Volume 44 No 2 March/April 2019

ACOUSTICS BULLETIN

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plus...
- The 2018 Reproduced Sound Conference report
- Acoustic measurements in airflow
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Institute of Acoustics

ACOUSTICS BULLETIN

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The Institute of Acoustics in the UK's professional body for those working in acoustics, noise and vibration. It was formed in 1974 from the amalgamation of the Acoustics Group of the Institute of Physics and the British acoustical Society. The Institute of acoustics is a nominated body of the Engineering Council, offering registration at Chartered and Incorporated Engineer levels.

The Institute has over 3000 members working in a diverse range of research, educational, govern mental and industrial organisations. This multidisciplinary culture provides a productive environment for cross-fertilisation of ideas and initiatives. The range of interests of members within the world of acoustics is equally wide, embracing such aspects as aerodynamics, architectural acoustics, building acoustics, electroacoustic, engineering dynamics, noise and vibration, hearing, speech, physical acoustics, underwater acoustics, together with a variety of environmental aspects. The Institute is a Registered Charity no. 267026

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Dear Members

Acoustics is easy to understand, or is it? This question is posed at a time when the Institute is undertaking a systematic re-evaluation of its strategy and marketing. An important component of this is the development of content and methods of delivery of courses in acoustics. This is particularly relevant since the Institute has, for a long time, recognised its responsibility to complement the teaching of acoustics by higher education institutions elsewhere. Higher education courses, whilst excellent, are few in number and many people come to acoustics from other backgrounds. We continue to need high-quality conversion courses, such as presently offered in the Institute's postgraduate diploma and professional competences courses.

Returning to the question in the first sentence, acoustics involves mechanisms such as generation, radiation, propagation, control, perception, etc. In my time in the university sector, I have covered these topics in courses to building engineers, electrical engineers, architects and musicians, at undergraduate and postgraduate level, and on the Institute's competences courses on environmental noise measurement and on workplace noise. It has been a pleasure and often a source of amusement.

Lecturers learn to be careful about what they say, since it can come back to bite them. Such as saying: "Screening is more likely to be effective if you can't see the source of sound…" This was quoted in an examination paper by an undergraduate, but who then followed up by writing 'and that is why we can't hear aircraft when there is cloud cover.' We all know of such howlers in teaching and in encounters with the public. My favourite was during a telephone call from an anxious factory manager in Birmingham who had received a visit from the inspectorate. He said that he had been informed that '…the factory floor is covered in decibels, which must be got rid of…' The acoustics consultant as a pest controller? Taxi drivers can be a rich source. One asked what I did and then went on to say that he was converting his garage into a music studio, so what did I think of egg-boxes as acoustic treatment? He still received a tip.

Insulation, absorption and isolation

Colleagues have pointed out the various conceptual 'leaps' needed towards an understanding of acoustics by people new to the subject. An example is the confusion about the roles of insulation, absorption and isolation in noise control, which can be addressed by laboratory demonstration. The most mentioned was the decibel, followed by the wave nature of sound. Members reading this letter are well beyond and above these issues, of course, but it remains the case that the rationale for a logarithmic scale of magnitude of sound must be given repeatedly and imaginatively. Less necessary, but still important, is an understanding of complex numbers, to describe how waves interact with objects and with each other.

I am sure the Institute has within it the teaching expertise needed to surmount these and other issues in future course developments.

This is a personal view and members of the IOA Education Committee might have different experiences and comments. Other members also may wish to forward their own teaching and learning experiences, and offer their own favourite howlers.

Barry Gibbs, President IOA

Engineering Division

By Blane Judd, Engineering Manager

The Engineering Division continues to work with members who wish to join the growing number of engineers who are professionally registered with the Engineering Council.

We are still maintaining our target of double figures, and we had a number of candidates going forward in February. We were able to fit one extra interview in just before Christmas, but hopefully, we can tell you more about that in our next report. We are still working with candidates who started the process some time ago and have recently found the time to continue their application. In some cases, this has led to us having to ask for information previously supplied. We have added a self-help check sheet to our support materials so that candidates can keep a record of what has been sent and what is still outstanding. This duplicates the recording process we use and those who have engaged in this have reported that it is another helpful tool from the IOA towards their registration.

How the IOA supports candidates

Emma Lilliman continues to do a great job supporting candidates through the registration process. We are just as dedicated to providing the necessary levels of support to help members like you, through the process. Special thanks go to Neil Ferguson, who assists with the academic equivalence support. Through his help and guidance, we have been able to support a wide number of applicants who do not have exemplifying qualifications as laid down by the Engineering Council.

Our next round of interviews will be later in the year and we already have some candidates working towards that session. We hold a number of interview events through the year, depending on the number of candidates we have coming forward for registration. We can offer face-to-face interviews or by video link.

If you are interested in taking the next step to becoming a professionally registered engineer, contact us on **acousticsengineering@ioa.org.uk** .

Routes to qualification

The requirements for academic qualifications for CEng and IEng changed in 1999. Pre-1999, an Honours Degree at 2:2 or above was required for CEng or a Higher Diploma/Certificate for IEng. Post-1999, this changed and for CEng, a Master's Degree was required or an Ordinary Degree for IEng.

There are two routes:

- **Standard route**, if you have the appropriate EC-accredited qualification (also referred to as an exemplifying qualification) in acoustics, and
- **Individual route**, which requires further preparatory work from you before submitting evidence of your competence.

Remember that we are here to help you get through the process and advice and support is offered to every candidate personally.

For the individual route, the Institute accepts a number of courses in relevant subjects such as audio technology, from certain academic centres, as being equivalent to accredited courses for the purposes of EC registration, without the need for further assessment.

The Institute recognises the IOA Diploma course and the several Masters courses linked to it as providing evidence if you are looking to gain CEng registration. You could also offer a PhD qualification, depending upon the content of the associated taught element. We can also offer support for registration via a 'technical report' route, if you do not have the relevant qualifications to help you demonstrate you are working as a professional engineer in acoustics.

Election process

The election process is overseen by the Institute's Engineering Division Committee, which is made up of volunteers from the membership, to whom we are extremely grateful. They represent the 300 or so members holding EC registration. They provide the essential peer review process that affirms that you are at the appropriate level for recognition as an Engineering Council Registered Professional Engineer.

The opportunity is there, and we are ready to support you through it, so that you can become one of almost 225,000 registrants that hold international professional recognition.

New members

Ninety-five applications were received for the Membership Committee to review. Of the total, 57 were new or reinstated, the remainder upgrades. 22 applications have recently been approved by the Council following the recommendations of the Membership Committee.

MIOA

Claire Allmark	Rob Ashby	Andrew Beamish
Thomas Bonnert	Callum Brewer	John Cane
Andy Cole	Raul Zafra Duarte	Dan Emery
Max Foster	Sam Garne	Sarah Gilson
Federico Gottardo	Andrew Hood	Matt Howell
Jamie Murray	Gizem Okten	Rosie Pitt
Joseph Sinker	Joseph Tony	Gareth Wells
Nick Williams		

Tech IOA

James Abbass	George Booth	Constantine Christofis
Kyle Donald	Peter Erskine	Emily Forster
Laura Jennings	Ronny Ospina Orozco	Lauren Thompson
Jamie Wilson		

Affiliate

Sam Garside-Cole	James Heaney-Ellis	Mark Hebblethwaite
Thomas Salisbury		

AMIOA

Mohyeddine Al Khatib	Muir Ashworth	Jonathan Barnard
Milos Basic	Daniel Bhatt	Charlotte Birch
Liam Bryan	Lewis Bullivant	Adam Cattell
Ross Chamberlain	Joanne Coleman	Anthony Coraci
Kyriacos Demetriou	Lukas Drinkwater	Matthew Elliott
Thomas John Evans	Albert Fit	Zac Fox
Jason Gallimore	Ian Gorton	Donal Heavey
Heather Isherwood	James Keegan	Lewis Kelter
Mark Kubis	Alexander Lamb	Peter Ling
Ignacio Martin-Granizo	Howard Masters	Mohamed Mekkawy
James Melville	James Morphett	James Muxworthy
Josef Nott	Mark O'Sullivan	Luke Pickering
Oskar Przybylski	Emma Ridley	Michael Ridley
Jaspreet Sandhu	Jake Saunders	Jake Schofield
Daniel Shaw	Naveen Simha	Phil Softley
Joy Stevens	Edward Taylor	Jacob Wilmott

2019 CONFERENCE PROGRAMME

Organised by EPSRC/IOA
New methods for predicting noise and vibration
1May 2019
Cambridge

IOA Annual Conference
ACOUSTICS 2019
13-14 May 2019
Milton Keynes

Organised by the Underwater Acoustics Group
Sixth International Conference on Bioacoustics
13-14 August 2019
Loughborough

Organised by the Noise and Vibration Engineering Group
Low Noise Design
10 September 2019
London

Organised by the Measurement & Instrumentaton Group
Sound Sensing in Smart Cities 2
16 October 2019
London

Organised by the Electroacoustic Group REPRODUCED SOUND 2019
Creating Engagement in Sound
19-21 November 2019
Bristol

For up-to-date information visit www.ioa.org.uk

Nathan Merchant awarded the A B Wood Medal in Underwater Acoustics

The A B Wood medal and attendant prize is awarded in alternate years to acousticians based in the UK/Europe (even years) and in the USA/Canada (odd years). It is aimed at younger researchers, those who are aged under 40, whose work is associated with the sea. Following his graduation from Manchester University in 1912, Albert Beaumont Wood became one of the first two research scientists at the Admiralty to work on antisubmarine defence. He designed the first directional hydrophone and was well known for the many contributions he made to the P10 ►

Nathan Merchant

WHATEVER YOU MEASURE, SEE THE WHOLE PICTURE WITH THE

NOR-145

science of underwater acoustics and for the help he gave to younger colleagues. The A B Wood Medal was instituted after Albert's death by his many friends on both sides of the Atlantic and was administered by the Institute of Physics until the formation of the Institute of Acoustics.

Citation for the award

Dr. Nathan Merchant is a young and already internationally respected scientist, bringing intellectual and mathematical rigorousness to the applications of ambient noise in underwater acoustics. Nathan graduated in 2007 with a *BSc (Hons)* in Physics and Astronomy from the University of Durham, UK. Soon afterwards, he started specialising in acoustics, graduating in 2008 with an MSc in Acoustics and Music Technology from the University of Edinburgh (Scotland).

Soon afterwards, he started research on the 'Acoustic impacts of human underwater activities and marine life' at the University of Bath (UK), from which he graduated in 2013. His PhD thesis was supported by five peer-reviewed articles in internationally leading journals, and in a few years, he has made a major impact in the field of ambient noise underwater. After a short postdoctoral fellowship in the Department of Biology at Syracuse University (USA), Nathan started work at the Centre for Environment, Fisheries and Aquaculture Science (Cefas) in Lowestoft (UK).

Nathan is at a very early stage in his professional career, but as Pierre Corneille wrote several centuries ago: *"In souls nobly born, valour does not depend upon age"*. In a few years, Nathan has already made several major contributions to acoustics, and he has quickly become a scientific reference and a key player at international levels. Underwater sounds are extremely important to marine wildlife, for purposes ranging from navigation to foraging to communicating. Increasing human activities in the marine environments include shipping, with new shipping lanes and higher traffic densities, exploitation of offshore energy resources (wind, wave, tidal and oil and gas), as well as near-shore construction and recreational activities. To better balance these activities and to protect these complex environments, it is therefore essential to measure sounds accurately and repeatably, ensuring end-users could work with trustworthy metrics. Nathan thus started a national collaboration during his PhD to quantify the long-term influences from shipping to a large bay, unravelling short-term contributions to underwater soundscapes from longer-term and more prevalent sources of noise, offering a methodology to better assess which ships were potentially the noisiest. In a collaboration with an African NGO, a major seismic company and two UK universities, he adapted this approach to ambient noise measurements in a marine protected area His results identified marine mammals missed by previous interpreters, and his thorough recalibration of the recorder identified some hardware issues, since corrected by the manufacturer.

Building on his field experience by working at sea in different parts of the world, whether installing or upgrading equipment at seafloor observatories in the Pacific, or studying endangered whales off the US East Coast or in Scotland, Nathan has gained experience of many different platforms and acoustic environments. This field experience has informed his thorough design of processing tools to identify the key contributors to underwater noise; Merchant et al. (JASA, 2012) and Merchant et al. (JASA, 2013) quickly became references in the field, offering innovative ways to separate short-term and long-term contributions and inspiring several PhD projects. Nathan federated the efforts of international researchers in underwater and airborne acoustics to develop the PAMGuide software, made available to the acoustics community as open-source software in several languages (Merchant et al., Meth. Ecol. Evol., 2015).

These activities have been pursued after he joined Cefas in 2014. Quickly promoted to Principal Scientist in Noise and Bioacoustics, Nathan is now leading a team of acousticians, providing advice to government departments and leading the UK contribution to international organisations, for example to coordinate the monitoring of underwater noise and compliance with environmental regulations around the entirety of UK shores. Thanks to his scientific knowledge, hard work and personality, Nathan has been excellent at forging international links with major teams in the UK and around the world, in particular, North America where he spent a year after his PhD. These collaborations have already resulted in an impressive 25 peer-reviewed publications in major, international journals. Most of them were published after he graduated from the University of Bath in 2013. He is first author on 12 of these publications, and was a major contributor to the 13 others, bringing unique expertise and tools to work with acousticians and different users of underwater acoustics. This impressive personal work is matched by a strong commitment to the dissemination of research at international level, with the chairing or co-chairing of several special sessions at major conferences. Leading by example, Nathan has become a role model for young underwater acousticians, including some of the PhD students he is now co-supervising.

For his major contributions to the measurement of ambient noise underwater, especially at this early stage, for his influence at international levels (especially UK, Europe and North America), and for his personal commitment to sharing good practice and involving acoustics in marine governance and decision-making at governmental levels, Nathan is a most deserving recipient of the *A B Wood Medal in Underwater Acoustics*.

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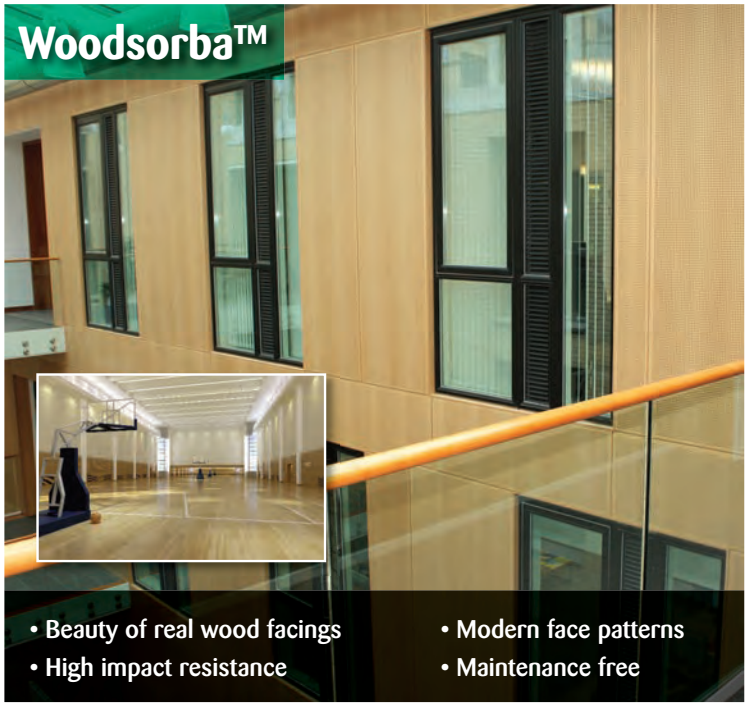

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Council elections

There will be six Ordinary Members' positions up for election in May. This is an opportunity for you to help guide the development of the Institute.

To stand for election you must be a Corporate Member of the Institute and you will require the endorsement of five other Corporate Members.

Being an Ordinary Member of Council is an active role. Council Members have overall control of the Institute and oversee its activities and responsibilities. The Institute is both a charity and a limited company and Council contains both the charity trustees and directors of the company.

Membership of Council is a voluntary role, but you can claim reasonable expenses.

Meetings

Council meets four times a year in March, June, September and December at our office in Milton Keynes. It is expected that Members attend in person, but Members can join meetings online in special circumstances. In standing for election as an Ordinary Member, you are committing to the equivalent of four to eight days a year, depending on additional work you volunteer to undertake.

The newly elected Members will join Council in June after the AGM, which will take place during the Conference Acoustics 2019 in May at Milton Keynes.

How to apply

IOA members who are interested should begin canvassing five corporate members to endorse their nominations. Council collectively will endorse up to six nominees and are therefore not able to endorse non-Council nominees, so please ensure none of your five endorsers are existing members of Council.

Details of the 2019 election process will be published in the April newsletter, with the election taking place in early May.

There are Charity Commission rules with which applicants must comply. Applicants should not apply, if they:

- have an unspent conviction for an offence involving dishonesty or deception (such as fraud);
- are bankrupt or have entered into a formal arrangement (e.g. an individual voluntary arrangement) with a creditor; or
- have been removed as a company director or charity trustee because of wrongdoing.

A recent Council meeting

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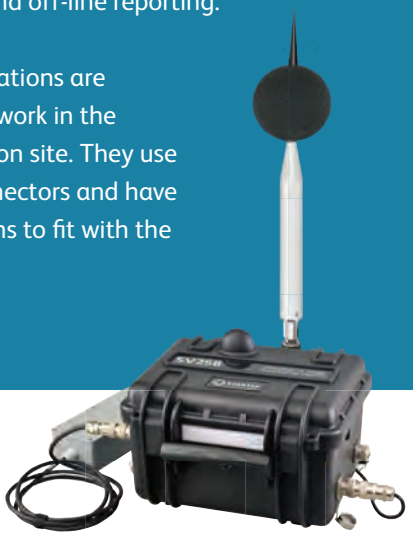

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Midlands Branch

Architectural acoustics – special considerations for gymnasiums and swimming pools

By Mike Swanwick

On the evening of Wednesday 24th October 2018, we were treated to two presentations from Louie Mitrevski of Embelton; a company specialising in noise and vibration isolation recently established in the UK, but having over 95 years of global experience.

