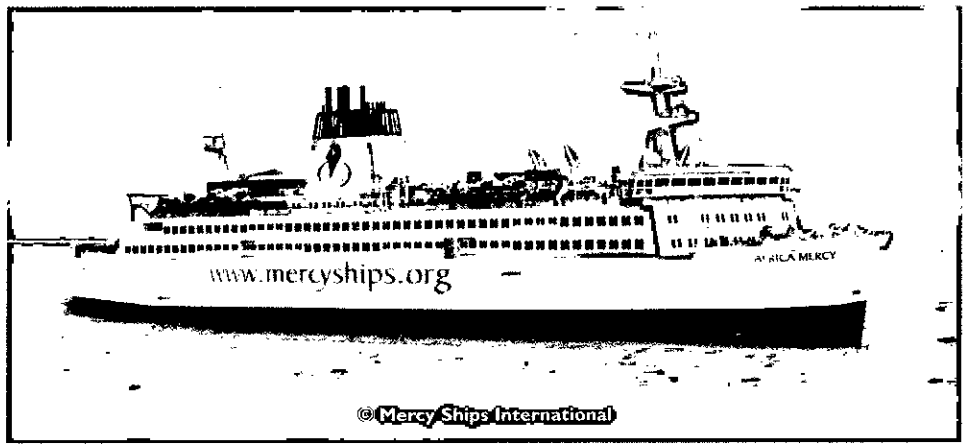
Gary Dawson, business manager for building services said that learning of the work that Mercy Ships did and the lives that they transform, the company wanted to be able to help and contribute to their truly inspiring work. They had the tools, knowledge and products to provide quality solutions to noise pollution and were delighted that the children on board the *Africa Mercy* would have a quieter and safer play area as a result.

Judy Polkinhorn, executive director of Mercy Ships UK, expressed her gratitude for kind donation from IAC. It was their paramount concern to ensure that the patients on board were as comfortable as possible. Many children who had been treated had undergone traumatic life-changing surgery, so ensuring that they had a safe and peaceful environment to play was of great importance. Donations like this meant a lot to the crew. The dedicated team of volunteers - including nurses, doctors, surgeons and engineers - gave up their time to help those less fortunate than themselves and, coupled with the support of donor companies, Mercy Ships really made a difference in Africa.

Over the last 30 years, Mercy Ships has worked in over 70 countries providing services valued at more than £350million. The charity has treated more than 230,000 people in village medical clinics, performed more than 35,000 surgeries and 190,000 dental treatments, and completed over 950 construction and agriculture projects, including schools, clinics, orphanages and water wells.

IAC manufactures and supplies noise control products to six market sectors world wide including the manufacturing and process industries; power industry, construction and audiology and the company's expertise and experience is world-class.

www.industrialacoustics.com/uk



Acoustic roof for Brest Airport

Pittsburg Corning

Independent acoustic tests have highlighted that a good sound reduction index R (dB) can be achieved at both low and high frequencies using Foamglas® Compact acoustic roofs on metal decks.

Low frequency noise is particularly difficult to control because of the wavelength and level of energy in the sound wave. Achieving a high sound reduction index R at low frequencies requires high mass, stiffness and isolation. This is provided by the use of the Foamglas Compact roof, which includes high-density insulation, bituminous membranes to provide both mass and isolation, and a fully bonded system to provide additional stiffness to the deck.

The insulating material is impervious to water and water vapour and the unique properties of a fully sealed Compact roof, mean that is acts as both an insulant and a vapour barrier. This capability means that a roof can also be designed to give good sound absorption with a low condensation risk when used in combination with a perforated deck and mineral wool infills. This type of roof construction is ideal for airports, sports halls, swimming pool and classrooms where the sound break-in and breakout need to be controlled together with the build up of reverberant sound within the space.

Such an acoustic roof with enhanced performance at low frequency was specified for a major infrastructure airport project in Brest, France. The build up of the main roof consisted of a zinc architectural metal roof on a single layer, high performance bitumen membrane, and included various plant room roofs with two layers of a high-performance bitumen membrane system. Both finishes were bonded to two layers of Foamglas with a further layer of bitumen membrane between the insulation layers providing extra mass and isolation. The foamed glass insulation was bonded directly onto the crowns of a perforated metal deck, having 15% perforation with mineral wool trapezoidal infills. The build up achieved a weighted sound reduction index R_w (C; C_{tr}) of 42 (-1; -5) dB.

Foamglas insulation was selected for a number of other properties because of its ability to be installed on the curved profile of the Brest Airport extension.

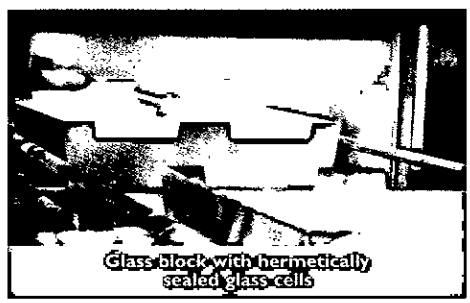
Firstly, the client required a guarantee of the durability of the roof system. Being a glass block which contains millions of hermetically sealed glass cells, the insulation consists of 67% post-consumer waste glass, silica sand and other elements. Foamglas is impervious to water and water vapour and because of this unique characteristic will remain dry and maintain its full thermal performance for the lifetime of the building. In addition, it provides an additional waterproofing layer. When combined with a bituminous membrane and zinc standing seam there is a total of three waterproof layers making it an extremely durable roof system.

Secondly, the material is easy to cut and shape on site, and was supplied pre-tapered allowing the contractor to form the complex form of the roof. This is curved in several directions, architecturally mimicking the shape of an aeroplane wing.