Gyms

The first presentation: 'Gym Isolation Fundamentals and Design Considerations', introduced the problems associated with gymnasium vibration isolation, the activities that cause vibration and the isolation solutions, supported by case studies. The spring, mass, and damping combinations are carefully predicted by Finite Element methods so that the gymnasium design can be built with high confidence. The talk concluded with a list of design considerations that ensured nothing was left to chance. The presentation made it clear that no one solution can catch all problems. Custom design, optimising of materials and isolation solutions were in each case needed, as one size definitely doesn't fit all!

Swimming pools

The second presentation entitled: 'Swimming Pool Isolation Fundamentals', expanded on the first, and it was made very clear that activity in a swimming pool (particularly diving) can generate high vibration levels in structures. As with many modern hotels and apartment complexes, the pools can be many floors off the ground, and thus be potentially problematic.

Isolation of a large swimming pool on the roof of a tall building is extreme engineering indeed. The mass of the pool, the movement and levelling of the water, and other design drivers such as 'infinity' edges, makes for a complex and potentially risky design. Only by meticulous preparation, modelling, predictions and the recommendation of suitable materials, can the architect and civil engineer make a confident choice.

Embelton have a large resource of products and materials, so the build can be realised at minimal risk. The correct isolation choice between a pool and a building can provide sufficient attenuation of vibration from a pool within multi-use complexes. Furthermore, with hard to reach areas (under completed swimming pools) the design and preparation before build, pays dividends as post-production alterations to completed pools for the mitigation of noise may prove difficult, expensive or impossible.

Thanks goes to Louie Mitrevski and Umit Baykur from Embelton for preparing such an informative and entertaining evening, and for the University of Derby for kindly hosting the meeting.

Practical considerations and experiences with sound masking's latest technology

By Fiona Rogerson

In November, the Midlands Branch enjoyed a talk and a demonstration from Charles Edgington of Acoustic Comfort about the use of sound masking technology.

Charles presented a number of case studies, demonstrating situations where sound masking had been used successfully to reduce distractions in open plan offices and to increase speech privacy in closed offices. Examples included a law firm requiring high levels of speech privacy and Network Rail offices, where noisy train operations controllers and signal controllers accustomed to quiet, were brought together. In this situation the combination of partial glazed screens, ceiling absorption and sound masking enabled these two groups with different requirements to work together effectively.

He also presented some examples where sound masking was not determined to be the best solution, such as in the case of an office conversion to a video conference room with poor sound insulation from the adjoining open plan space, leading to conversations being intelligible outside. Sound masking was tested in this situation but it was found that the level of masking noise would have to be at an uncomfortable level in order to effectively mask conversations and therefore, it was recommended that the sound insulation of the partition be improved first.

Charles talked through some of the practical considerations in installing the systems, including a situation where it was necessary to install it under grilles in the floor due to a lack of depth in the ceiling void.

The Midlands Branch committee would like to thank Charles for his interesting and informative talk and Atkins, Birmingham for providing the room and refreshments.

Sound Design in Our Sound Environment: Soundscape Design, Auralisation and Evaluation in Environmental Acoustics

By Aglaia Foteinou

At the last meeting for 2018, 6th December, Damian Murphy, Professor in Sound and Music Computing at the Department of Electronic Engineering Audiolab, at the University of York, presented a flavour of his work on soundscape and auralisations. Damian gave examples of the noisy industrial world that we perceive in our day-to-day life, including the soundscapes of airports, motorways, wind turbines or HS2.

The significant impact of the noise levels of the infrastructure in the UK on peoples' health and wellbeing was discussed and supported with examples of the sound maps of various cities. In addition to this visual information, soundscape auralisation is used to help us listen to these environments. Replicating the sound of urban environments, parks, roads, shopping centres and hospitals, or even the noisy landscape of road traffic around Stonehenge, in a lab environment, can help us to understand the soundscapes and to evaluate the acoustic changes.

It is also interesting that there is a mismatch between citizens' perceptions and feelings versus the measured noise level of such community environments in a city. As a result, the importance of focusing on the improvement of a sound environment in quality terms rather than quantity has been emphasised.

The Midlands Branch in collaboration with the AES (Midlands) would like to thank Professor Damian Murphy for sharing this very informative and inspiring presentation, as well as the University of Wolverhampton for hosting the event.

Welsh Branch

BS 4142 Tonality a software approach

By David Hunter

Matthew Cand, of Hoare Lea, gave a presentation on the various methods of assessing tonality in BS 4142, focusing on software to undertake the assessment.

Firstly, he discussed the simple objective method and played an example that showed how this is not effective at low frequencies and should therefore only be used as a 'survey grade' method.

Matthew covered the reference method in detail. It is difficult to implement by hand, but can be done on the B&K 2260 with FFT analysis, or via audio recordings with narrow band analysis of audio files (e.g. dBFA software). Matthew provided tips and discussed some common pitfalls for implementation of the method:

- don't do FFT analysis indoors – too many spikes from room acoustic modes;
- watch out for difference between source and receiver;
- watch out for audio corruption from other sources and listen for steady state noise – the more you average, the better the accuracy;
- high quality audio is needed – the sampling rate must be at least double that of the tone you want; and
- watch out for phone recordings which may not have suitable bandwidth and may use digital compression algorithms.

Matthew's worked examples showed that with complex spectra, different corrections are required depending on which settings you choose for the critical window, masking levels and the slope of the masking tones. Matthew highlighted the importance of sense checking at the end – does it match what was heard on site? This was illustrated with an example of analysis of an audio file that erroneously included the calibrator tone, which the analysis showed was highly tonal.

Following the presentation, attendees discussed the impulsivity method and the scope of BS 4142 for assessing very low frequency noise. It was noted that NANR and ECMA4 are the appropriate standards for assessing low frequency tones, but there was no clear consensus in the room on how to assess low frequency tonal noise. Masking noise at low frequencies was highlighted as a potential problem for very low frequency tones.

Matthew explained that non-stationary tones can be assessed by analysing in short periods and energy averaging. The risk with this method is that with shorter time periods, frequency spectra can be messier. For wind farms, Hoare Lea's approach is to identify the tone which is most dominant and then analyse tonality in 400 ms chunks, adding up to the total averaging time.

The Welsh Branch Annual General Meeting was held after the discussion.

Obituary

By Ian Flindell, Maureen Mew, and Andy McKenzie.

John Gerard Walker (1940-2018): An old-school family man, cricketer, audiologist and acoustician.

John Gerard Walker was involved with the Institute of Sound and Vibration Research (ISVR) at the University of Southampton for well over 27 years. He joined as a Research Fellow in 1967 just four years after it was founded and then continued his association beyond his early retirement as the University Dean of Continuing Education in 1994.

Having completed his PhD on circumaural headphones for use in audiometry at the Royal College of Advanced Technology at Salford, he came to ISVR as an audiologist. Over the next few years he worked on hearing damage risk from high intensity impulsive noise; the relationship between acoustic reflex and loudness discomfort levels; and susceptibility to noise induced temporary threshold shift.

A change of topic in 1975 lead to him becoming more widely known as the joint author (with Professor J. M. Fields) of the first (and only) National Railway Noise Survey of Great Britain, which required him to spend a considerable amount of time outdoors by main railway lines throughout the country. He did this armed with a precision grade sound level meter, a Nagra tape recorder and some heavy car batteries, a clipboard, an umbrella and a camping chair.

He then spent even more time back in the lab laboriously and conscientiously analysing his recordings with then state-of-the-art electro-mechanical equipment. During this period he developed an interest in teaching, particularly in support of continuing professional development (CPD). He was appointed ISVR Short Course Organiser in 1979, where he met many hundreds of students from outside the University and edited (with Frank Fahy) a series of textbooks based on the content of the one-year ISVR postgraduate Masters Programme 'Sound and Vibration Studies' and the annual ISVR short course 'Advanced Course in Acoustics, Noise and Vibration'.

Over the next few years, he established research collaborations with other academics and consultants both in the University and across Europe on subjective response to impulsive noise (one of the early European joint projects); comparative response to different types of transportation noise; long range noise propagation; and community reaction to general and business aviation noise, while his increasing involvement in short courses lead to his appointment as University Dean (Elect) of Continuing Education in 1987, an appointment which was confirmed in 1990.

As Dean of Continuing Education, John co-ordinated the European SAVOIR programme of short courses under the EC COMETT Programme, where he continued to expand his wide circle of friends and associates and to contribute to the associated knowledge-base.

Unfortunately, University politics and inter-departmental rivalries eventually caught up with him and when early retirement at age 54 became a possibility, he took the opportunity to spend more time with his family, his Austin 7 Ruby restoration project, and his beloved cricket, where he started coaching the younger players at his local (amateur) cricket club. He was also able to expand his consultancy work and he was awarded an Honorary Fellowship of the Institute of Acoustics in 2004.

John was born into a Catholic family and indeed, his older brother, Father Bernard Walker, was able to officiate at the funeral at John's local church where John had been a regular attendee.

He is remembered by his many friends as a thoroughly nice and decent chap, who always did what he said he would do, and I, for one, will always remember him for his friendly greetings and never having a bad word for anyone.

He is survived by his older brother and younger sister, his lovely wife, Heather, who expertly managed all his domestic arrangements, and his delightful daughters, Pippa, Susanna and Veronica and his grandchildren.

John and Heather at a Railway Workshop in Buxton

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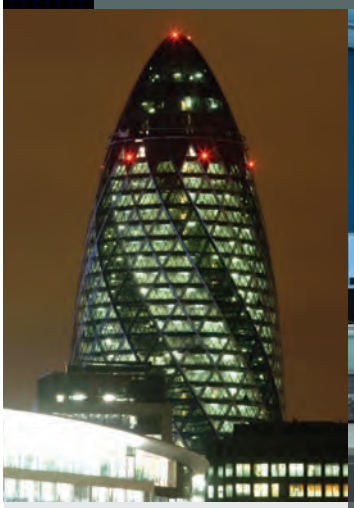

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Electroacoustics Group Reproduced Sound Conference report

By Bob Walker

The 2018 Reproduced Sound (RS) Conference, organised by the Electroacoustics Group (EAG), was held on Wednesday 28th and Thursday 29th November. This time, the conference was held in a new venue, the Bristol Hotel Conference Centre, with accommodation in the adjacent Bristol Hotel. On Tuesday evening there was an informal demonstration of the d&b audiotechnik 'Soundscape' system presented by John Taylor and his colleagues, Steve Jones and Jack Page.

The conference theme continued from previous years with its exploration of developments in spatial acoustics, electroacoustics, room acoustics, cinema sound and intelligibility. The main focus of the 2018 event was on localisation, as indicated by the conference sub-title: 'Putting Sound in its Place'.

In addition to the Peter Barnett Memorial Award and Tyndall Medal Award papers, 19 technical papers were presented in seven sessions. These included topics on intelligibility and sound reinforcement, object-based audio, room acoustics and measurement, loudspeakers, modelling and signal processing They provided a very busy and intensive main programme, fully occupying both days from 9:00 or 9:30am until 5:30 or 5:45pm.

The Institute's thanks and appreciation go to Keith Holland for chairing the organising committee and to all the committee members for their contributions over the preceding year in the organisation of the event. Thanks also go to the staff of the Conference Centre, always friendly, helpful and co-operative, for ensuring the smooth running of the conference and providing excellent and efficient catering for lunches and refreshment breaks. The EAG committee also expresses its thanks to Linda and the other staff of the Institute for their work and constant support.

The technical presentations took place in a large meeting room at the Conference Centre, with an adjoining room being used by the exhibitors and for the refreshment breaks.

The meeting room had been equipped with an advanced audio system. This had been organised and managed by John Taylor of d&b audiotechnik, staffed by Jack Page and Cairan Maxwell also from d&b, with assistance from Adam Hockley and Andrew Horsburgh, who very ably managed the technical aspects of the event. The conference organising committee gratefully acknowledges the effort put in by many people in arranging, setting up and managing the technical support. Thanks also go to d&b audiotechnik for the use of their extensive audio systems and equipment.

The contributions of the exhibitors to the success of the conference are also gratefully acknowledged. Some exhibitors also included sponsorship as part of their exhibition package. Those were valuable and much-appreciated contributions to the conference budget.

The conference was well attended, with 78 registered delegates, of whom 15 were registered as students and four as exhibitors. The committee was again pleased to see the number of students and several faces new to RS.

SS Great Britain chief event steward, Bob Evans, addressing the delegates and guests before dinner

The delegates certainly appeared to have had an enjoyable and worthwhile conference. Overall, the Electroacoustics Group committee was very satisfied with the response to the programme and the smooth running and friendly atmosphere. The RS2019 event is now being planned, most likely in the same venue on 19th, 20th and 21st November, but the details have not yet been finalised.

The conference programme

The programme began at 6:30 pm on Tuesday 21st, with an interactive demonstration of d&b audiotecknik's new 'Soundscape' sound reinforcement system. Delegates were able to see the user interface and compare the system with a traditional 'stereo' system. The presentation was preceded by drinks and light refreshments, courtesy of d&b.

On Wednesday 11th November, registration for the conference proper was open from 8:00 am, with the desk ably managed by IOA's Linda Canty, as usual.

The conference was formally opened at 9:15am by the Electroacoustic Group Chairman, Keith Holland, who presented a brief history of Reproduced Sound conferences and noted the opportunities offered by the conferences for networking. He welcomed the delegates to the venue and said that the conference had been well supported, with many papers submitted and good attendance numbers. The welcome address was followed immediately by the first of the technical sessions.

The presentation of the 2018 Peter Barnett Memorial Award to John Vanderkooy took place after the lunch break. The citation was read by Glenn Leembruggen. John had been unable to attend the conference in person but had recorded a talk entitled 'Highlights of a Career in Audio and Electroacoustics'.

The first day's technical sessions were followed by the EAG AGM. After that there was a short break until 7:00pm before a reception, followed by the conference dinner at 7:30pm. The reception and dinner was held aboard the SS Great Britain, which had been made available to the delegates from 7:00 pm until midnight.

Acting as host for the SS Great Britain Trust was chief event steward, Bob Evans (see image on page 18). Bob did an excellent job of outlining the long and eventful history of the vessel in a most friendly, informative and helpful manner. He stayed aboard to give the delegates and guests the benefit of his knowledge until the last people were shown ashore at about 11:45 pm. The Institute and the delegates offer their sincere thanks to him, the SS Great Britain Trust and to the catering staff for their efficient hosting of a most enjoyable event.

After dinner, the Electroacoustics Group Chairman, Keith Holland, thanked everyone involved in organising and attending the conference, especially the committee members, venue staff and Linda Canty. He said that Linda in particular had, as usual, put a great deal into the organisation of the conference, assisted by other members of the Institute staff.

Following the Chairman's after-dinner address, Philip Newell presented his talk from RS2017 on 'Recording in the 1970s – a view into a different world'. This repeated talk was at the request of the committee because the presentation in 2017 had been thought worthy of recording for posterity, and because the scheduling last year had prevented many delegates from attending.

The second day of the conference started at 9:00am with the presentation of the 2018 Tyndall Medal Award to Filippo Fazi by the Institute President, Barry Gibbs. The award was followed by a talk entitled 'Loudspeaker arrays for audio reproduction'.

The technical sessions continued until the last paper of the conference ended at 5:45pm. The formal end of the P20 ▶

John Vanderkooy, recipient of the Peter Barnett Memorial Award

Philip Newell

conference was followed by a visit to the new foyer area of the Bristol Old Vic theatre, hosted by acoustic consultants, Charcoal Blue. The features of note were the low RT in such a large space and the entirely passive ventilation system.

Technical sessions, Wednesday 28th November

Session 1, Loudspeakers 1, chaired by Glenn Leembruggen

Session 1 began with 'Low distortion wide bandwidth midrange loudspeakers' by James Hipperson, (Funktion One Research). The paper described how poor intelligibility is a common cause for complaint in multi-driver loudspeakers, especially if the cross-over region is 1-2kHz and how improvements can be obtained using a wide-bandwidth, low distortion mid-range driver. Distortion levels 20 dB lower and improved directivity were claimed for this approach.

The session should have continued with 'Superior HI FI sound' by Ted Fletcher and Daniel Fletcher (Orbitsound Ltd). However, at the last minute, they were unable to attend the conference and the paper was omitted.

Session 2, Object-based audio, chaired by Paul Malpas

After the lunch break, the programme continued with 'Multi-zone personalisation for hard of hearing listeners using object-based audio' by Marcos F Simon Galvez, Lauren Ward and Ben Shirley (University of Salford). The paper was presented jointly by Marcos and Lauren. Marcos began with a summary of age-related hearing loss and how object-based audio could be used to selectively tailor reproduction. Lauren explained that the S3A project was investigating immersive listening in the home and that one in six people suffer from some form of hearing impairment. Marcos finished with a description of how object-based audio could deliver separate mixes to different listeners using loudspeaker arrays.

The second paper was 'Object-based audio for live sports' by Robert Oldfield (University of Salford) and Ben Shirley (Salsa Sound). The paper was presented by Robert, who described how object-based audio was beginning to gain wider acceptance, especially in broadcast sports events, and how the competition with computer gaming was leading to higher expectations. He described systems for detecting sources and emphasising localisation using arrays of microphones arranged around a venue and neural networks.

The next paper continued the theme, with 'Development and preliminary results of the University of Salford Media Accessibility and Hearing Impairment Database (U-SAID' by Lauren A. Ward, Ben Shirley and William J. Davies (University of Salford)). The paper was presented by Lauren.
She described the collection of data from 24 hearing-impaired subjects linking their objective hearing loss with their experiences with current and next generation audio technology, using a set of four different tests.

The session was completed by Adam Hockley (d&b audiotechnik) presenting 'Improvements in perceived intelligibility from source orientated sound reinforcement system'. Adam described how recent experiences with source orientated reinforcement systems had shown results contrary to those suggested by normal design metrics. It was suggested that human perception mechanisms may help to unmask speech sources. Some word-score comparison tests had been carried out between dual-mono and distributed object-based systems.

After the lunch break, Glenn Leembruggen read the citation for the Peter Barnett Memorial Award. It was awarded to John Vanderkooy (University of Waterloo, Canada)Following the citation and the proxy award, John presented a recorded acceptance paper 'Highlights of a career in audio and electroacoustics' in which he outlined some of the more important topics that he had dealt with during his lifetime in audio and his long collaboration with Stanley Lipshitz. John included discussions on the dither in digital audio, the acoustical centres of loudspeakers, low-frequency sound from wind turbines and the acoustic effects of airbag deployment in vehicles. He remained present on the end of the line for questions afterwards. The presentation was followed by an extensive, live Q&A session.

Session 3, Modelling, chaired by Bob Walker

The first paper of the session was 'An ideal workflow for electroacoustic modelling' by Paul Malpas (Ramboll, Cambridge, UK). Paul described the steps that need to be carried out when setting out to use an acoustic model. It is important to understand the objectives and the constraints before even beginning to construct the model. Then, in the limitations of the modelling process, complexity is critical and the software needs to be understood. The model then needs to be extensively tested to check the initial assumptions and the model modified if necessary.

The second paper in the session was 'Creating an acoustic computer model with EASE 5 tools' by Wolfgang Ahnert and Stefan Feistel (AFMG Technologies), presented by Wolfgang. An outline of the history and progression of the EASE family of modelling applications was presented, beginning with the first DOS version in 1990. Since the beginning, all versions had used open loudspeaker data rather than proprietary data, making it possible for users to use or import their own. The additional features and tools in the forthcoming Version 6 were also presented.

The next paper in the session was 'Discrepancies between audience modelling methods in performance venues' by Ross Hammond and Adam Hill (University of Derby) and Peter Mapp (Peter Mapp Associates), presented by Ross. He described a number of different implementations of audience absorption parameters and methods of measurement. The presentation described comparisons between three different methods in our various types of spaces as well as an assessment of the effects of audience density. The presentation was followed by a lively discussion.

The final paper of the day was 'Modelling horn radiation using wave envelope elements' by Patrick Macey (PACSYS). Patrick gave his usual erudite comparison of some different methods for implementing acoustic numerical analysis, using as examples, conical and exponential forms of horn radiator. The effects of increased orders of radial wave elements and changes in element size on the edge diffraction were demonstrated by numerous animated visualisations. One conclusion was that a hybrid form of horn, beginning as a cone and finishing as exponential, gave better results than either of the simple forms.

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Technical sessions, Thursday 29th November

The day began with the presentation of the 2018 Tyndall Medal Award to Filippo Fazi (ISVR, University of Southampton) by the Institute President, Barry Gibbs. The award paper was entitled 'Loudspeaker arrays for audio reproduction'. The presentation covered an extensive range of topics including the principles of arrays, a matrix formulation and the need to invert the matrix, for which there was sometimes no rigorous solution. The second main topic was the ongoing S3A collaboration with four other organisations on future Spatial Audio. Fillipo concluded with a 'hope' that arrays would become a de-facto standard, potentially with MEMS transducers.

Session 4, Room acoustics and measurement, chaired by Mark Bailey

The first paper was 'Guitar soundboard measurements for repeatable acoustic performance manufacturing' by Ludovico Ausiello, Laurence Yule and Chris Barlow (Solent University) and G. Squicciarini (University of Southampton). The paper was presented by Ludovico. He described how 'exact' mechanical copying of wooden guitar bodies didn't give consistent results for sound quality. The paper presented two methods of mechanical excitation, using impulses or electromagnetic transducers, and the results obtained. Ultimately, a CNC machining process could be used to prepare braces to give more uniform instrument behaviour. The presentation was followed by a lively discussion.

The second paper of the session was 'A new way to portray the acoustics of a fine venue to the layman' by Tom Taylor and John Taylor (d&b audiotechnik). The paper was presented by Tom. The objective had been to produce a demonstration unit that the public could use, unattended, to assess the acoustic performance of the Snape Maltings. The project had involved a great deal of work, including the recording and assessment of music recorded both in an anechoic room and played back through the model with the same music performance in the real space. The presentation was very well received, with a lively discussion afterwards. The completed demo booth was also on display in the refreshment area.

Session 5, Loudspeakers 2, chaired by Adam Hill

The session began with 'The 'Bass Transmission Index': a new concept for evaluating loudspeaker performance' by Lara Harris (University of Southampton), Philip Newell (Consultant) and Keith Holland (University of

P24 ▶

(L-R) Barry Gibbs presenting the 2018 Tyndall Medal Award to Filippo Fazi

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Southampton). The paper was presented by Philip. The presentation began with a historical review of measurements of low-frequency responses of loudspeakers, as presented at numerous previous RS conferences. The new approach was to simplify the data presentation into MTFs in 10 frequency bands at seven different modulation frequencies, to allow loudspeaker responses to be categorised more directly by inspection.

The second paper was 'Keeping bass in its place – an evaluation of the practicalities and outcomes of different methods for controlling low frequency sound' by Mark Bailey (QSC). In the presentation, Mark asked what was actually needed from loudspeakers. The presentation consisted mostly of an interactive session with live demonstrations of a number of different types and arrangements of lf loudspeakers with directional radiation patterns.

Session 6, Intelligibility and sound reinforcement, chaired by Robin Cross

The first paper of session 6 was 'Getting to the right place: Life safety standards and the speech transmission index as a driver of effective interdisciplinary design' by Paul Malpas (Ramboll). Paul began by outlining the motivating forces behind improvements in voice alarm and security systems, with illustrations from progressively more stringent standards and some historical incidents. He presented a pair of video clips illustrating that more information led to more rapid evacuations. He made the assertion that recent improvements in systems had been driven by the availability of meaningful STI measurements.

John Taylor

The second paper of the session was 'A first principles method to rapidly optimise the acoustic gain of a sound system with multiple live microphones' by Glenn Leembruggen (Acoustics Directions) and David Gilfillan (Gilfillan Soundworks). The paper was presented by Glenn and described the implementation of a real-time method for the measurement of loop gain, using the system itself. The results could then be used to devise appropriate filters to maximise the system gain without the risk of coloration or feedback.

The final paper of the session was 'Live sound loudspeaker array optimisation for consistent directional coverage with diffuse radiation characteristics' by Adam Hill (University of Derby) and Malcolm Hawksford (University of Essex). The paper was presented by Adam and described how it was necessary to control sound in noise-sensitive areas. A modified Fourier technique, using temporal diffusion, was implemented to achieve the desired coverage patterns and reduce the magnitude of the interference patterns. However, that did lead to reduced overall efficiency and reduction of system headroom.

Session 7, Signal processing, chaired by Keith Holland

In 'Modern sampling: Is Shannon ready for the scrap heap?' by Jamie Angus (Salford University), Jamie presented an in-depth review of the audio sampling process and demonstrated theoretically that the sampling preserved the input data exactly. However, the reconstruction filters required to restore the data perfectly to the analogue domain were not realisable, as they required infinite time responses. The resulting noise and errors were theoretically unavoidable. In practice, they could be reduced to being acceptable.

The second paper was 'Head rotation compensation for cross-talk cancelling loudspeaker arrays' by Loseb Laghidze, Marcos Simón, Andreas Franck, Giacomo Constantini and Filippo Fazi (University of Southampton). The paper was presented by Loseb and described the modelling of a 7.1 surround system using a listener-adaptive cross-talk cancelling sound bar with head-rotation compensation. In tests, the system had been found to over-compensate for head rotation. In the discussion, reference was made to an earlier paper on the location of the actual loudspeaker radiation centre as a possible cause.

The third paper of the session and final paper of the conference was 'Walk-through auralisation framework for virtual reality sceneries powered by game engine architectures' by Daniel Castro (Wood & Grieve Engineers). In the presentation, Daniel described how modern VR techniques could be used in consultancy, marketing, archaeology, education or art installations to give more realistic experiences. A number of available software modules had been combined into a Unity3D plugin to give an enhanced audio experience. A demonstration of a 3D model of an existing library building was also presented.

That concluded the formal conference proceedings at 17:45 hrs. It was followed by a visit to the foyer area of the Bristol Old Vic theatre.

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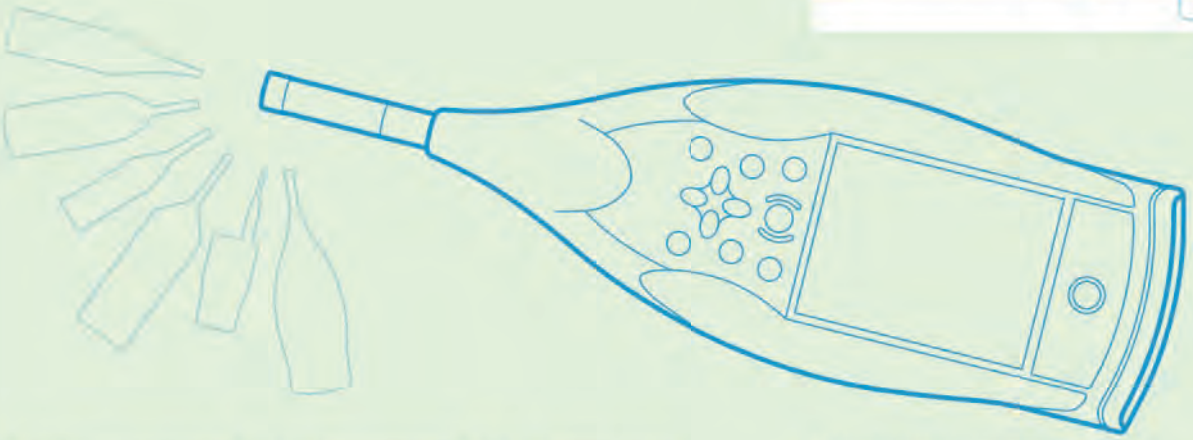

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Acoustic measurements in airflow

Steve Cawser, MEng CEng MIOA, Principal Acoustics Consultant, Environment and Ground Engineering at AECOM

Virtually all acoustics practitioners are aware of the importance of providing protection to microphones to guard against wind induced noise. The use of the ubiquitous 90mm foam windscreen as a minimum for all outdoor measurements is common practice. The increasing use of windfarms has led to the extension of these types of windscreens to include secondary windscreens, which are larger and provide greater protection from wind induced noise on the microphone diaphragm. While these types of windscreens are now mandated for baseline surveys for windfarms, they are not practical for handheld measurements, where the 90mm windscreen is most often used.

Most sources of guidance will advise that a 90mm windscreen will only provide suitable protection up to wind speeds of 5m/s. Any airflows above this velocity may lead to noise measurements being affected by the noise induced by the air movement across the microphone diaphragm. An example of measured wind induced noise at different flow velocities is shown in Figure 1.

For wind speeds of 20 km/h (5.5 m/s), it is likely that wind induced noise is adversely affecting the measurement, particularly at high frequencies. Increasing the wind speed to 40km/h (11m/s) causes a significant increase in wind induced noise. In many instances, winds in excess of these speeds will lead to environmental noise survey data being discarded, and surveys being rescheduled for more favourable weather conditions. However, there are instances when measurements must be carried out with airflows of this magnitude.

One notable application is when commissioning ventilation installations. If the ventilation system has been designed to produce noise levels below the background noise at the closest receptors, demonstrating noise levels meet the required targets can only be reliably undertaken by measuring close to ventilation intake/discharge. If the air velocities of these systems exceed 5m/s, which is possible in high-duty ducted systems, the use of a standard 90mm windscreen begins to limit the effectiveness of the noise measurement and may add uncertainty to the measured data.

Fortunately, there are methods that can be used to reduce the wind induced noise in such situations. The standard 90mm foam windscreen provides protection from air movement in all directions, but if the airflow is from one specific direction, such as you would experience in a ventilation system, many microphones can be fitted with different accessories to reduce the amount of airflow induced noise detected by the diaphragm.

The first of these accessories is the nose cone, which is a replacement for the microphone protection grid and is aerodynamically designed to provide the lowest resistance to airflow possible. A typical nose cone and the associated performance when subjected to airflow are shown in Figure 2. A comparison with Figure 1 shows the reduction in wind noise that can be achieved by using such a device.

P28 ►

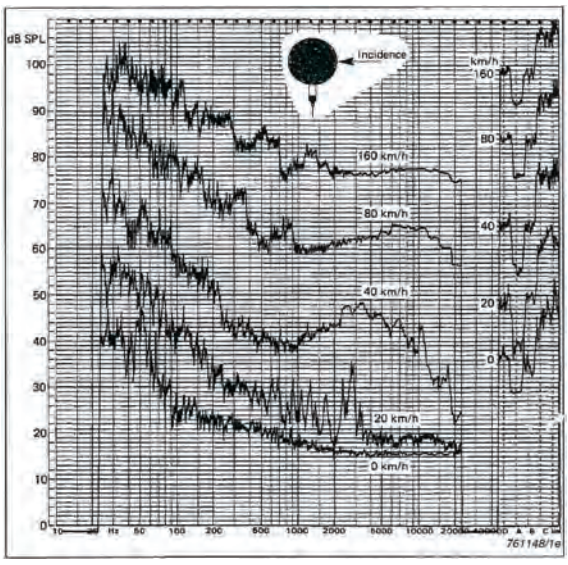


Figure 1: Wind induced noise on microphone fitted with 90mm windscreen (source: Brüel & Kjær)

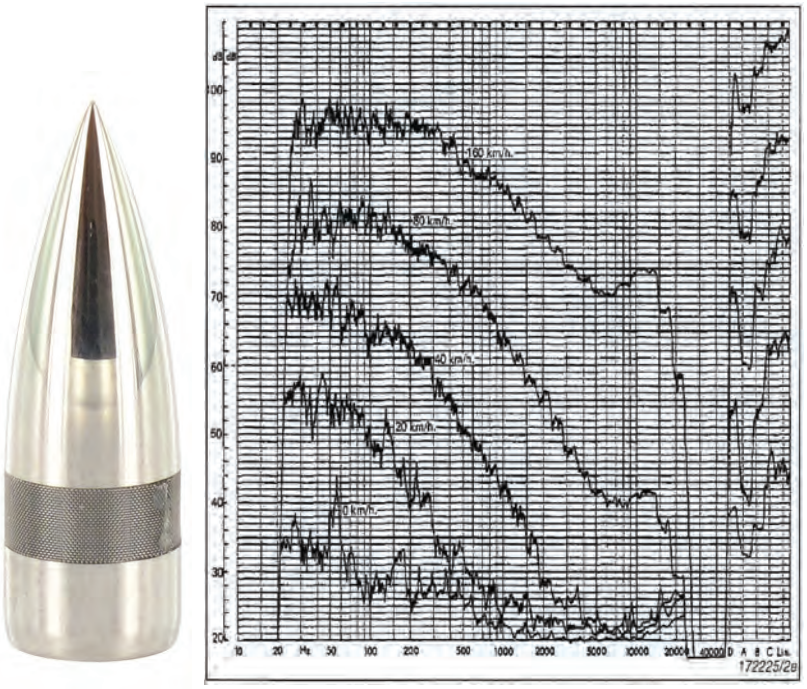
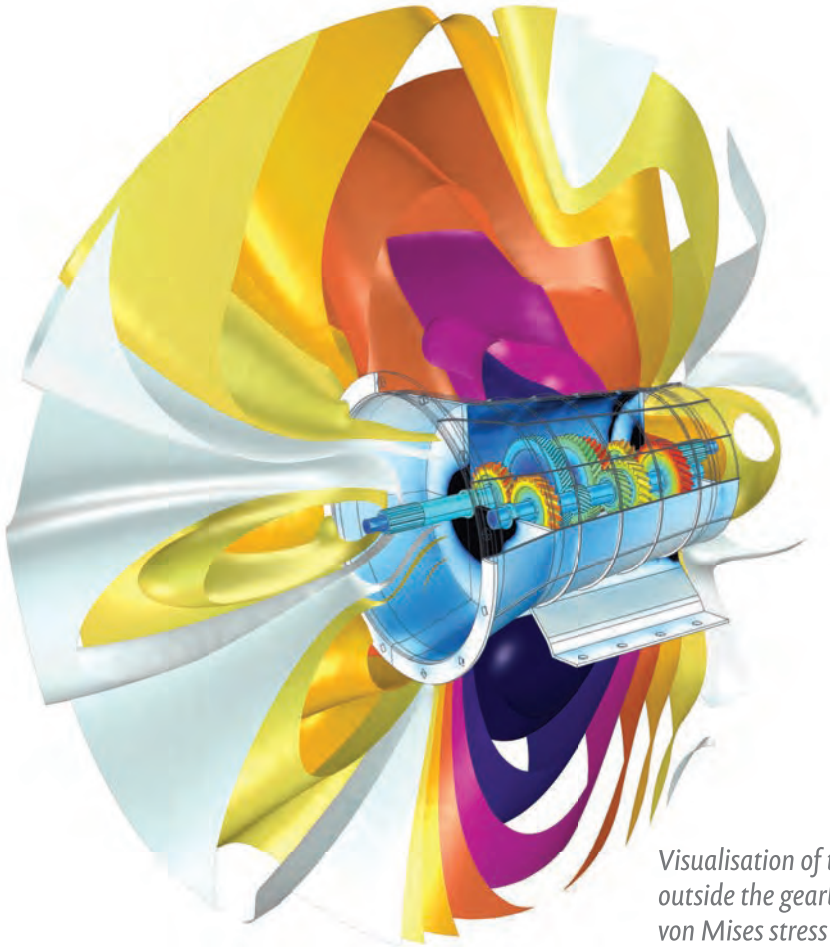


Figure 2: Microphone nose cone and wind induced noise when microphone fitted with nose cone (source: Brüel & Kjær)

How noisy is this gearbox design?