Often a flat roof will be used to mount mechanical and electrical plant and equipment. Foamglas has a high compressive strength ranging from 700kN/m² to 1700kN/m² and can easily support the weight of mechanical and electrical plant and the structural base which can be laid directly on the insulated roof without the need for supports through to the structural deck. The completed roof system is highly robust and is suitable for balconies and other areas of the roof subject to foot traffic. The light gauge metal supporting deck is considerably stiffened and the finished roof has the feel and appearance of a solid concrete roof deck.

Finally, the insulation is non-combustible and achieves Euro Class A1, meaning should a fire occur the insulant does not burn, support combustion or give off toxic fumes, but actually acts to retard the spread of fire.

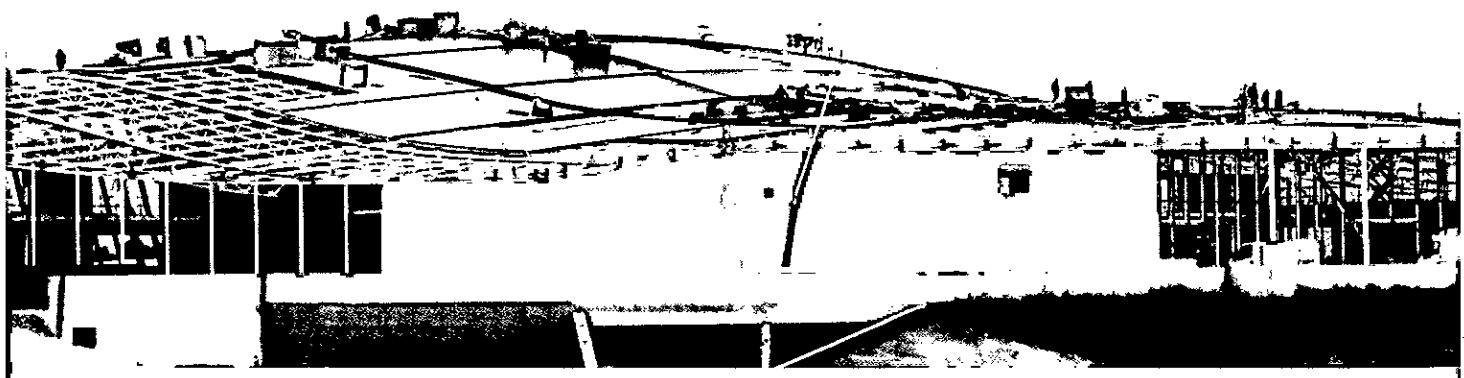
The product is easy to cut to shape on site



Glass block with hermetically sealed glass cells

High density insulation with a single ply membrane on a metal deck is often used as a bench mark for acoustic roofs for an airport, sports halls and similar buildings. However, independent acoustic tests carried out on behalf of Pittsburgh Corning demonstrate that a Foamglas Compact acoustic roof can provide an improvement over other systems using high density insulations at the difficult low frequencies, without the need to include acoustic membranes or an overlay of a cement.

Ken Francis is technical manger with Pittsburgh Corning **Tel: 0118 950 0655**
www.foamglas.co.uk



The curved profile of the roof under construction

Parliamentary reports

From Hansard

Commons Written Answers

22 July 2008: Antisocial Behaviour Act 2003

Mr Ruffley: To ask the Secretary of State for the Home Department how many prosecutions under the Antisocial Behaviour Act 2003 there have been for noise in each local authority and each police authority, broken down by basic command unit, in each region of England and Wales since January 2008.

Maria Eagle: I have been asked to respond. The information requested covering the number of defendants proceeded against at magistrates' courts for noise in England and Wales for 2006 by police force area and region, are shown below. It is not possible to separately identify prosecutions taking place in local authority area and basic command units within police force areas in England and Wales from the information reported to the Ministry of Justice.

There were two prosecutions under the Noise Act 1996 in the East of England (Bedfordshire Police), and five in London (Metropolitan Police), making seven successful prosecutions in all. In all, there were 2950 prosecutions under the Antisocial Behaviour Act, the great majority being for depositing litter. Court proceedings data for 2007 will be available in the winter of 2008, and data for 2008 will be available in the winter of 2009.

1 September 2008: Antisocial Behaviour

Mrs Riordan: To ask the Secretary of State for the Home Department what recent steps she has taken to address antisocial behaviour in local communities; and if she will make a statement.

Mr Coaker: Since April 2008, there has been a neighbourhood policing team in every area. These teams are now increasing their focus on working with local communities to identify and tackle local problems together, while continuing to provide high visibility policing, reducing antisocial behaviour and the fear of crime.

We have provided practitioners with a wide range of tools and powers to tackle antisocial behaviour, issued guidance on their use through a practitioner website and set up a free telephone advice line to provide specific support on individual problems. It is for local agencies to decide on the most appropriate interventions to tackle antisocial behaviour based on their knowledge of what works best locally.

Julia Goldsworthy: To ask the Secretary of State for the Home Department what regulations govern the use of ultra-sonic youth deterrent devices.

Mr Coaker: There are no regulations that govern the use of ultra-sonic deterrent devices. However, the prolonged exposure to the noise emitted by a device may be a statutory nuisance. If an environmental health officer took the view that it affected the occupants of a property, action could be taken against the owner of the noise emitter. Inappropriate use of the device may also be classed as a harassment offence under the Public Order Act 1986 or the Protection from Harassment Act 1997.

Sound of thunder sponsorship

raising awareness outside the factory

Castle Group Ltd, the technical safety specialists, is sponsoring motorcycle racer Nick Gledhill of Dawtune motorcycles, who is riding a Honda 125cc in the British Thundersport championship this season. In the early stages of the championship, Nick showed great potential by getting 9th and 5th place results under his belt, one of them after starting 23rd on the grid.