Visualisation of the noise pressure level outside the gearbox and vibration-induced von Mises stress in its housing.

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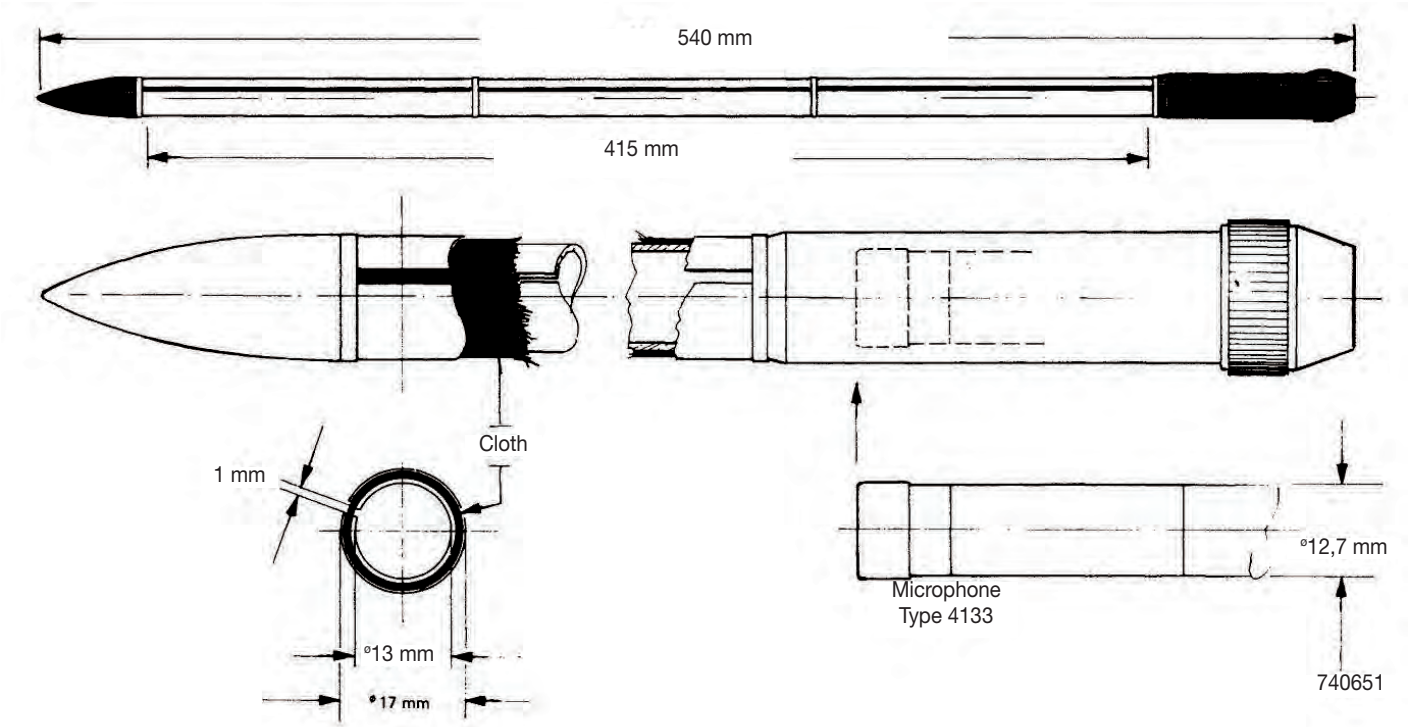

Figure 3: Microphone turbulence screen (source: Brüel & Kjær)

The main disadvantage of using a nose cone is that it replaces the microphone protection grid, which requires the grid to be removed and the diaphragm to be exposed while installing the nose cone, which can increase the likelihood of causing damage to the diaphragm.

If the noise measurements are required to be carried out within the ductwork of the system, a higher level of protection may be necessary to prevent noise from turbulence in the airflow. In these circumstances, it is possible to use a turbulence screen, which provides even better levels of protection than a nose cone. An example of a turbulence screen is shown in Figure 3 (above).

In these devices, the microphone is inserted into the cylindrical tube. The tube is equipped with an axial slit which is covered with damping material to control the flow resistance of the slit. It essentially allows the sound to pass through, while restricting the pressure fluctuations of the air turbulence. These devices are generally only needed in specific circumstances; manufacturers generally quote their performance based on air velocities of 20m/s and it will perform significantly better than a nose cone at those velocities. However, air velocities of this magnitude are generally higher than most practitioners will experience.

If the testing is to be carried out within a solid-walled wind tunnel, there are specialist windscreens available specifically for this purpose. These types of turbulence screens can be flush mounted into a recess in the wall of a duct and are designed to reduce the turbulent component at the microphone by up to 25dB. An example of a turbulence screen for ducts is shown in Figure 4.

P30 ►

Figure 4: Turbulence screen for use in duct walls (source: GRAS sound and vibration)

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Since both nose cones and turbulence screens are aerodynamically shaped, they will only function as intended when the airflow is from a single and constant direction. It should be noted that any device fitted to a microphone to reduce airflow induced noise will affect the frequency response of the microphone. The effect on the frequency response of the microphone for a 90mm windscreen and a nose cone are shown in Figure 5.

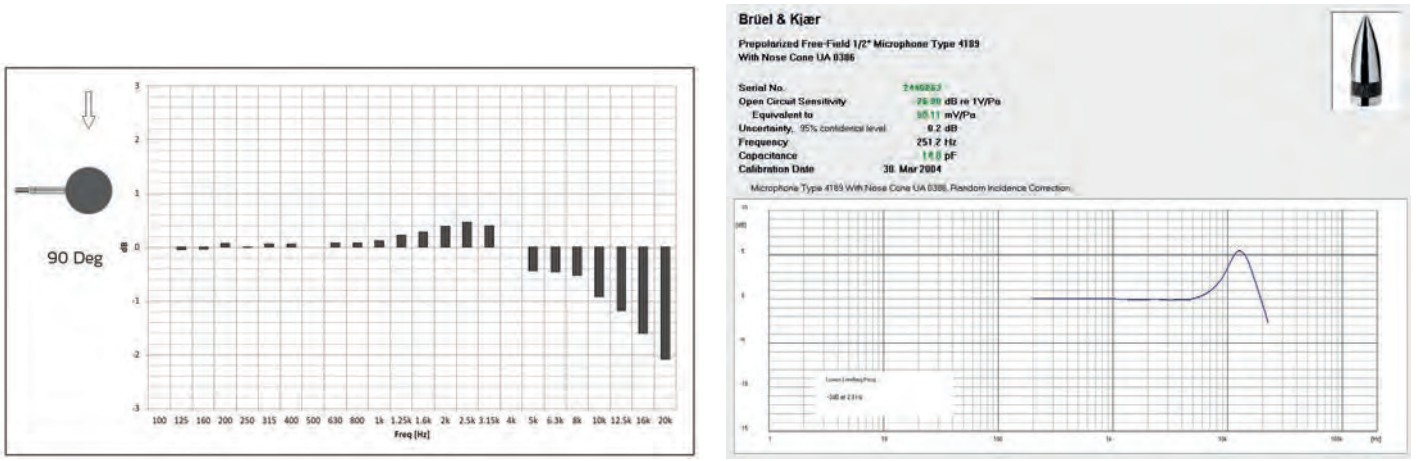

Figure 5: Effect on frequency response of ½" microphone for a 90mm windscreen (left - source: GRAS sound and vibration) and a nose cone (right - source: Brüel & Kjær)

The traditional 90mm windscreen has a small effect on the frequency response for which many modern sound level meters have compensation filters included. These types of sound level meters can automatically correct for the presence of the windscreen. However, if a device such as a nose cone is to be used, the effect of this on the frequency response of the system should be noted and corrected for if necessary. The manufacturer of the device should be able to provide these details if required, as shown in the example in Figure 5.

Many people will also be aware of the large windscreens used by television broadcast teams to reduce wind noise, where a large fluffy cover is placed on the microphone. There appear to be no manufacturers of instrumentation quality equipment that produce an equivalent product. The use of such products is not recommended unless documentation on the effect on the microphone sensitivity and frequency response can be demonstrated.

This article has covered the options available on the market for minimising wind induced noise on microphones. Each of the options has advantages and disadvantages, which should be considered carefully when carrying out measurements of these types to ensure that measurements reduce the uncertainty as much as possible.

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https://www.gras.dk/products/product/662-67ts-1-cl.html

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- Manufacturing / Noise Control & Attenuation
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Acoustics events in focus 2019

This is a list of some of the main upcoming events for acousticians in the UK and abroad. Let us know if there are other events that ought to be of interest to fellow members, and we'll be sure to include them in future issues. Please email: **marketing@ioa.org.uk**

13-14 May ACOUSTICS 2019, Milton Keynes, UK

The IOA's Annual Conference will be held 13-14 May 2019. It will include sessions from the IOA's specialist groups and the RWB Stephens Medal 2019 Lecture. A drinks reception at the IOA's new office will take place on the Sunday evening for those arriving early and the awards dinner will be held on the Monday evening.

https://www.ioa.org.uk/civicrm/event/info%3Fid%3D417%26reset%3D1

13-17 May ASA, Kentucky, USA

The 177th meeting of the Acoustical Society of America (ASA) will be held 13-17 May 2019 at The Galt House, Louisville, Kentucky.

https://www.emedevents.com/c/medical-conferences-2019/177th-meeting-of-the-acoustical-society-of-america-asa

20-22 May International Symposium on Fluid Acoustics (IFA2019), Sopot, Poland

The International Symposium on Fluid Acoustics will be held 20-22 May 2019 at Hotel Eureka, Sopot, Poland.

https://euracoustics.org/events/events-of-2019/international-symposium-on-fluid-acoustics-ifa2019

12-14 June Wind Turbine Noise, Lisbon, Portugal

The theme of this conference is 'Consolidating our Knowledge on Wind Turbine Noise'. It will be held 12-14 June 2019 at Altis Grand Hotel, Rua Castilho, 11, Lisbon, Portugal.

https://www.windturbinenoise.eu/content/conferences/8-wind-turbine-noise-2019/

16-19 June INTERNOISE 2019, Madrid, Spain

The 48th International Congress and Exhibition on Noise Control Engineering will be held 16-19 June 2019. The Congress is organised by The Spanish Acoustical Society on behalf of the International Institute of Noise Control Engineering at Palacio Municipal de Congresos de Madrid, Campo de las Naciones, Madrid, Spain

http://internoise2019.org/

17-20 June OCEANS 2019, France

OCEANS is the bi-annual event for global marine technologists, engineers, students, government officials, lawyers and advocates and highlights relevant topics and current trends, while creating a community of learners and influencers who advance research, practices and policies for the marine field.

www.oceans19mtsieeemarseille.org

30 June-5 July 5th International Conference and Exhibition on Underwater Acoustics, UAC2019, Crete

The fifth International Conference and Exhibition on Underwater Acoustics will be held on 30 June-5 July 2019 in Crete.

https://acoustics.ac.uk/events/underwater-acoustics-will-take-place-in-hersonissos-crete/

7-12 July The Effects of Noise on Aquatic Life 2019, The Netherlands

The focus of this conference is on marine animals and the potential effects of sound. It aims to broaden the perspective of participants and help them see that their issues are far larger than the marine environment.

http://www.an-2019.org/

7-11 July ICSV26, Montréal, Canada

The International Institute of Acoustics and Vibration (IIAV) and the Canadian Acoustical Association (CAA) invite scientists and engineers to attend the 26th International Congress on Sound and Vibration (ICSV26) to be held in Montréal 7-11 July 2019.

https://www.icsv26.org/

13-14 August BIOACOUSTICS 2019, Loughborough, UK

This conference will be the sixth in the series and will review the present state of this evolving subject area, report on new developments and examine future trends.

https://www.ioa.org.uk/civicrm/event/info%3Fid%3D404%26reset%3D1

25-28 August NOISE-CON 2019, San Diego, USA

NOISE-CON 2019 will be held 25-28 August 2019 at the Sheraton San Diego Hotel and Marina, San Diego, USA.

https://noisecon19.inceusa.org/

25-30 August 14th International Conference on Mathematical and Numerical Aspects of Wave Propagation (WAVES2019), Vienna, Austria

This biannual conference will be held 25-30 August 2019 at Vienna University of Technology, Vienna, Austria. It is one of the main venues for dissemination of the latest advances in theoretical and computational modelling of wave phenomena, both in science and technology.

https://10times.com/waves-vienna

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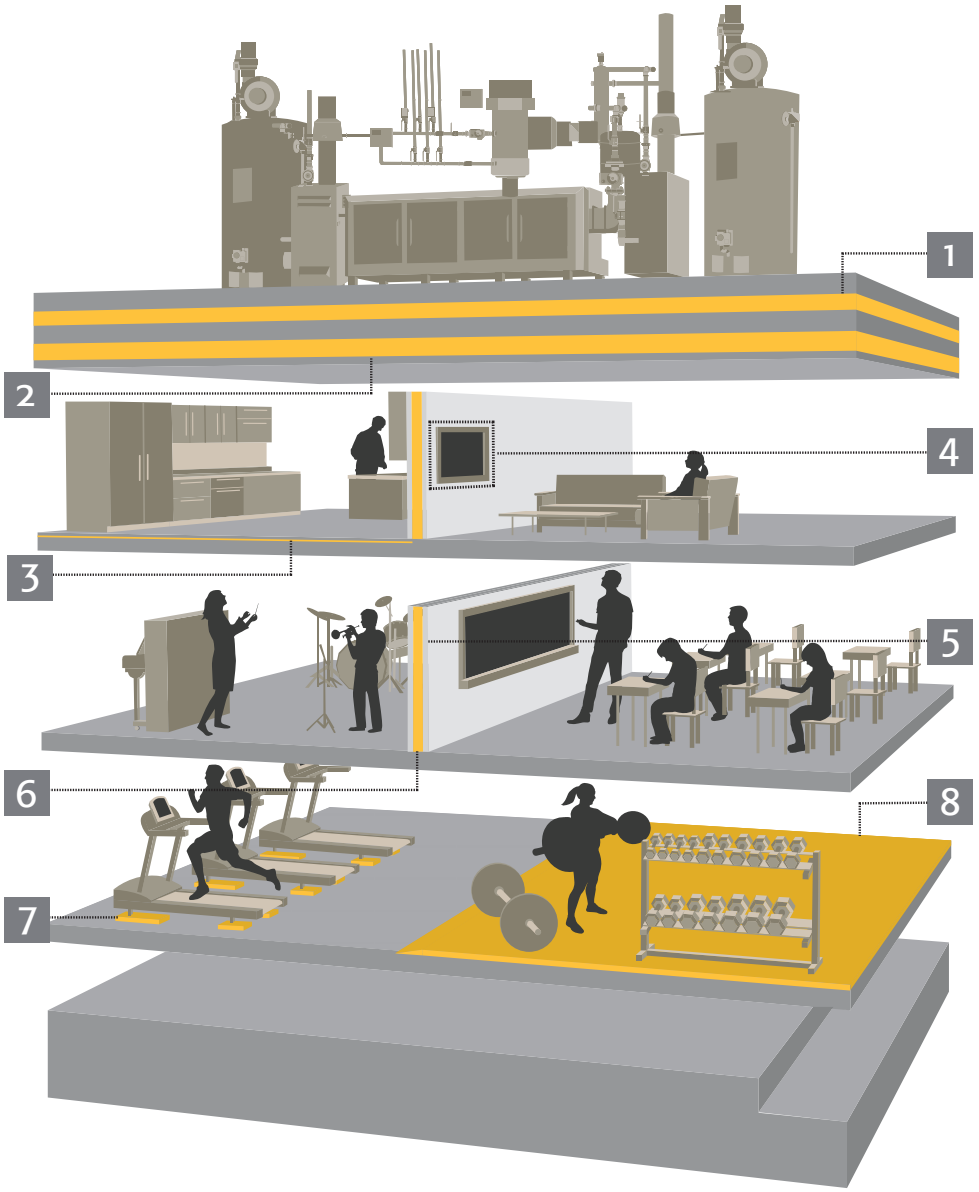

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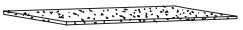
3 GenieMat RST



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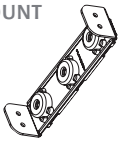

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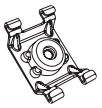

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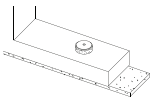

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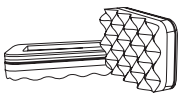

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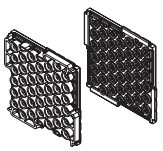

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3-6 September International Congress on Ultrasonics 2019, Bruges, Belgium

The International Congress on Ultrasonics, held 3-6 September 2019 in Bruges, Belgium aims to bring together professionals and experts from academia and industry in all disciplines of ultrasonics, covering fundamental science as well as applications in the field of engineering material characterisation and quality inspection, chemical and biological US-based monitoring, medical imaging, and therapy.

https://agenda.kuleuven.be/en/content/2019-international-congress-ultrasonics

8-13 September 23rd International Congress on Acoustics (ICA2019), Aachen, Germany

The German Acoustical Society (Deutsche Gesellschaft für Akustik, DEGA) is holding its 23rd International Congress on Acoustics on 8-13 September 2019 in Aachen, Germany. The technical programme will include plenary, distinguished, invited, contributed and poster papers covering all aspects of acoustics.

http://www.ica2019.org/

13-17 September International Symposium on Musical Acoustics (ISMA2019), Detmold, Germany

The International Symposium on Music Acoustics will be held 13-17 September 2019 at Detmold Summer Theater, Neustadt 24, 32756 Detmold, Germany.

http://www.isma2019.de/

15-17 September International Symposium on Room Acoustics (ISRA2019), Amsterdam, The Netherlands

The Dutch Acoustical Society is holding the International Symposium on Room Acoustics 2019, in Amsterdam, The Netherlands, on September 15-17, 2019. ISRA 2019 is a satellite event to the International Congress on Acoustics, ICA 2019.

https://euracoustics.org/events/events-of-2019/international-symposium-on-room-acoustics-isra-2019

19-21 November Reproduced Sound 2019 – Creating Engagement in Sound, Bristol

This conference, held 19-21 November 2019 in Bristol, will focus on all aspects of electroacoustics, and will be an informal gathering for all working in or starting out in this industry.

https://www.ioa.org.uk/events

30 Nov-6 Dec ASA, San Diego, USA

178th Meeting Acoustical Society of America (ASA) is organised by Acoustical Society of America (ASA) will be held 30 November-6 December 2019 in San Diego, California, **USA.**

https://www.emedevents.com/c/medical-conferences-2019/178th-meeting-acoustical-society-of-america-asa-1

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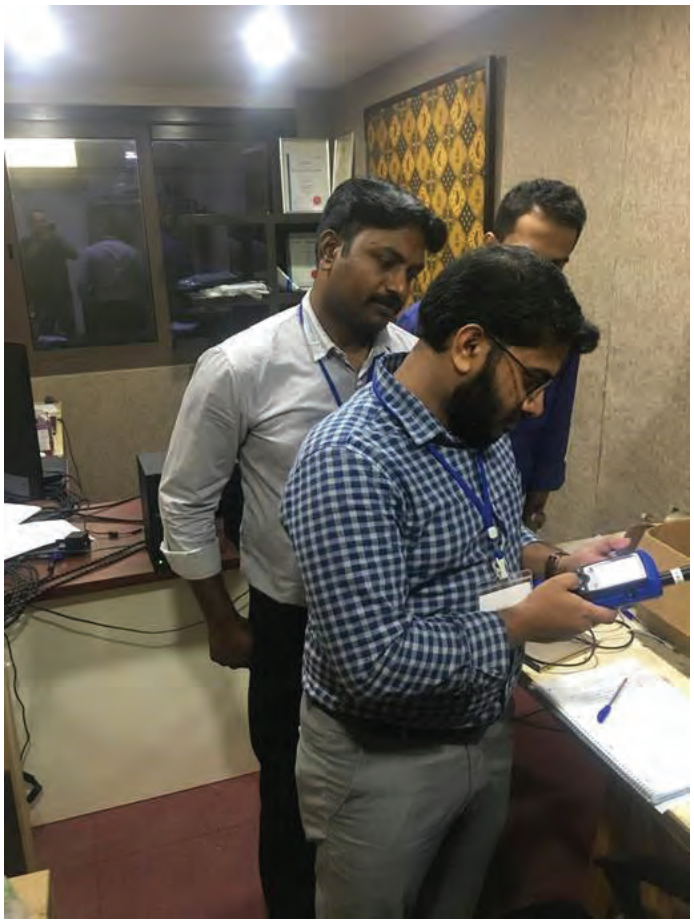
New venue for Diploma Laboratory classes in the Middle East

IOA Education and Training is pleased to be able to announce and welcome the new Diploma Laboratory venue in the Middle East. IOA Education Manager, Professor Keith Attenborough HonFIOA, reports.

For the past few years, a substantial proportion of Diploma candidates have been from overseas and the IOA seeks both to maintain and preferably, to increase this number. An obstacle for many overseas Diploma candidates is the need to travel to the UK or Dublin to participate in the classes required for the laboratory module.



The images show the first cohort of six students to take the laboratory classes at DARL

P38 ▶

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Dublin has tended to be favoured over Liverpool since the classes are held over a four-day block in January, whereas Liverpool requires two two-day trips in November and February respectively.

During a meeting between Graham Parry (Vice-President for Groups and Branches) and Paul Schwartz (Technical Director of the Dubai Acoustic Research Laboratory (DARL)) in March 2018 to discuss the inauguration of a Middle East chapter of the IOA, the idea was initiated that DARL could be used for Diploma laboratory classes, thereby offering candidates from the Middle East in particular, considerable savings in time and in the cost of travel.

Accreditation

Paul followed this up in October 2018, by finding out what was needed to arrange for accreditation at DARL for delivery of the Diploma laboratory classes. As a result, Gary Seiffert, the Diploma laboratory examiner and tutor for the Diploma laboratories in Liverpool, visited DARL at the end of November 2018 to check out facilities and tutors. Gary reported back positively and thanks to the efforts of Gary and Gerald Stewart at DARL, experiments and notes were prepared to enable the first cohort of six students (shown in the photographs) to take laboratory classes at DARL in January 2019.

Last year, DARL delivered seven of the eight laboratory activities used at Liverpool. The eighth, on vibration, was offered as 'demonstration only' this time but will be available for 'hands-on' activity this year. Nevertheless, given the short time scale in which everything has been achieved, congratulations are deserved all round.

The images show the first cohort of six students to take the laboratory classes at DARL

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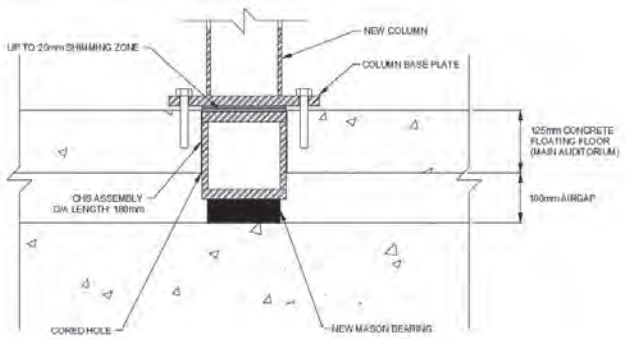
Royal Opera House Case Study

After an initial floating floor installation in 1997, Mason UK joined up again with the Royal Opera House to assist in the design and supply of acoustic isolation solutions. The “Open-Up” project undertook a substantial refurbishment which included the Piaza and Linbury Theatre which went under a major redesign with a brand new seating structure being constructed on top of the existing Mason Floating Floor.

Royal Opera House Piaza entrance ▶



▲ *Sectional view of the new bearing assembly through the existing floating floor*

The main scope of the Mason UK works was to investigate the existing 20 year old Mason floating floor bearings and assess whether the new loadings from the steel structure were still suitable. On review, additional bearings were required to satisfy the additional new loads despite the existing bearings being in good condition. Redundant jacks were disengaged and holes were cored through the floating slab at new column locations for bearings and steel extension sleeves to be inserted; the structural steels where then constructed upon the sleeves.

In addition to the main auditorium, a new waterproofed floating floor was required in the lift pit. The floor was designed and supplied by Mason UK along with a bespoke column baseplate design which enabled the existing lift columns to be preloaded onto the floor. The bearings were selected to satisfy the 12Hz acoustic requirement as well as the high loading and emergency conditions that are common with lift design.

The Royal Opera House project is typical of how Mason UK are able to not only provide high quality acoustic solutions, but also able to assist in the design and installation of complex, bespoke arrangements.

Steel columns being loaded onto the floating floor

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SWG3 case study and Agent of Change in Scotland

The story of SWG3, one of Glasgow's foremost and fascinating arts and music venues, began with the transformation of a customs and excise bonded warehouse on the banks of the River Clyde, after a long and derelict slumber.

Glasgow's Finnieston district wasn't always the domain of the hipster bar that it is now. With its shipbuilding heyday a distant memory, the darkened industrial warehouses lined the river and unemployment cast a long shadow. Decades later, the first sheds of of the Scottish Exhibition Campus sprang up beside the iconic Finnieston crane, breathing new life into the abandoned docks and, over the decades, the area has shape-shifted to become a popular music and arts quarter with bars, restaurants, student halls and private apartments all vying for space by the River Clyde.

SWG3 started life in the former bonded warehouse from a few green shoots, firstly as a hidden studio space and exhibition venue for those in the know. It drifted out of the shadows in 2005 as a 'shabby chic' art initiative, once described as being "slap bang in the middle of nowhere." Owner and curator, Andrew Fleming-Brown, noted in a recent interview that even the cabbies didn't know where it was.

In the early days, SWG3's closest neighbours, Clydeside Galvanizers, provided their own unique industrial soundtrack to the area. Just a couple of years previously, permission had been granted for the development of private student halls of residence on the boundary with Clydeside Galvanizers, these were built and subsequently bought nine years later by the University of Glasgow as they sought to attract more international students to the city. At the same time, the warehouse venue was gradually gaining traction – a handful of gigs in the old buildings sparkling among the developing arts initiatives.

Almost as a harbinger of greater cultural things to come, local promoters organised an audacious electronic music festival in Clydeside Galvanizer's yard, remembered to this day by Glasgow City Council's night noise team, swiftly followed by a retreat to the day job. But the de-escalation of industrial uses ground on and eventually, in 2016, Clydeside Galvanizers packed up and left the site.

P42 ►

The Galvanizers Shed (before)

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Acoustic advice for planning and licencing

For a time, the land lay vacant with rumours of residential development, until eventually as the land value waned, SWG3 acquired the whole lot, including the former Galvanizers shed, abutting their own existing warehouse, and the yard stretching across to the halls of residence. The site, with its diverse selection of spaces, was now full of potential as a multi-use venue; its substantial stripped-back industrial aesthetic reflecting similar enterprises in New York or Berlin. The owners now had three event venues and three floors of arts studios and workshops, as well as some ambitious plans for the former Galvanizers shed and yard.

The new complex now required technical acoustic advice for planning and licencing, as well as architectural and building acoustics design input for indoor and outdoor live music events, with aspirations for late licencing across all indoor venue spaces.

Around the same time, fate dealt the City's arts and music community a devastating blow; the Mackintosh building of the Glasgow Art School was destroyed in a fire, which also razed the O2 ABC nightclub and music venue on Sauchiehall Street to the ground. This left a gap in the availability of mid-sized venues available to host touring bands and other entertainment events and the potential of the Galvanizers shed came into sharp focus.

Challenges

The first tentative steps towards achieving the planning and licencing goals of the complex sought to bring the University of Glasgow to the table as the closest noise sensitive neighbour, with a view to sharing plans for the venue and to identify the implications and protection measures necessary for the residents of Maclay Halls.

The Maclay Halls postgraduate international students had previously complained about the industrial noise from Clydeside Galvanizers and now, following a lull while the shed and yard lay vacant, they might be faced with late night music and entertainment noise, and crowds of revellers drifting up and down Eastvale Place.

When the proposals were revealed for the transformation of the shed and yard, the University raised a list of potential concerns, including:

- music noise from club nights and other events (bass beat);
- ingress and egress of patrons late into the night;
- drunk and anti-social behaviour;
- insufficient stewarding; and
- disposal of glass after hours.

Most of the concerns reflected the absence of a meaningful relationship between the two institutions with the University citing examples of previous complaints from residents, the details of which had never been passed to the venue to address as there were no open channels of communication. It was immediately apparent that a holistic approach to noise management and the relationship between SWG3 and the University Halls would be key to success.

Noise during ingress and egress

Over the course of the following weeks, interviews and listening exercises with current residents confirmed the results of frequency specific noise studies on the boundary of the yard with the Halls; that bass beat from club events in the existing warehouse building was audible externally. However, by far the greatest concern from residents was noise from patrons during ingress and egress, especially late at night and the resulting adverse effects on sleep and amenity.

Despite the fact that SWG3 proposed substantial improvements to the Galvanizers shed to integrate it into the existing warehouse complex and, in doing so, to improve noise break out from the existing warehouse venues, the proximity of Maclay Halls to the Galvanizers shed and yard limited the potential for complete containment of music and entertainment noise and associated patron profile. Physical works were not going to present the full solution.

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Patrick Topping in the Galvanizers

Solutions

Given that the Galvanizers shed was initially nothing more than a well-ventilated corrugated metal and brick industrial workshop, work began immediately to improve the construction for weather-proofing and sound insulation, in so far as was realistically achievable.

The roof was removed and replaced with a complex structure, increasing mass with layers of dense Soundbloc plasterboard and introducing a significant air gap with mineral wool in-fill. The brick elements were surveyed and single skin areas also made good/infilled and the walls overclad. A modern timber kit bar/restaurant with roof deck, (now known as the Acid Bar), was built on the yard side of the shed and all patron accesses restricted to the Eastvale Place aspect, minimising the number of doors along the façade facing the Halls to lobbied double emergency exits only.

All measures were carefully selected to be sympathetic with the industrial heritage and aesthetic, but whilst being affordable.

Underfloor heating was included along with mechanical ventilation and all duct work exiting to the north. Ducting internally was physically separated from high noise areas to limit break-in and a scheme of attenuators drawn up to limit music noise egress between venues and to air side.

A load-in and technical area was created at the north stage end of the Galvanisers shed, with drive-in access for most vehicles and roller shutters to contain load in and load out activities, as well as to satisfy the needs of other users, including TV, theatre and exhibitors. Most recently, a suite of greenrooms has been added with direct access to each of the venues.

Inside, the reverberation time of the Galvanizers has been reduced and the sound field dissipated using triple plaid drapes and, on the back wall, vertical timbers with sound absorbent material behind to limit the hard reflection to the front of house mix position. These features have tamed the room, ensuring an easier mix and have reduced the temptation to fight the room with more sound. A d&b distributed in-house sound system has also been introduced sufficient to satisfy the touring acts and to create a known quantity for the venue audio team to work with. All these schemes have helped to keep front of house sound levels within manageable parameters.

Recently, a 01dB Duo has been installed on the boundary wall with Maclay Halls with cabled ethernet and mains power, providing a reliable real-time A-weighted and 1/3 octave feed into the Galvanizers. This complements 10Eazy real-time music noise monitoring software and hardware, with both feeds simultaneously visible on a dedicated laptop at front of house. This ensures that house and touring audio teams can proactively control music noise levels inside the venue and see the effects outside, providing the opportunity to smooth out unnecessary impacts.

A music and operational noise management plan was drawn up and agreed with the University of Glasgow and Glasgow City Council, with commitments including:

- dedicated complaints mobile number in production during all events;
- frequent exchange of information with the University to keep them informed of upcoming events as well as sensitivity to University term dates, exam dates and key submission deadlines;
- active control of music noise levels inside and outside the venue;
- additional and coordinated security provision, responsive to crowd dynamics;
- relocated smoking area;
- relocated glass disposal bins and restrictions on their hours of use;
- physical restrictions to hidden areas on Eastvale Place with potential for anti-social behaviour;
- multi-agency approach to managing all travel to and from the venue; and
- opening dialogue with Glasgow City Council to establish a pop-up taxi rank.

SWG3 also offers social media and email contact direct between students and the venue, with monthly lists of events with opportunities for student attendance, and provision of space for student meetings/clubs and other University functions.

This practical approach has been very successful and has led to a strong relationship with all parties, which, with open lines of communication, is yielding positive results and has facilitated transformation of the Galvanizers.

Since transformation, the Galvanizers has been used for various arts and cultural events, including the quarterly iconic electronic music event, Pressure, visits from internationally acclaimed bands and DJs, Scottish Opera's Opera Sparks programme finale for new performers, composers and librettists, dinners, catwalks, brand launch and activations.

Planning consent for the yard

Meanwhile, plans for the Galvanizers yard were also taking shape, although, the initial planning consent for the yard specifically precluded amplified music, to protect the adjacent halls of residence. A Section 42 application would be required to unlock this, however it would also be dependent on the opinion of the University of Glasgow, given the proximity of the halls to the yard.

Building on this much improved relationship though, plans were tabled for two live music events each with 5,000 capacity.

Using the collaboration between SoundPLAN and d&b, arraycalc files for the proposed PA were modelled in 3D to determine the acoustic footprint of the events, and to demonstrate that the off-site noise profile would not adversely affect the wider area beyond the halls. The University agreed that, for a small number of shows during University holiday periods, they would voluntarily exempt the halls from any music noise limit condition and, thereby satisfied, Glasgow City Council granted the Section 42 application. This paved the way for two sold out nights of The XX in August 2017, followed by visits from Belle and Sebastian and LCD Soundsystem in 2018.

The venue had finally fulfilled its potential.

Agent of Change

As the story of SWG3 was unfolding, the conversation about the protection of existing music venues in the context of a rapidly changing urban landscape was becoming louder and more urgent. As city and town centres across the UK were losing their traditional high streets and shops, planners were creating new dynamics with increasing levels of residential use mixed in with existing commercial and entertainment uses. Amid the aspiration to create vibrant mixed-use spaces, increasing numbers of stories were emerging of music venues, in some cases established for years, suddenly coming under pressure from noise complaints generated by new residents

P46 ►

distressed by levels of music noise, load in and load out activities and patrons coming and going.

In some cases, venues were desperately trying to retrofit mitigation at their own expense to stem complaints and fend off noise abatement notices. In others, the venues were losing their battles and simply having to close their doors. It was, the music community claimed, a cultural crisis which the UK and regional governments must address.

Agent of Change is a common-sense principle and not a novel one. It simply puts the onus on the party effecting a change in the vicinity of an established use to demonstrate that the design is adequate such as not to adversely effect the existing use.

So, if a residential developer seeks permission to build flats beside an established grass roots music venue, then the onus to ensure that adequate mitigation of noise transfer from the venue to future habitable rooms is the obligation and at the expense of the developer. So far so good. However, the devil, as ever, is in the detail.

In Scotland, a music industry pressure group had formed, technically supported by KSG Acoustics and North Planning and Development. Consisting of prominent music venue operators and promoters, some of the members themselves were under pressure from encroaching private apartments and hotels. A targeted media campaign and lobbying of Members of the

The Yard (before)

Scottish Parliament led to a meeting with the Minister for Local Government, Housing and Planning at Holyrood.