Motorcyle racing, with sounds reaching in excess of 130dB and plenty of hazardous substances from brake fluid to exhaust fumes, provides more than enough reason to be worried about the health and safety of both the riders and their teams.

Simon Bull, managing director of Castle Group says that managers do what they can to protect employees during working hours, but it was time that awareness was raised of the damage they could be doing outside work in these potentially dangerous sports. He measured the noise at the event with a GA215 pocket sound meter and found peak readings of over 124dB, and average noise levels well in excess of the limit value of the Control of Noise at Work Regulations.

Having operated since 1971, technical health, safety and environmental specialist Castle Group provides a formidable range of products and services covering noise, vibration, audiometry, air sampling, gas detection, and particulate monitoring. Castle offers a wide range of products alongside professional competence training courses, equipment rental, consultancy and calibration services.

For Further information contact Michelle Uprichard on **01753 858063**,
email: **mu@bulluk.co.uk**
Web site: **www.castlegroup.co.uk**

Nick Gledhill in action

Letter

I was interested to see that the IOA criticised the National Air Traffic Services for their presentation of A-weighted decibel measurements. The IOA recommended 'dB(A)' as correct usage, but I was recently criticised for using this very form, and when I checked up, I had to agree with my critics. The NIST web site, which provides a reference to SI nomenclature, states clearly that 'unit symbols (or names) are not modified by the addition of subscripts or other information'. Although the decibel is not an SI unit, it is accepted for use in conjunction with SI units and one would expect it to be treated in the same way as they are. Besides NIST, the IEC and the AES take the same view.

This has been the official view for some years, so it is no use saying that the logic behind the ruling has already been fatally compromised. True, there is no such thing as an A-weighted decibel - the difference is not in the decibel but in what is measured - but there does already exist a different sort of decibel to describe such quantities as R_w, which cannot be converted to nepers like 'proper' decibels. It will equally be pointless to argue that statements such as 'the sound level was $L_A = x$ dB' seem very awkward. We must have and follow standards bodies, even though I sometimes wonder if their most important function might be to remind us that complete logicality and consistency is not achievable in human affairs. So I said goodbye to the dB(A) about 18 months ago, and I can report that life goes on.

Tony Woolf
Tony Woolf Acoustics, London NW6 3JP

New faces at RPS Group Plc

R W Gregory and Partners acquired by RPS

The combined acoustics capabilities of the RPS Group Plc increased significantly when R W Gregory joined RPS in March; this was following the acquisition of R W Gregory by RPS Planning & Development. Seven members of the Institute of Acoustics plus three technicians has boosted the RPS Acoustics team strength to 29 - one of the largest in the UK.

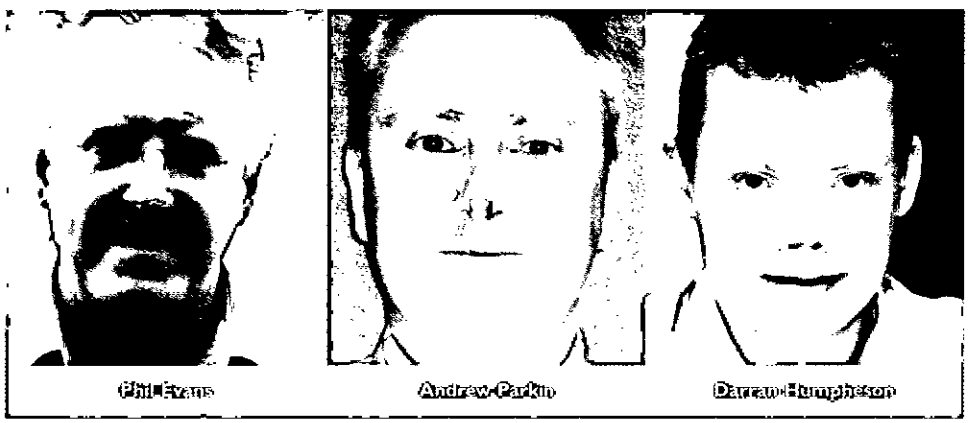
The RPS Gregory office network and acoustics team based in Birmingham, linking in with the RPS offices and acoustics teams in Brighton, Manchester and Belfast, will facilitate efficient acoustics consultancy coverage across a wide geographical area, allowing clients to access our expertise from offices in their regions. Each of the teams offers advice on environmental noise and vibration, building acoustics and occupational noise and vibration, and is able to call on the resources of the other offices as required, for site surveys and acoustic testing. Local knowledge, backed by the international reputation and strength of the RPS Group, will enhance our ability to grow our business by working together as a large team led by experts acknowledged to be amongst the best in their sectors.

Each RPS Acoustics office will continue to provide its clients with a focused professional service, but now supported by the additional resources of other offices, and of the RPS Group, according to the needs of our clients. This may involve organising for a survey to be carried out by a local office to reduce travel time, costs and emissions, or assembling a specialist team from different offices according to the project needs.

With a wide client and skills base, RPS Acoustics continues to have a healthy order book, with projects in a diverse range of sectors, including: Crossrail, redevelopment of the NEC Arena, the new extension to the Tate Modern, several BSF programmes and a multitude of other education projects, in addition to the design, testing and construction noise monitoring for large-scale urban regeneration projects (including Park Central in Birmingham, Wembley Village in London, the Olympic Village in Stratford City and Ellesmere Port). RPS Acoustics is looking to expand further to compliment its ever-expanding workload and carry on meeting client requirements.

RPS Acoustics offers sound insulation testing to both UKAS and ANC accredited schemes and is a Sponsor Member of the Institute of Acoustics.

For further information on projects or careers, please contact any of the following:
Brighton - **Phil Evans** (evansp@rpsgroup.com) or **Simon Kahn** (simon.kahn@rpsgroup.com)
Birmingham - **Andrew Parkin** (andrew.parkin@rpsgroup.com)
Manchester - **Darran Humpheson** (humphesond@rpsgroup.com)
Belfast - **Stephen Cleary** (clearys@rpsgroup.com)



Capita Symonds

Appoints Susan Witterick

Capita Symonds' acoustics team has appointed Susan Witterick as senior acoustic consultant.

Susan joins from Applied Acoustic Design and has over 10 years' experience covering a variety of acoustical disciplines and project types. She has recently specialised in acoustical design for offices and schools and also has significant experience in HVAC noise control, having recently desiged teaching, recording and performance spaces at the Cork School of Music.

Susan has also worked extensively on environmental noise projects including the Eastern Quarry development in Kent, the M50 motorway widening and expansion in Dublin, and transportation noise issues at Los Angeles International Airport and the Getty Museum, Los Angeles.

Dr Rukhsana Adam, director of acoustics and air quality is delighted to welcome Susan to the team, where her experience in large architectural and environmental schemes would help to build both the internal client base within Capita's design and infrastructure divisions and external clients such as Balfour Beatty and Kier.

As well as her acoustic expertise Susan has a keen interest in Cornish history and genealogy, and has an MA in Cornish studies.

Capita Symonds is one of the UK's largest and most diverse multidisciplinary consultancies operating in the building design, civil engineering, environment, management and transport sectors. With over 4,000 staff in over 50 UK offices the company offers a unique blend of professional and technical skills to schemes of all types and complexities.

For further information, please contact Karl Blockwell on **02920 333777** or **karl.blockwell@capita.co.uk**

New partners at Hoare Lea

Hoare Lea has announced that Jo Edwards, Roger Smith and Mike Tso have accepted invitations to join the partnership. All have developed their engineering careers within Hoare Lea and proven themselves in a range of endeavours.

Jo Edwards, Hoare Lea Acoustics

Jo Edwards BEng(Hons) MSc joined Hoare Lea Acoustics in 1998. She has twelve years' experience as a consultant in architectural acoustics and noise and vibration control for buildings and neighbourhoods.

Jo has completed a wide range of projects in sectors that include shopping centres, offices, residential, leisure, schools and hospitals. Recent and current projects include various developments for AstraZeneca, including a lecture theatre, a conference suite and a research and development facility; Lots Road and Greenwich Millennium Village residential developments in London; and a new arts and technology facility for Walsall College.

Jo is responsible for the acoustic group's operations in London, Poole, Manchester and Leeds. She manages the group's finances and leads the personnel development and training programme.

Roger Smith, Hoare Lea Engineering Management

Roger Smith BSc(Hons) CEng FCIBSE MIMechE joined Hoare Lea in 1995 as a project manager. He has considerable experience of consulting engineering in building services. He has completed projects in retail, commercial offices, leisure, food processing and breweries for the private sector, and HM Prisons and Ministry of Defence sites for the public sector.

In 2002 Roger established Hoare Lea Engineering Management (HLEM). HLEM's specialist expertise focuses on building operation, in particular maintenance and energy management. Now numbering 15 engineers, the group has been highly successful in building long-term relationships with many clients, including Accenture, BP, King Sturge, Knight Frank and Cushman and Wakefield.

Mike Tso

Mike Tso BEng(Hons) CEng MIEE MCIBSE MIHEEM joined Hoare Lea in 1990. He manages one of several multidisciplinary project teams within Hoare Lea's Birmingham office that specialises in major projects.

Mike has been responsible for the successful delivery of a variety of projects in the retail, leisure, pharmaceutical, commercial office, education and healthcare sectors. These include the Centre:mk at Milton Keynes and the Dudley Group of Hospitals PFI.

In addition to client liaison and project work, Mike enjoys management team responsibility for coordinating the Birmingham office technical development and the IPD and CPD training schemes that operate successfully throughout Hoare Lea.

Jo Edwards and Roger Smith are based in Hoare Lea's London office. Mike Tso is based in Hoare Lea's Birmingham office.

Gary Tucker, partner, Hoare Lea commented that the three new partners brought a range of known abilities that would reinforce the team. Their skills and their client-focused approach would help to ensure that the firm continued its outstanding growth in staff numbers, market share and financial performance.

Brüel & Kjær

Appoints New Managing Director

Lars Rønn has been appointed Managing Director of Brüel & Kjær Sound & Vibration Measurement A/S with effect from 1 September 2008.

Lars, who holds an MSc in Electrical Engineering from the Technical University of Denmark, has most recently served as President of the Hearing Instruments Components of Sonion, and since its acquisition by US company PULSE Inc, Senior VP of its MedTech Group into which the Sonion business was integrated.

Prior to his career at Sonion, Lars had more than 20 years of experience in the electronic components industry, where he headed several high-technology companies, including NKT Integration A/S and later Tpack A/S. Over a period of 10 years, he has also held various positions within sales and management at Hitachi Europe Ltd.

Brüel and Kjær is a world-leading manufacturer and supplier of sound and vibration solutions for use in a wide range of applications including: environmental noise measurements, building acoustics, vibration measurements and quality control for use in the automotive, aerospace and consumer industries, as well as by local authorities.

The company designs and manufactures sound level meters, microphones and accelerometers, conditioning amplifiers, calibrators, noise and vibration analysers and software. To see the full range and for more information, visit www.bksv.co.uk or contact the sales team on **+44 (0) 1438 739 000** or email: **ukinfo@bksv.com** .