Shortly afterwards, on 16th February 2018, the chief planner wrote to the heads of planning in all local authorities, quoting the Minister's assertion that:

'I am attracted by the prospect of embedding the Agent of Change principle into our planning system so that we can protect the established and emerging talent in our music industry. Our live music venues should not become financially disadvantaged or have their viability threatened as a result of new development in their vicinity.'

The stated purpose of the letter was also to *'advise of our intention to implement the principle explicitly through future national policy.'*

After the flurry of press coverage and the Ministerial photo calls however, it soon became apparent that significant steering and shaping would be required to crystallise the principle of Agent of Change into functional legislation, to ensure that it serves its stated purpose of protecting existing music venues in this way.

The initial assertion that the principle would be adopted into the forthcoming National Planning Framework and Scottish Planning Policy was quickly superseded with tabled amendments from all major political parties to introduce it directly into the Planning (Scotland) Bill, currently making its way through the Scottish Parliament.

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The XX in the Yard

Regardless of the form of words which it will eventually take in the Bill, it is crystal clear that implementation at local authority level will require unambiguous technical guidance to assist environmental health and planning officials in determining whether the content of a given application is fit for purpose.

This includes the technicalities of supporting noise impact assessments and the likely efficacy of the various mitigation measures that might be included, and, which may, for example, purport to ensure acceptable amenity for future residents such as to protect the continued operation of the existing music venue.

The acknowledgement of the Agent of Change principle by the Scottish Government is, it seems, only the tip of the iceberg. Although it only exists at this stage as a letter of intent and a reminder of the existing planning guidance from the chief planner, it is already having an affect on decision making and on judicial review proceedings for challenges to decisions of this kind.

Whatever the final wording in the Planning (Scotland) Bill and the resultant technical guidance, what seems certain is that endorsement of the principle by the Scottish Government in any form will, if nothing else, force the issue into the open and give weight to the presence of existing music venues in the drive for new noise sensitive development.

Music venues should be seen in a positive light

Some concerns have been expressed that the Agent of Change is effectively carte blanche for noise generators, and that somehow, venues will be allowed to proceed unfettered to make unlimited amounts of noise with no consequence. However, the other channels of regulation, including the powers of environment health officers to establish that a nuisance has or will occur, and the role of a venue's operational noise profile in the licencing process remain unaffected. There has been significant emphasis within the music industry that music venues should be seen by councils and local communities in a positive light, making a valuable contribution to the cultural offering of a place.

In Glasgow, this is particularly relevant, given its UNESCO City of Music status.

It is therefore arguably more in the interests of venues to be neighbourly and well managed, to ensure that they receive the protection that Agent of Change offers while benefitting from the vibrant mixed-use communities that local planning authorities have within their gift to create.

Simply, Agent of Change should clearly and fairly make developers accountable for the changes they bring.

Future neighbours

For SWG3, once in a part of town that cabbies forgot, is now shimmering on the edge of one of the most desirable parts of the city known for its culture and music, the principle of Agent of Change may soon be turned on its head. Ensuring that the venue's impacts on Maclay Halls of Residence are adequately mitigated and managed remains critical, the venue now faces the possibility of new residential use to the north and south as the former Yorkhill Hospital site and Castlebank Quay on the riverside have both become prime targets for developers.

SWG3 is acutely aware of the need to be a good neighbour and a responsible operator to ensure that the Agent of Change will protect them when they need it most. As an established use, it will be for future developers to demonstrate to Glasgow City Council planners and environmental health officers that future residential development can sit comfortably side by side with the venue. The Music Industry Group and other influential lobbying groups will be watching closely to ensure that the hard-fought principle is appropriately applied.

In the meantime though, like the city it calls home, SWG3 continues to flourish.

SWG3 is at 100 Eastvale Place, Glasgow G3 8QG
www.swg3.tv

Author
Lindsay McIntyre is a Director of KSG Acoustics, part of the KSG Group based in Glasgow. KSG Group provides a range of audio and acoustic services and consultancy to the music industry, including planning and licencing related acoustic advice, venue specific matters and PA design.

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AIRBORNE NOISE REDUCTION CLASSES:

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IMPACT NOISE LEVEL CLASSES:

F	E	D	C	B	A	A*
> 60 dB [1]	≤ 60 dB [1]	≤ 50 dB [1]	≤ 45 dB [1]	≤ 40 dB [1]	≤ 35 dB [1]	≤ 30 dB [1]

Source: DEGA Empfehlung 2018 (103), S.9

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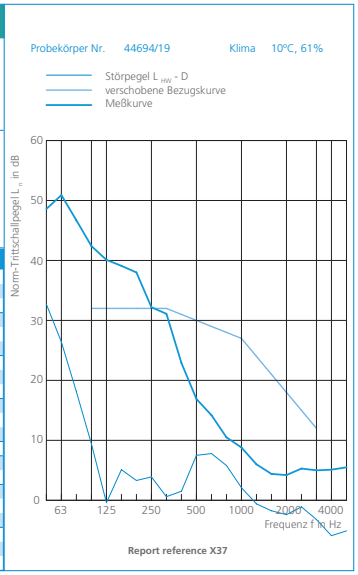
IMPACT NOISE

$L_{n,w}$ 30 dB

$L_{n,w}$	30 dB
$L_{n,w,+}$	30,0 dB
max Abw.	10,4 dB / 100 Hz
Summe	31,8 dB
Norm	DIN EN ISO 717
$L_{n,sum,100-2500}$	46,6 dB
$C_{I,100-2500}$	2 dB
$L_{n,sum,50-2500}$	54,6 dB
$C_{I,50-2500}$	10 dB

f(Hz)	L_n(dB)	L_{HW}-D	L_h
50	48,6	-	-
63	50,9	-	-
80	46,7	-	-
100	42,4	-	-
125	40,1	-	-
160	39,1	-	-
200	38,0	-	-
250	32,2	-	-
315	31,1	-	-
400	22,9	-	-
500	16,9	x	x
630	14,2	x	x
800	10,5	x	x
1000	8,8	x	x
1250	6,0	-	x
1600	4,4	-	2,6
2000	4,2	-	4,0
2500	5,3	-	4,2
3150	5,0	-	5,0
4000	5,1	-	6,1
5000	5,5	-	6,9

x <=> Wert korrigiert
99.9 <=> Korr.= +1.3 dB

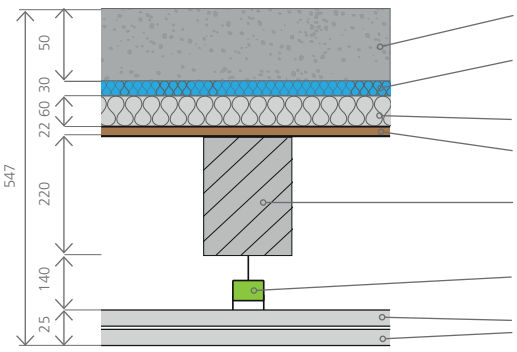


AIRBORNE NOISE

R_w 82,3 dB

R_w	82 dB
$R_{w,+}$	82,3 dB
max Abw.	11,1 dB / 100 Hz
Summe	27,9 dB
Norm	DIN EN ISO 717
$C_{100-3150}$; $C_{tr,100-3150}$	-4;-11
$C_{50-3150}$; $C_{tr,50-3150}$	-17;-31
$C_{100-5000}$; $C_{tr,100-5000}$	-3;-11
$C_{50-5000}$; $C_{tr,50-5000}$	-16;-31

f(Hz)	R (dB)
50	27,7
63	34,6
80	43,2
100	51,9
125	64,4
160	64,1
200	69,0
250	72,4
315	77,0
400	80,5
500	79,6
630	82,8
800	83,9
1000	86,5
1250	89,3
1600	87,8
2000	87,9
2500	85,5
3150	86,7
4000	90,0
5000	87,5



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- Elastic thermal isolator (30 mm, 5,2Kg/m²)
- Fibre cement (60mm, 89,3Kg/m²)
- Chipboard (22mm, 13,3Kg/m²)
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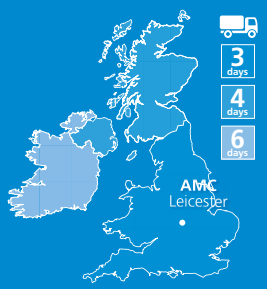

Uses and abuses of sound power determinations in noise impact assessments

By Dr Simon Scott, Technical Permitting Specialist within the Environment Agency's Air Quality Modelling and Assessment Unit (AQMAU) team.

The Environment Agency audits environmental impact assessments for operations that require a permit under Part A of the Environmental Permitting Regulations. In cases where a noise impact is anticipated for a site that is not yet operating, as part of a noise impact assessment report (NIA), the noise impact (putting aside here the vital consideration of this numerical impact within the local context) will have to be predicted rather than directly measured. This is sometimes done as a spreadsheet calculation but more often with the aid of noise prediction software. In either case, it is necessary to have values for the sound powers of each of the site activities that will contribute to the overall impact.

Sound power levels should be obtainable from the manufacturers of the equipment in question, although great care must be taken to ensure that these values are actually representative of the proposed activities, and that the appropriate directivities have been determined and used to calculate the propagation to the proposed receptors. For instance, a trommel operating with a hard core load will be noisier than when it has a load of green waste, and the shredding of plywood will emit more noise than solid wood, and will have more sound from the engine end than from the sides.

BS 5228:2009 + A1:2014 contains example sound power data in its appendices C and D[1]. Frequently though, sound pressure measurements are made at a specified distance, e.g. 1m, 5m or 10m and the sound power is estimated from these measurements. Various ISO standards define the approach to be taken here[2, 3]. First, an enveloping measurement surface, S, must be defined, which encompasses the noise source on a ground plane and is a set distance away. Two examples are given in Figure 1 (on page 52).

The sound power is calculated from the integral of the intensity (W/ m^2) over the measurement area. For a plane wave in air at a pressure of one atmosphere, the intensity (in dB, wrt 1 pW/m^2) is numerically equal to the sound pressure (dB, wrt to 20 µPa). Then the sound power (Lw) is given by the simple expression:

$$Lw = Lp + 10.\,\mathrm{Log}\,(S) \quad \mathrm{dBA} \qquad (1)$$

where Lp is the average sound pressure on the measurement surface and S is the area of the measurement surface.

The sound pressure may vary across the measurement surface due to variation in the distance from the source and also emission anisotropy. These factors are accommodated for by taking multiple measurements at predefined points around the source, and then determining the average value for the sound pressure before calculating the sound power. An example from ISO 6393:2008 can be seen in Figure 2 (on page 52) for the determination of the sound power of earth moving equipment[2]. Here, a hemispherical measurement surface is defined that surrounds a source and has six measurement points on it at a radius of r from the centre of the source.

The standard specifies values of r, the hemisphere radius, for differing maximum source dimensions, L. Over the range of values for L of < 1.5 to > 8m, the standard states that the ratio r/L can vary from a minimum of 2 up to over 6. As this ratio increases, any spatial variation in the sound pressure contours will diminish so that eventually, a single pressure measurement will give a reasonably accurate determination of the sound power. Given ISO 9363's minimum r/L ratio of 2, it could be expected that the point at which a single point measurement to be valid to be considerably greater than this.

Of course, sound power estimations made in the course of an NIA have to be made in the context of limited funds and time and may have practical limitations on accessibility. Appendices C and D of BS 5228 provide tabulated data of single sound pressure measurements made at distances of 10m, from which sound powers may be readily calculated on the basis of an assumption of hemispherical emission, i.e.

$$Lw = Lp_{(10\,m)} + 20.\,\mathrm{Log}\,(10) + 8 \quad \mathrm{dBA} \qquad (2)$$
$$= Lp_{(10\,m)} + 28 \quad \mathrm{dBA}$$

(Note that this data should be used with caution where strong directivity is suspected).

A DEFRA funded study in 2006 provided some justification for a single-measurement approach[4]. Researchers from Salford University compared single sound pressure measurements at 10m from a large wheeled loader of maximum dimensions of over 4m with the results of a six-point microphone survey as specified in ISO standards. They found that the sound power levels as estimated from the single point at 10m were within 1.5 dB of that found by the ISO method (95% confidence level).

A high proportion of NIAs contain derivations of sound power on the basis of a single sound pressure measurement at a distance which, typically, is in the range 1 – 10m and for sources with maximum dimensions usually greater than 1m and sometimes much larger. The derivations are frequently carried out on the basis of formulae which themselves are derived on the basis of a physical model of a point source with spherical propagation of sound (or hemispherical for sources on a ground plane), e.g.

$$Lp_{r1} = Lw + 20.\log(r_1) + 11\ (8\ \text{for hemispherical}) \qquad (3)$$
$$Lp_{r1} = Lp(r_2) + 20.\log(r_2/r_1) \qquad (4)$$

where r_1 and r_2 are measurement distances from a point source of sound power Lw and Lp_1 and Lp_2 are the sound pressures measured at these distances.

The use of these formulae therefore are only valid if the sound emission is spherical or hemispherical. If the source dimensions are such that it is not radiating in this manner at the single measurement distance then it is likely that it will result in an underestimate of the sound power. As we have seen, this is unlikely to be the case for r/L less than 2 for the source types usually encountered. Unfortunately, this is a point that is often forgotten and consequently it is not unusual for the Environment Agency to receive estimates of sound power where the measurement distance is far too small for a point source assumption.

Example 1

For instance, a biofilter of open area 630m^2 (approximately 90m long by 7m wide) had a manufacturer's specified sound pressure of 70 dBA at 1m from the face. The consultant used the formula (4) to derive a sound pressure at a distant receptor taking r_2, the distance to source, as 1m. This assumption implies hemispherical propagation and a sound power of 78 dBA – on the basis of (2) Lw = 70 + 20. Log (1) + 8. If however, the sound power is derived from integrating over the open area of the bio filter, using (1):

Lw = 70 + 10. Log (630) = 98 dBA

the sound power is found to be 20 dBA or 100 times higher. Clearly, an error of this magnitude can make a significant difference to a predicted impact at a receptor. While this is an extreme example, it is not unusual to find measurement distances of one or a few metres with equipment that has dimensions of several metres.

Example 2

As an example of a case where an acceptable approach was taken, a consultant did measurements at 11m and 14m from a shredder, of length 4 – 5m and derived sound power values of 114 and 115 dBA. Here, the size of the source and measurement distances were such that the ratio of r/L was greater than two and the sound power levels calculated were within a range that we would expect.

Obviously, in an active site, as the measurement distance increases from the source in question, the contribution from other sources may also increase and care must be taken to avoid this or account for it.

Analysis of distance

Some 50 years ago, a paper was published which included an analysis of the distance at which the onset of point source type propagation occurred for a finite plane (i.e. 2D, area) source[5]. The results from this paper are often quoted. The source is shown in Figure 3 (on page 54), with dimensions b and c, together with the perpendicular distance, a, from the centre of the plane.

Three ranges of values for a with respect to b and c were identified:

1. Area source (no variation in sound pressure level with a);
2. Line source (3 dB fall-off with doubling of a);
3. Point source (6 dB fall-off with doubling of a).

These are shown in Figure 4 (on page 54). The plane source was envisaged as a 2D area such as a window of thin glass in a wall of heavier material, but the theory is frequently applied to 3D sources without justification. However, there are other problems with the theory as it stands.

Extrapolations were made between the valid regions 1, 2 and 3 (indicated by the hashed areas and solid lines) by simply taking lines out beyond these areas of validity and stating that where these meet can be taken as the values of log (a) where the onset of the line or point source propagation occurs. However, while the onset of line and point source propagation will undoubtedly be somewhere between the regions 1, 2 and 3, there is no reason for assuming it to be at the points a = b/ π and a = c/ π. The author's conclusions are in contradiction to the various ISO guidance documents and documentation supporting BS 5228:2009 where the minimum measurement distance is at least two times the maximum dimension of the source – he advocates a distance of roughly six times less.

A more rigorous expression of the distance where point source type propagation is well established can be found in other papers[6,7]. Here, the distance, d, is related not just to the source dimension, c, but also the wavelength of the sound, λ:

$d \sim c^2/2\lambda$

In Figure 5 (on page 55) we show plots of distance d from source against source size using these formulae for frequencies of 100, 200 and 300 Hz (for the types of sources most frequently listed in NIAs, relatively low frequency noise will usually dominate the acoustic spectrum). We also show a constant distance line at 10m and a plot of d = 2 c.

There are many observations that could be made about these plots:

- Clearly the distance for the onset of hemispherical, or spherical, propagation increases with source dimension and, for the $c^2/2\lambda$ plots, with the progression from 100 Hz to higher frequencies this minimum distance increases.
- For source dimensions up to 7m and frequencies of up to 200 Hz the simple formula of d = 2c appears to be adequate for determining the minimum measurement distance.
- A measurement distance of 10m appears adequate for source sizes up to around 5m, and for frequencies of up to around 250 Hz.

Of course, sources do not always conform to simple mathematical models – they do not always emit uniformly in all directions and a given item of equipment may contain numerous smaller emitting areas. For these reasons, the ISO measurement methods will be more reliable than any single point determination. Nevertheless, where time and space are limited, as they often are, measurements at distances of 10m or 2c may give acceptable results, unlike predictions based on c/π.

To conclude, acousticians must always consider the physical relevance of the equations they propose to use to determine the sound power of a source and to estimate the sound pressure at a distance. Within the context of NIAs, failure to do so may lead to a miscalculation of the source sound power and of the numerical BS4142 impact estimation at a receptor.