Brüel and Kjær also runs a variety of training courses throughout the year, from basic introductions on noise and its effects to more specialised classes teaching customers how to get the most out of their equipment. To see the full training course calendar, visit **www.bksv.co.uk/?ID=3506**

Lars Rønn

Acousticians' award

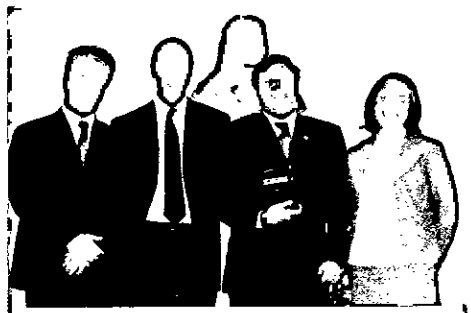
The Engineer recognises technical achievement

On Friday 3 October a team of acousticians was honoured at the Royal Society, London, at the 2008 Awards ceremony of *The Engineer*. The journal, which was founded in 1856, began last year to award a prize in each of five technical categories: automotive, energy, aerospace and defence, environmental technology, and medical and healthcare.

The judging panel (drawn from Government, business and academia) gave the for medical and healthcare award to a collaborative team consisting of Tim Leighton of the Institute of Sound and Vibration Research (ISVR), University of Southampton, Andrew Coleman and Fiammetta Fedele of Guy's and St Thomas' NHS Foundation Trust (GSTT), and Andrew Hurrell of Precision Acoustics Ltd.

The award was for their 'smart stethoscope', a passive acoustic sensor for the real-time monitoring of extracorporeal shock wave lithotripsy (ESWL). During EWSL, thousands of shock waves are transmitted into the human body to fragment kidney stones, but current monitoring systems are insufficient for determining when stone fragmentation has occurred. This means that 30-50% of patients require repeat treatment (with commensurate costs to hospitals, waiting lists and patient care). An unknown number are subjected to more shocks than they need, which can produce unnecessary tissue morbidity. Two clinical trials at Guy's Hospital have shown how the 'smart stethoscope' can ameliorate this problem by providing feedback on the effectiveness of the shock wave treatment whilst it is being administered. The sensor is taped onto the skin and picks up the echoes of the lithotripter shock waves as they reverberate through the patient. These are automatically interpreted in real time by a laptop computer, allowing a nurse to determine the effectiveness of each shock in contributing to kidney stone fragmentation. In the clinical trials, a nurse operating the device during treatment could correctly predict successful treatments 95% of the time, compared with the 37% scored by the clinician in theatre using the best equipment currently available.

Prof Leighton commented that to take the original concept to a useful hospital device required almost every technique in the engineer's toolkit: theory, simulation, in vitro and in vivo experimentation, design, ethical and commercial considerations, human testing (no animal tests were done), two clinical trials, and the interactions with patients (including data handling and confidentiality). A low-cost solution like this was particularly important in developing countries. Tim was delighted that the four key players could be present on stage at the Royal Society to receive the award. However the development



The award-winners at the Royal Society, [L to r] Andrew Hurrell (Precision Acoustics Ltd), Andrew Coleman (GSTT), Tim Leighton (ISVR, holding the award), and Fiammetta Fedele (GSTT and ISVR)

required the support of clinical staff at GSTT (nurse Cathy McCarthy and consultant urologist Simon Ryves), Paul White of ISVR, and Antonello de Stefano (formerly of ISVR, and now at St Mary's Hospital, Portsmouth). In addition, there had been an application to EPSRC for the funding of a computational fluid dynamics (CFD) programme in parallel with the equipment development to aid in the interpretation of the signal. This had been realised with former members of the university (Graham Ball, and two graduate students Riza Jamaluddin and Cary Turangan).

Precision Acoustics Ltd has received requests for units from Europe, USA and Asia. The clinical results were published in *Ultrasound in Medicine and Biology* (**34**(10), 1651–1665, 2008) and the first of the CFD studies was published in *Journal of Fluid Mechanics* (**598**, 1-25, 2008). Further details can be found at: **http://www.isvr.soton.ac.uk/fdag/Litho_07/litho_07(main).htm**

Bureau Veritas

Acoustics and vibration team expands in the North West

The Bureau Veritas acoustics and vibration team has expanded over the past year with the addition of Michael Barrett and Tristan Blaine. Michael joined the team in Didsbury, Manchester as a consultant having worked previously in noise consultancy for several years, and Tristan joined as a graduate from Salford University.

The most recent additions are Vincent Hii who joins as a senior consultant with extensive experience in noise mapping and modelling, and Reuben Ditchburn, an assistant engineer, who has transferred to Didsbury from BV's Southampton office. In line with the organisation's expansion strategy, this further strengthens the Bureau Veritas acoustics and vibration skills, particularly in the use of noise modelling programmes including the Integrated Noise Model for predicting aircraft noise, as well as IMMI and CadnaA. Other UK Bureau Veritas offices with acoustics, noise and vibration capabilities include London, St Albans, Southampton, Birmingham, Glasgow and Aberdeen.

Left-to-right, top row: Michael Barrett, Paul Freeborn, Karen Corry
Bottom row: Vincent Hii, Tristan Blaine, Reuben Ditchburn

Change of address

Philip Dunbavin Acoustics

PDA's staff breathed a sigh of relief as the company settled into its newly purchased offices in Lymm, Cheshire. Having moved twice in as many years PDA will be staying put for the foreseeable future. Alder House is surrounded by Lymm conservation area and has magnificent views over farmland and accessibility is second to none, with the M6, M56 and M62 all within easy reach.

Philip Dunbavin Acoustics Ltd
Alder House, Willow Tree Park,
Booths Lane, Warrington,
Lymm, Cheshire
WA13 0GH

Reliable remote download a reality

with ANV Measurement Systems and Rion

ANV Measurement Systems' Remote Control Download Software (RCDS) enables the Rion NL Series to be downloaded remotely over the GSM network. Remote downloading of instruments over the mobile 'phone network has proved unreliable in the past. The ANV Measurement RCDS System overcomes this through continuous error checking within the program and because the NL-Series stores the data as relatively small text files which are easily transmitted across the network.

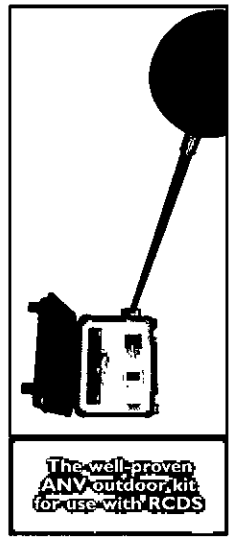
The user interface is based upon a screen image of the meter. The mouse pointer is used to press the buttons just as if the operator had the instrument in their hand. The display of the instrument in real time can even be seen (subject to the delay over the GSM network). Both the meter and the software are simple and intuitive to use.

The system is used extensively on construction and demolition sites with ANV Measurement Systems' reliable and site-proven outdoor kit.

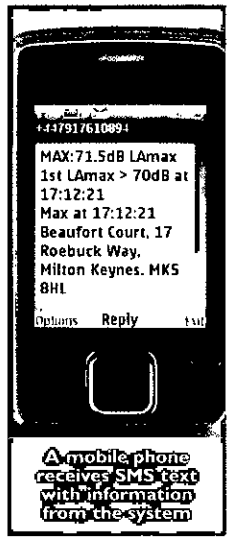
The SMS text alarm option has proved particularly popular within the construction industry. This enables 'intelligent' alarms to be sent to up to four mobile phone numbers. Trigger levels can be set in terms of L_{Aeq} or L_{Amax} and separate alarm levels can be set for daytime, evening or night. The alarm messages can specify the maximum level reached since the previous alarm message, when the maximum was reached and the number of times the alarm level has been exceeded. The software also incorporates the ability to specify a minimum time between alarm texts thus avoiding the generation of multiple text messages when the alarm level is being exceeded continuously.

A bolt-on program, the Auto Remote Download Scheduler (ARDS), is also available: it can automatically download and restart up to 30 instruments remotely. This can be set, for instance, to dial in and retrieve the data from instruments in the field overnight so that the data is already on the office computer when staff arrive in the office in the morning.

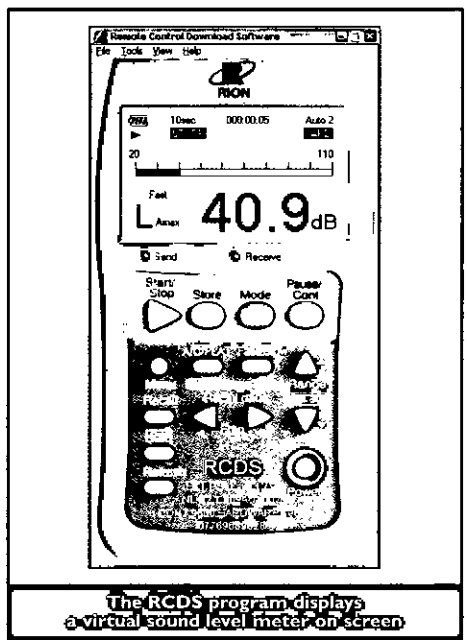
The system is available for rental or purchase with a number of options including solar power. For further information call Chazz Gill at ANV Measurement Systems (**01908 642846, info@noise-and-vibration.co.uk, www.noise-and-vibration.co.uk**).



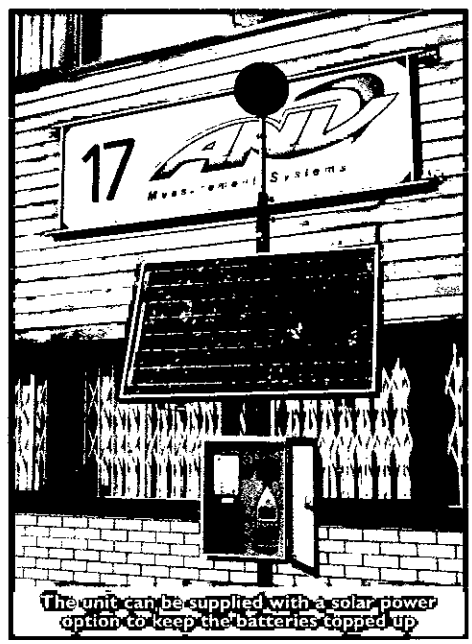
The well-proven ANV outdoor kit for use with RCDS



A mobile phone receives SMS text with information from the system



The RCDS program displays a virtual sound level meter on screen



The unit can be supplied with a solar power option to keep the batteries topped up

Little Red Book

Second edition of acoustics text released

The second edition builds on the success of the original book which received a very positive response from students, local authorities, planners, solicitors, environmental health professionals and consultants alike. It includes a much increased legal section, edited by an expert solicitor, which brings clarity to many areas such as the Noise Act, Licensing Act and the Human Rights Act. The book also has some new sections giving information on topics such as wind turbines and construction sites.