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Figures

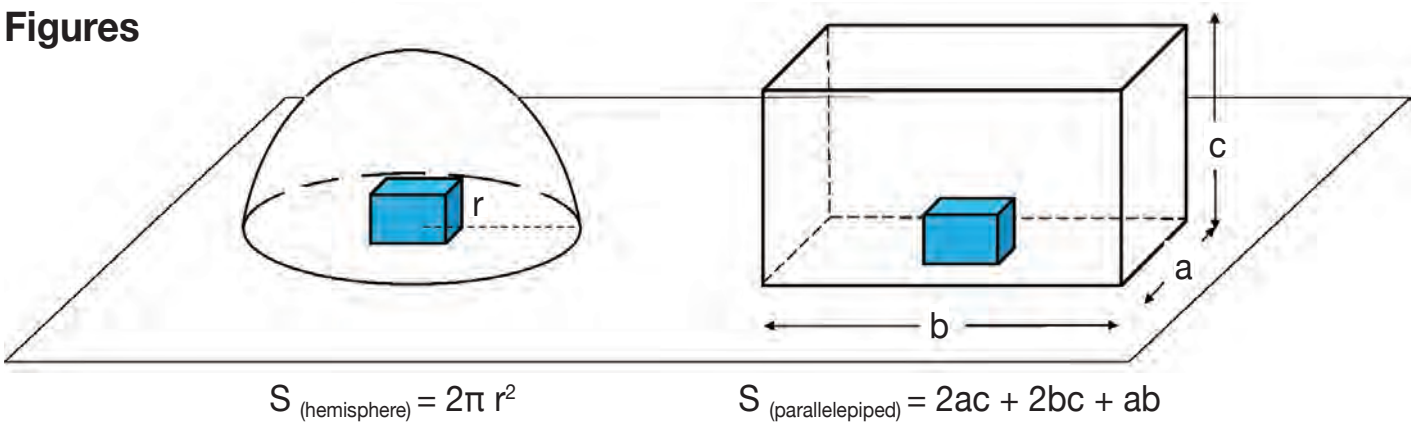

Figure 1: Typical measurement areas, S, for sound power determination

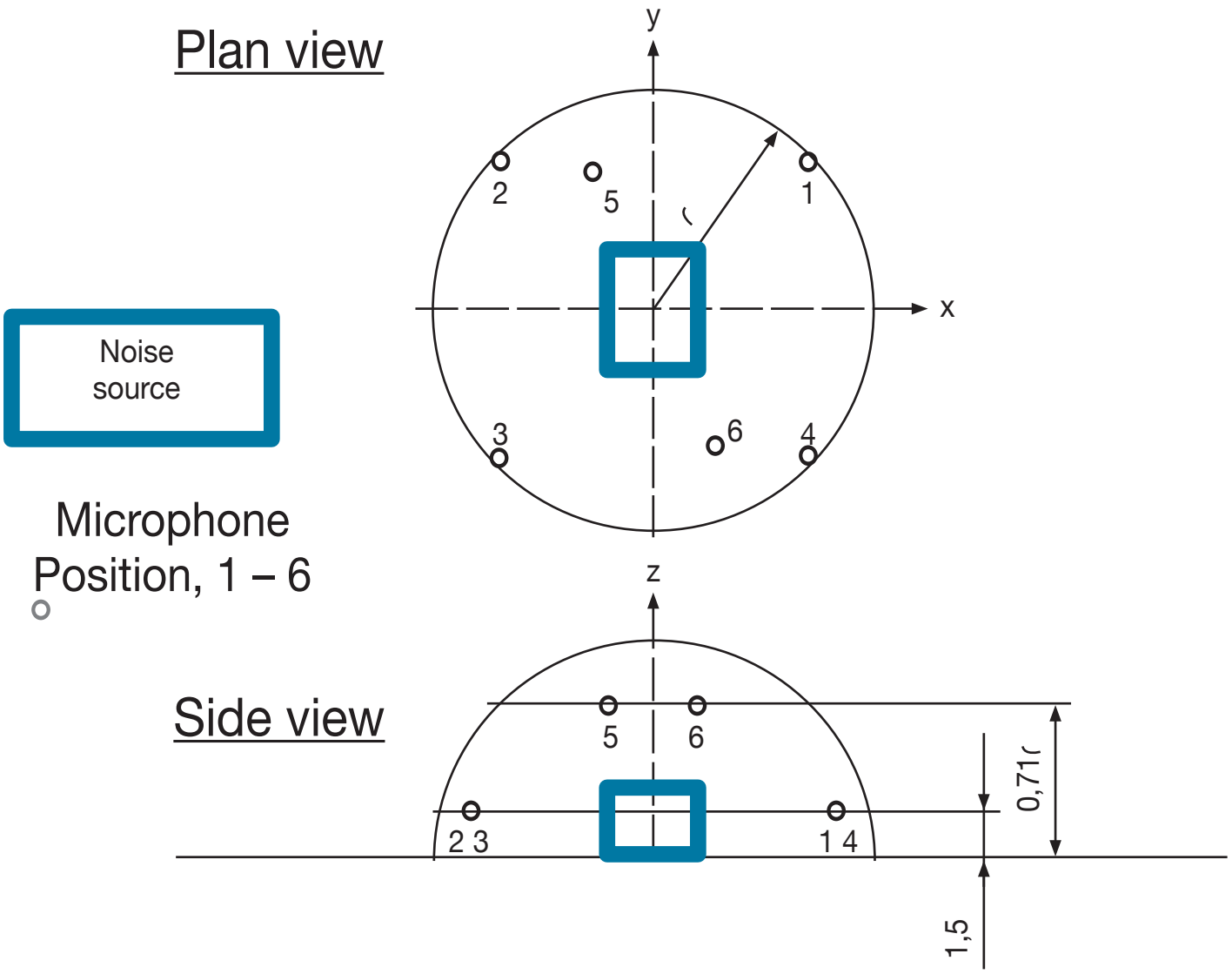

Figure 2: Arrangement of microphones for determination of sound power of earth moving equipment, as specified in ISO 9363: 2008

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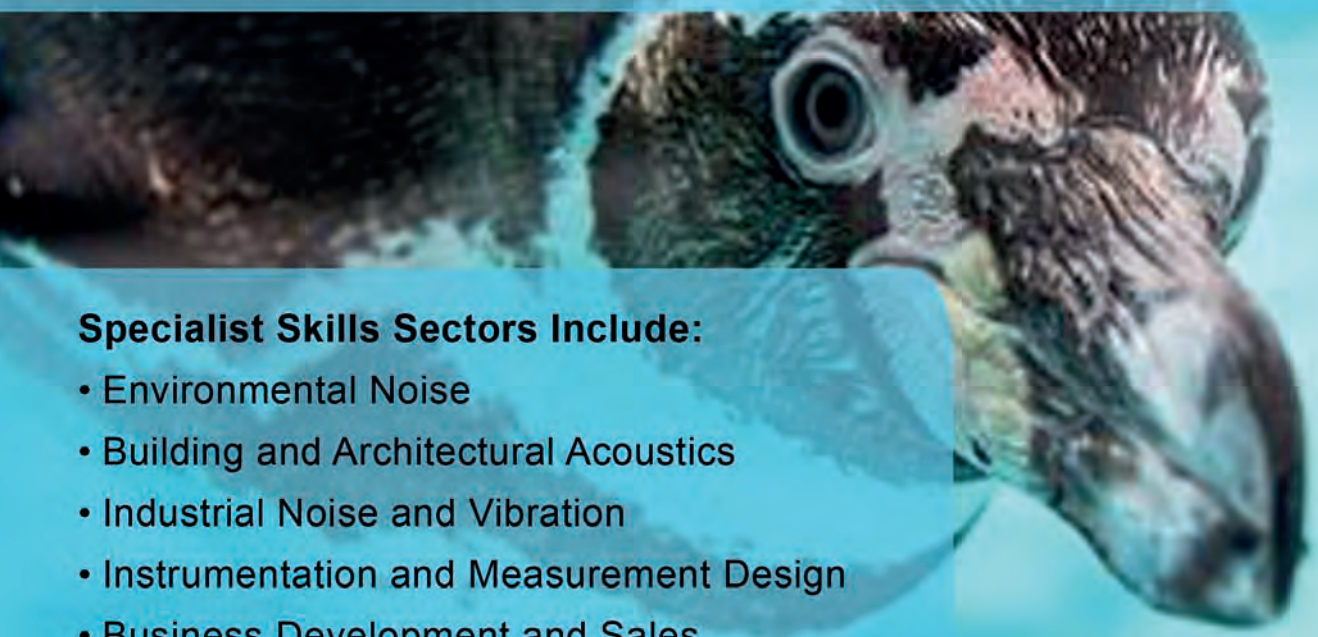

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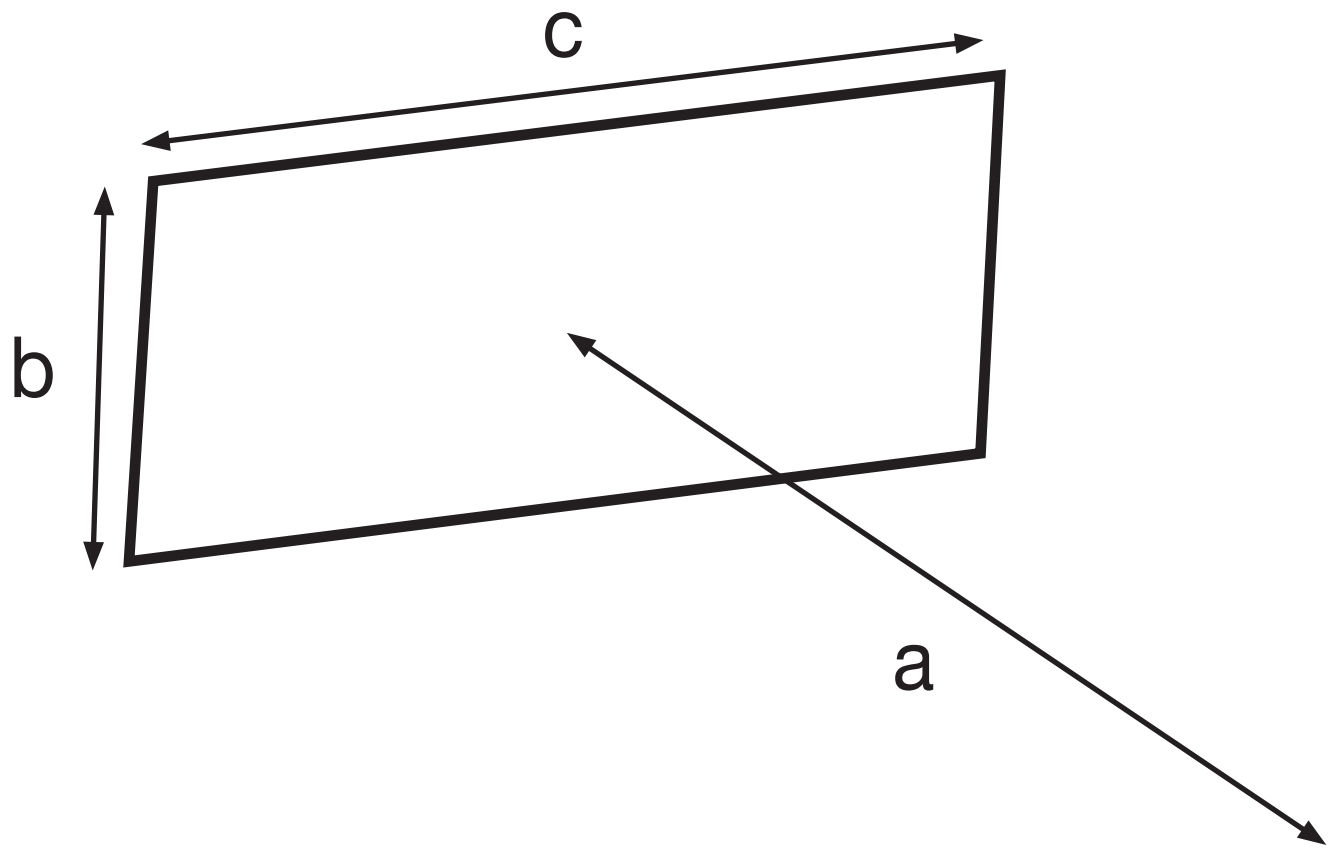

Figure 3: Plane noise source as used in analysis of E. J. Rathe for deriving value of a, at which point source type (spherical) emission can be assumed

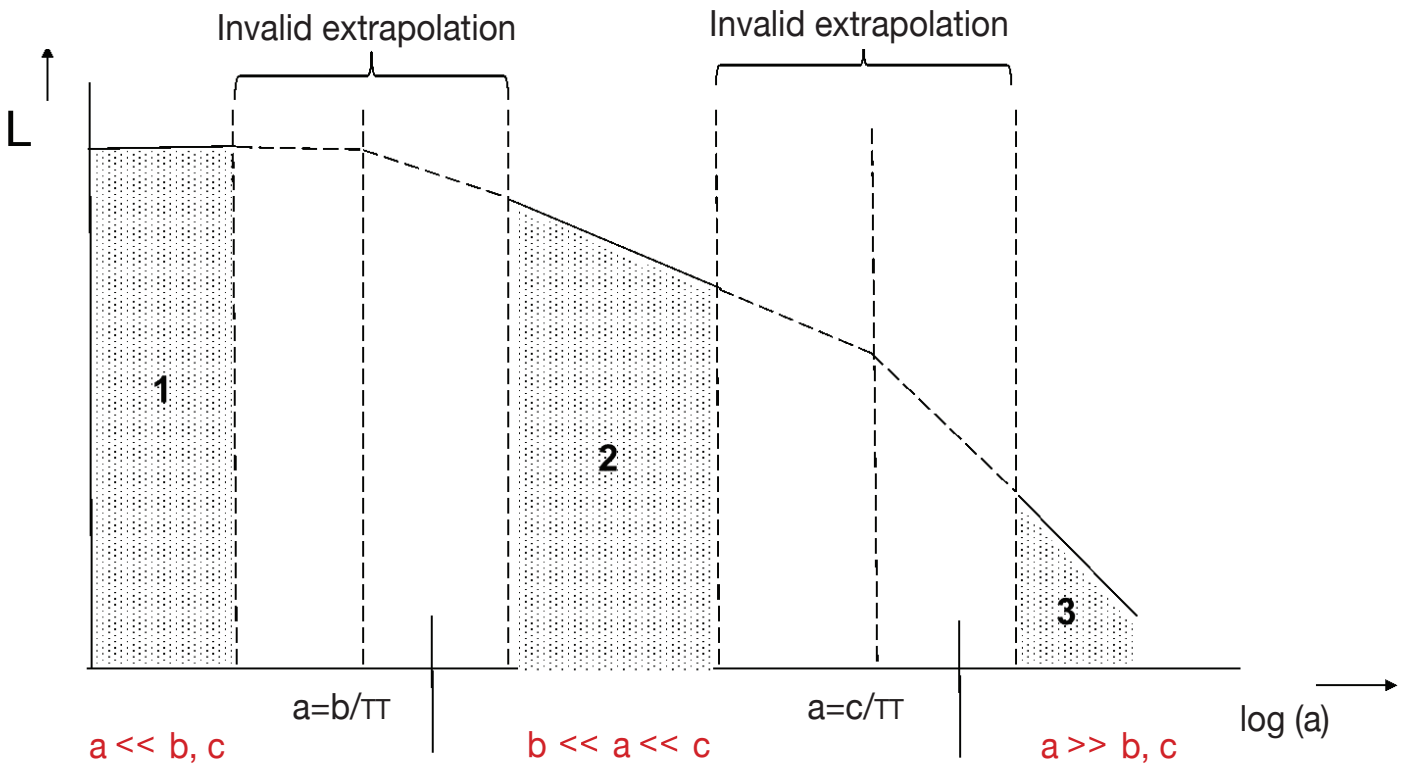

Figure 4: Summary of predicted fall-off of sound pressure, L, with log (dist. from centre of source, a)

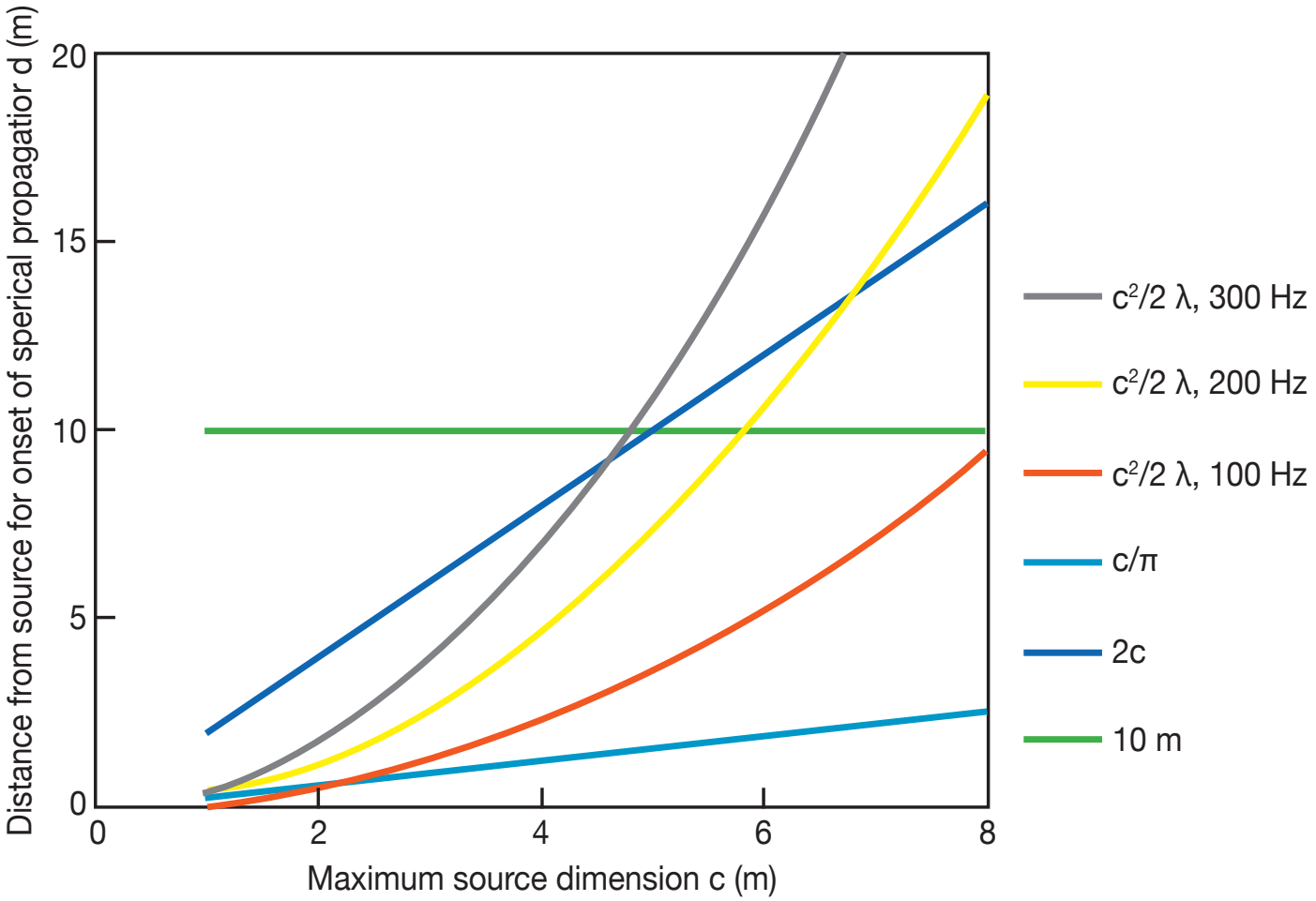

Figure 5: Minimum distance from source for assumption of point source type sound propagation versus source maximum dimension for predictions of single measurement distance of 10 m, 2 c, c/π (Rathe), $c^2/2\lambda$ (Ocheltree & Frizzell, Freedman) at sound frequencies of 100 Hz, 200 Hz and 300 Hz (c = maximum dimension of source, λ = wavelength of sound)

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Dr Simon Scott

Dr Simon Scott works for the Environment Agency on modelling of noise impact and air quality. He wishes to thank Dr Jill A Ogilvy for her invaluable assistance on the later sections of this article.