The style of the book is unaltered, with various acoustic processes and key information from standards presented clearly and concisely. The Little Red Book of Acoustics does not attempt to raise the bar of acoustic understanding. What it does well is to set out the most important information needed by anyone learning or working in and around acoustics. It takes away the guesswork for students; it helps bring clarity for local authorities; it demystifies acoustic terminology for lawyers; and it replaces the dog-eared photocopies of NR curves and PPG24 categories carried around by consultants.

The 274 page spiral bound book is now only available in one size, approximately 110mm by 175mm, which is slightly larger than the original pocket book. The new size can be thought of as a cross between the two sizes of previous version. The book is now a recommended text for the IOA diploma and is already in use by various universities. It is available from large booksellers as well as from the publishers direct, at a list price of £24.99.

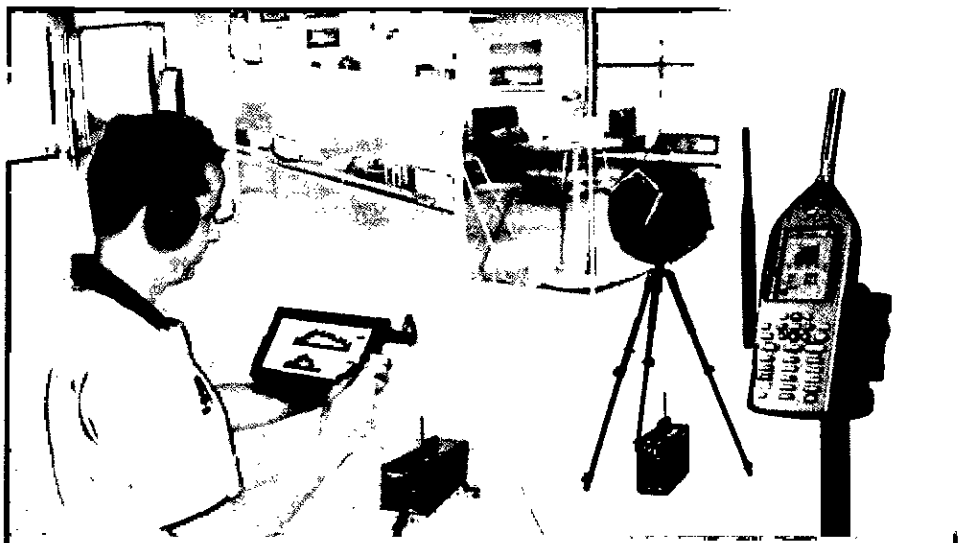
ISBN: 9780956001207, Publisher: Blue Tree Acoustics **www.bluetreeacoustics.com**

New wireless Bluetooth system

Revolutionises building acoustics measurements

Running cables between rooms and under doors is a thing of the past with the Bluetooth-enabled NOR140 building acoustics analyser. The dual-channel sound level meter is used as a PC-controlled measurement module, with a transmission range of up to 300m in the field. Features include:

- Production of results and finished report in the field (ISO140 and ISO 717 standards)
- White noise, pink noise and serial scan measurements
- Sweptsine measurement technique for measurements in high background noise, or where the partition under test has a high sound insulation



No need to run cables when using the Bluetooth-enabled NOR140 analyser

The NOR140 as a standalone hand-held unit fulfils the requirements of the survey grade ISO10052, and includes reverberation time calculations from either interrupted noise or impulse response measurements. It also carries out speech intelligibility measurements (STIPA) as required by BB93, and records sound in full fidelity audio. FFT narrow band analysis is available, which is ideal for investigating low-frequency noise, as well as sound level measurements correlated with revolutionary speed for trackside monitoring. The unit complies with all relevant IEC and ANSI Tyope I specifications.

Campbell Associates Ltd, Great Dunmow,
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Committee meetings 2009

DAY	DATE	TIME	MEETING
Thursday	8 January	10.00	Meetings
Thursday	22 January	10.30	Diploma Tutors and Examiners
Thursday	22 January	1.30	Education
Thursday	29 January	10.30	Membership
Thursday	12 February	11.00	Publications
Thursday	26 February	11.00	Medals & Awards
Thursday	26 February	1.30	Executive
Thursday	5 March	10.30	Engineering Division
Tuesday	10 March	10.30	Diploma Examiners
Thursday	**12 March**	**11.30**	**Council**
Tuesday	7 April	11.00	Research Co-ordination
Thursday	16 April	10.00	Meetings
Tuesday	21 April	10.30	CCWPNA Examiners
Tuesday	21 April	1.30	CCWPNA Committee
Thursday	7 May	10.30	Membership
Thursday	21 May	11.00	Publications
Tuesday	2 June	10.30	CMOHAV Examiners
Tuesday	2 June	1.30	CMOHAV Committee
Thursday	4 June	11.00	Executive
Thursday	**18 June**	**11.30**	**Council**
Thursday	25 June	10.30	Distance Learning Tutors WG
Thursday	25 June	1.30	Education
Wednesday	1 July	10.30	CCENM Examiners
Wednesday	1 July	1.30	CCENM Committee
Thursday	2 July	10.30	Engineering Division
Tuesday	7 July	10.30	ASBA Examiners
Tuesday	7 July	1.30	ASBA Committee
Thursday	9 July	10.00	Meetings
Tuesday	4 August	10.30	Diploma Moderators Meeting
Thursday	3 September	10.30	Membership
Thursday	10 September	11.00	Medals & Awards
Thursday	10 September	1.30	Executive
Thursday	17 September	11.00	Publications
Thursday	**24 September**	**11.30**	**Council**
Thursday	1 October	10.30	Diploma Tutors and Examiners
Thursday	1 October	1.30	Education
Thursday	8 October	11.00	Research Co-ordination
Thursday	15 October	10.30	Engineering Division
Thursday	5 November	10.30	Membership
Tuesday	10 November	10.30	ASBA Examiners
Tuesday	10 November	1.30	ASBA Committee
Thursday	12 November	10.00	Meetings
Tuesday	17 November	10.30	CMOHAV Examiners
Tuesday	17 November	1.30	CMOHAV Committee
Thursday	19 November	11.00	Executive
Wednesday	25 November	10.30	CCENM Examiners
Wednesday	25 November	1.30	CCENM Committee
Thursday	26 November	11.00	Publications
Thursday	**3 December**	**11.30**	**Council**
Tuesday	8 December	10.30	CCWPNA Examiners
Tuesday	8 December	1.30	CCWPNA Committee

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

Conferences and meetings:

Diary 2008/09

20 - 21 November
Electroacoustics Group
Reproduced Sound 24 - Immersive audio
Brighton

16 January 2009
Wind farm noise
Bristol

5 March 2009
Measurement & Instrumentation Group
Audible - Inaudible
London

31 Mar - 1 April 2009
Underwater Acoustics Group
Bioacoustics 2009
Loughborough

28-29 April 2009
Environmental Noise Group
Spring Conference 2009 - Environmental noise management in a sustainable society
Oxford

26-28 October 2009
EURONOISE 2009
Edinburgh

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

List of advertisers

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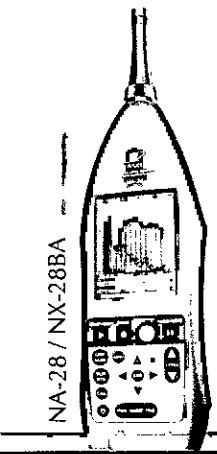
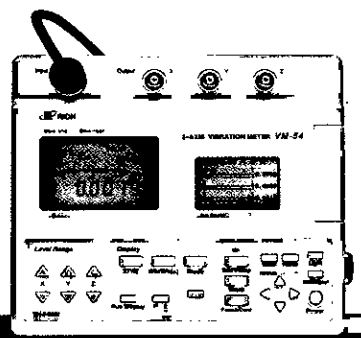
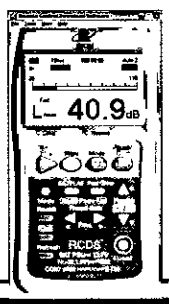
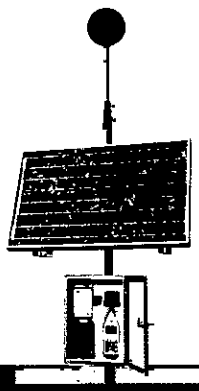
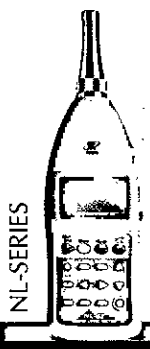
ANV Measurement Systems











RION NA-28 Class 1 Sound Level Meter & Real Time Octave/3rd Octave Analyser

The quickest and easiest to use Class 1 multifunction sound analyser

- All measurement modes available instantly at the press of a clearly labelled button
- Full measurement information clearly visible in all lighting conditions on a large back-lit LCD display
- Octaves & Third Octaves can be measured simultaneously
- Building Acoustics, Audio Recording, FFT and Data Management Software Options Available

RION NX-28A Building Acoustics Option for the Rion NA-28

The quickest and easiest to use Building Acoustics Package

- Fully compliant with both ISO 140 and Approved Document E (ADE)
- Single figure results calculated inside the meter (ISO 140 and/or ADE)
- Provided Excel Macro produces ISO 717 compliant graphs in seconds
- Extremely quick and simple operation – RT times calculated in an instant

RION VM-54 Tri-Axial Vibration Meter

The quickest and easiest to use meter for environmental or occupational vibration

- Directly measures and logs VDVs & complies with the requirements of:
  - BS 6472: 2008
  - Vibration at Work Regulations 2005
  - ISO 2631: Parts 1, 2 and 4

RION NL-Series Integrating Sound Level Meters

The quickest and easiest to use meters for environmental, occupational or general noise measurement

- 100 dB linearity range
- Logged data stored on to compact flash cards as text files which open directly by Microsoft Excel™.
- Unrivalled simplicity and speed of use
- Log up to 99,999 sets of data (LAeq, LAmax, 5LNs etc) or up to 200 hours of 1 second LAeq or 100 or 200ms samples

Long-term Noise Monitoring Solutions

Practical, Reliable and Site-Proven for Construction Sites and Baseline Surveys

- Rion Prepolarised Microphones – utmost reliability for outdoor measurements
- Rion WS-03 – simple & proven outdoor protection for microphones for weeks, months or even years
- Weather Resistant and Lockable Cases for Sound Level Meter (with or without integral pole for mounting microphone)
- Gell Cell Batteries & Charger Provide 10 days' Continuous Use (standard configuration) – Solar and other Options Now Available
- Remote Control Download & Control System – Uniquely Easy to Use and Reliable
- Audio Recording – continuous or triggered by level and/or periodic audio 'snapshots'
- Data management software – synchronises data and audio recordings & allows audio to be played with one mouse click

Why Leading Professionals Choose Rion Instruments

Ease of Use	✓
Speed of Use	✓
Clarity of Display	✓
Full information on display – you can always see what the instrument is doing	✓
Excellent Battery Life	✓
Can be used with standard or rechargeable batteries	✓
Quality of Hardware	✓
Reliability of Hardware	✓
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Ease of Downloading Data – opens directly in Microsoft Excel™	✓
Pre-polarised Microphones for reliable outdoor use	✓
Availabity of practicable and reliable Long-term Monitoring Kit	✓

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Fast, flexible, responsive and reliable service	✓
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