‘Making a New World’: Armistice soundwave for the Imperial War Museum

A team at the Imperial War Museum (IWM) worked with Coda to Coda, a music and sound production company based in East London, to reimagine what the end of the First World War might have sounded like for their *Making a New World season*.

IWM asked Coda to Coda to create an interpretation based on a unique image from their archive – a section of film called the *End of the War* which shows a before and after recording made by a sound ranging unit at the end of the First World War, on 11th November 1918.

Interpreting an image

The *End of the War* shows a ‘recording’ made on film of sound pressure impulses picked up by sound ranging equipment stationed along the allied front.

The purpose of this equipment was to try and determine where enemy guns were positioned by analysing the length of time it took sound impulses from the firing of guns to arrive at the allied front. The sound ranging equipment used six tuned low frequency ‘microphones’[1] (indicated by the six parallel lines on the film) arranged in a wide arc behind allied lines. The microphones were connected to a string galvanometer at a forward listening position. A low frequency signal picked up by one of these microphones would move a thin wire in the galvanometer and cast a shadow onto a piece of moving film.

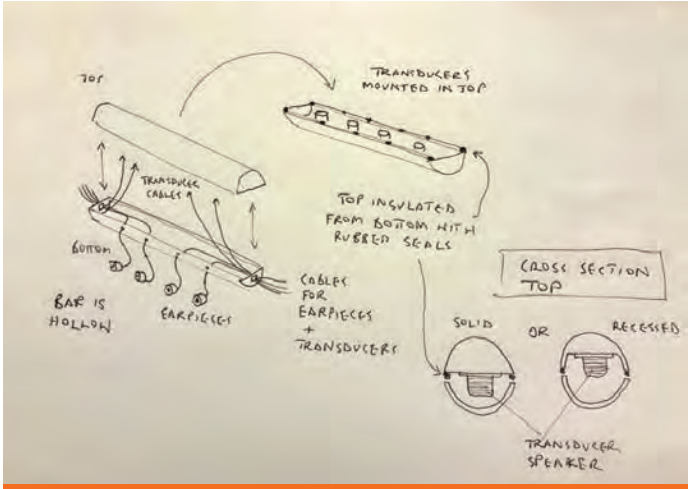
The equipment takes advantage of both the consistency and relative difference between the speed of sound and the speed of light to create a visual recording of the sound impulse, which would arrive at the microphones after the flash of the guns being fired. An operator would wait for the flash of an enemy gun to start the film rolling and the equipment would record the signals as they arrived progressively based on their proximity to the impulse source.

The film took around five minutes to develop after which, trained analysts could decode the patterns on the film and use them to work out the positions of enemy guns using a process called multilateration[2].

By the end of WW1, sound ranging techniques could locate enemy guns within 25m to 50m under normal atmospheric conditions and even determine the calibre, number of guns and the target[3]. The document provides a great insight into just how intense and chaotic the barrage of gunfire must have been to those fighting. The missing section that has been edited out of the film in the middle of the image also begs the question “what would those two minutes have sounded like?”

Forensic sound

Using this document, the team at IWM asked Coda to Coda to try and create an interpretation of how this ‘missing’ moment might have sounded, as the introduction to a series of exhibitions they were working on to commemorate the centenary of the end of the WWI.



Sketch for early prototype of bone conduction installation

In order to create the reconstruction, Coda to Coda had to corroborate historical information about the type of artillery that would have been in use by the US, German and French armies at this point in the war, with what the visual information from the sound ranging film provided about the size, distance and frequency of blasts and finally, they had to interpret the kind of reverberation that would be expected, by looking at landscape photographs and archive film footage from the front.

Will Worsley at Coda to Coda said: “As its basis, our reconstruction uses contemporary recordings of the Howitzer, Mauser, Stokes, Vickers and Lee Enfield guns made for the purposes of sound design in film and television[4]. These recordings were then grouped and triggered according to who was using them and in patterns that corresponded to archive newsreel footage taken at the front[5]. The density of the gunfire was interpreted both from the sound ranging document and further archive footage. All of these elements were mixed together relative to each other and with respect to the distances over which the fighting was taking place. Finally, a convolution reverb[6] with an impulse response recorded in a relative ‘free field’ scenario was used to simulate the space and dispersion of the sound across the front.”

Feeling sound: bone conduction

Will continued: “The team at IWM were very keen to present this unique document and our reconstruction in a way that would bring them to life, and make the relationship between them explicit for visitors. With this in mind, we drew inspiration from the mechanics of the ‘sound ranging’ equipment itself.

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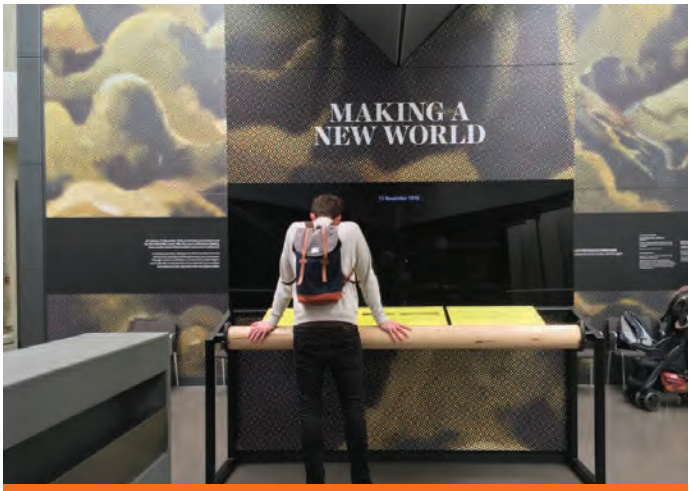
'Sound ranging' equipment was stationed along the allied front



Visitor to '*Making a New World*'

"The 'sound ranging' equipment that was deployed at the end of WW1 used an innovative low frequency microphone developed by William Sansome Tucker[7] in 1916. This microphone used a Helmholtz resonator to detect the physical vibrations of low frequencies of the guns in order to record them onto film[8].

"The physicality of 'sound ranging' and the fact that the explosions of the guns firing would have been felt as shock waves by soldiers at the same time as being heard, led us to the idea of trying to incorporate bone conduction into the exhibit, as a way of tying together our reconstruction with the physicality of 'sound ranging'. "

How does bone conduction work?

Aside from the normal hearing mechanism, the ear also picks up vibrations through the skull via bone conduction. The logic of bone conduction is that anything that vibrates can be put directly on to a subject's head and is heard through the skull. It is possible to bridge a gap between something vibrating and the skull with an intermediary solid object.

Laurie Anderson, in her piece 'Handphone Table', discovered that arms can bridge the gap between a vibrating surface and the ears[9].

Will explained: "'Handphone Table' struck us as the perfect method for visitors to IWM to both hear and feel our reconstruction of the WW1 armistice, so with this in mind, we set about designing a sound bar which would enable this to happen.

© IWM Visitors to *Making a New World* at IWM London listen to audio that re-imagines what the end of the First World War may have sounded like

"The result is an exhibit that we hope enables visitors to experience something of the intense barrage of sound at the front in WW1 as if they themselves were the sound ranging equipment, a symmetry which also hopefully helps project them into that moment in history."

Authors

Will Worsley and Sam Britton, January 2019

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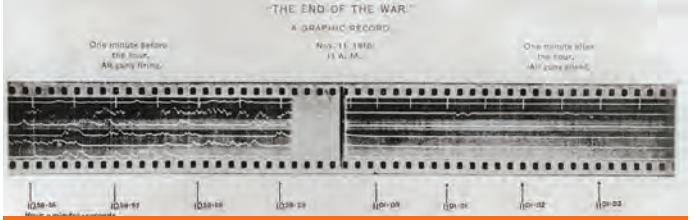


This Imperial War Museum, *'End of the War'* recording shows the exact moment the First World War ended

Sandy Brown celebrates golden anniversary

This year, Sandy Brown celebrates 50 years of providing acoustics advice to the building industry.

Founded in 1969 by renowned jazz clarinetist, architect and acoustician, Sandy Brown, and fellow architect, David Binns, the consultancy originally provided specialist architecture and acoustic design services. Their early projects included London Weekend Television studios and the refurbishment of Edinburgh's Usher Hall.

Sandy Brown and David Binns

Over the years Sandy Brown has been instrumental in the development of building acoustics with projects such as Cardiff's St David's Hall, Lloyd's Building, AIR Studios Lyndhurst, The Lowry, MediaCityUK, Dubai Opera House, and Edinburgh International Conference Centre with the UK's first 'turntable' auditorium. It advised on Stirling Prize winning projects The Gherkin, Scottish Parliament, Madrid Barajas Airport, Evelyn Grace Academy and Bloomberg London.

Sandy Brown is currently advising on the Royal Albert Hall, Museum of London, Southbank Place, offices for Google, Amazon and Goldman Sachs and many other national and international projects.

Golden anniversary party for Sandy Brown

With staff in London, Manchester, Edinburgh and Birmingham, Sandy Brown has continued to build on their knowledge and practical experience to bring about imaginative design solutions.

Sandy Brown would like to thank its staff, who have been instrumental in the success of the company, alongside its clients and fellow design team members, whose relationships are highly valued. They look forward to continued success over the next 50 years.

Farrat celebrates 60 years in noise and vibration control

IOA sponsor organisation, Farrat, is celebrating 60 years of trading this year.

Farrat was founded in 1959 by Richard Farrell and remains a family owned and operated business. Now in its third generation, Farrat is led by CEO, Oliver Farrell, and Managing Director, Andrew Farrell, as a globally established engineering and manufacturing firm with offices in the UK and Switzerland.

Celebrating 60 years in noise and vibration control

Renowned for their noise and vibration control expertise, the past few years in particular have seen significant and continued growth for Farrat.

Heavy investment into people and R&D, in partnership with the University of Manchester and Salford University, has led to a range of solutions engineered to prevent the transmission of vibration, noise, heat and movement in load bearing connections.

The Building Acoustics Team at Farrat have recently designed a range of acoustic isolation solutions for cinemas. The new Farrat 'Cine' range will include acoustic floating floors (CineFLOOR), raked stadia seating isolation (CineSTEEL and CineTIMBER) and partition base-track isolation (CineWALL) intended solely for the acoustic isolation of auditoria.


The Farrat board (L-R): CEO Oliver Farrell, Director John Farrell and Managing Director Andrew Farrell

Farrat thank all of their clients and colleagues for their continued support over the past 60 years and look forward to many more, working together.

Award-winning ORION

01db's ORION smart vibration monitor was a winner at the 2018 New Civil Engineer Tunnelling Awards held in London last December.

The award for 'Innovation in Technical Product or Equipment' recognised ORION's role in London Underground's Bank Tube Station capacity upgrade project, which is due for completion in 2020. Construction contractor, Dragados, chose ORION for its ability to simultaneously capture vibration dose values, peak particle velocity data and re-radiated noise as a result of vibration, in a single piece of monitoring equipment in real time.

Acoustic1, 01dB's exclusive UK distributor was responsible for commissioning the ORION smart vibration meters that have been placed in buildings, including banks and hotels, above the construction site, to measure vibration and re-radiated noise from tunnelling and excavation works.

For the first time, accurate and easily accessible online data is allowing Dragados and environmental consultants working with individual properties to pinpoint the exact cause and origin of particular re-radiated noise and vibration.


ORION smart vibration monitor wins award for keeping London's historic Bank district protected during underground construction

For more information visit **http://www.01dB.com** or **http://www.acoustic1.co.uk**

Quiet Mark Award for Armourcoat Acoustic

Armourcoat's new Acoustic Plaster System has been granted the Quiet Mark Award – the international mark of approval from the Noise Abatement Society Charitable Foundation.

Quiet Mark is the international award programme and system of support for brands and consumers, it awards its 'Purple Q' mark to products and services that show excellence in low-noise and high-performance.

Designed to optimise the acoustics of interior spaces, the Armourcoat Acoustic plaster system offers a clean and smooth mineral surface that can be applied seamlessly over large expanses to both flat and curved surfaces. Comprising a mineral wool composite panel that is bonded onto the substrate and finished with a seamless layer, the system presents a marble-based plaster finish, while allowing sound energy to pass through the surface.

The Armourcoat system includes a high percentage of pre and post-consumer recycled material, zero VOCs, is class '0' fire-rated, and achieves a class 'A' Noise Reduction Coefficient rating for the 50mm system.


Poppy Szkiler, Founder and Managing Director, Quiet Mark

Poppy Szkiler, Founder and Managing Director, Quiet Mark, said: "Armourcoat's acoustic plaster system performs to the highest building standards, it delivers excellent noise reduction properties and minimises the unnecessary intrusion of unwanted sound into our buildings."

Steve Garritt

Steve Garritt died on 29th December 2018.

A freelance acoustic consultant, Steve was a part-time lecturer on the Diploma in Acoustics at Leeds Beckett University from the course's inception in the early 1980s until a few years ago when he retired. His role in teaching the NVCE module was then taken over by his son, David, who had joined him in the family firm after himself completing the Diploma here. Steve had continued to support David's teaching a great deal from behind the scenes. One of Steve's daughters, Liz, is also a member of the firm.

Steve was well known as a consultant and very highly regarded by those with whom he worked, no matter whether they were on the same side of any particular case.

ANC sound insulation testing

The Association of Noise Consultants (ANC) puts the building industry in control with a trusted route to deliver compliance in sound insulation testing for the housebuilding sector.

Their Approved Document E Registration Scheme was developed in 2003 to provide independent verification of pre-completion sound insulation testing.

Providing pre-completion sound insulation tests in accordance with Approved Document E 'Resistance to the Passage of Sound' of the Building Regulations and its equivalent in Scotland, the service meets these requirements to test new and converted dwellings for sound insulation.

Fifteen years since its launch, ANC members have completed some 440,000 sound insulation tests. Key to the success of the scheme is the design-build-test cycle, which provides a link in optimising the balance between compliance rates and construction cost.

From approximately 30,000 tests carried out in 2018 through the scheme, the pass rate was an impressive 97.4%.

ANC's registration scheme enables the building industry to tap into the expertise of 300 registered testers, all qualified in acoustics, who are able to deliver the Approved Document E testing nationwide.

Dan Saunders, Chair of the ANC, said: "The Scheme was established to make the process as streamlined, cost effective and straightforward as possible, while retaining the high quality standards and expertise our members can offer.

"Members of the ANC Registration Scheme hold approved third-party accreditation in a form approved by DCLG (Department of Communities & Local Government). Independent third party assessment of its procedures and operation is provided by BRE Global."

The ANC's sound insulation test comes with a range of added benefits including access to expert advice and a useful reporting function through ADvANCE online.

Dan added: "These tests come at the end of the construction phase; getting it wrong and addressing the issue then can be a very costly learning process – so it's much better to learn from the experience gathered from all those other sites."

To find out more about the ANC visit **www.association-of-noise-consultants.co.uk/members-search**

Keep studying

John Evans has just completed the IOA's Diploma in Acoustics and Noise Control at Derby University. So far, nothing unusual. But John, a chartered engineer and a chartered arbitrator in the engineering and construction industries, is not in the first flush of youth. It's accepted that 80 is the new 60, but John is 81 and is a fine example of chronological age being no barrier to career advancement.

As part of his course, John's two specialist modules were Environmental Noise and Building Acoustics. He continued to work while he studied and said that finding time to study dovetailed well with his day-to-day work. Lectures took up one day per week and in addition to that, he set aside about eight hours a week for reviewing and completing assignments.

This additional knowledge and qualification will help John, he hopes, as he undertakes some private research with a view to developing a new method of reducing sound pollution.

About five years ago, he studied for a Masters Degree in Law at Nottingham Law School, to complement his work as an arbitrator, next, he said: "I'm considering perhaps doing a PhD in some branch of acoustics, I found it interesting being back in the classroom.

"Early on in my career I was a lecturer for some seven years in mechanical engineering, specialising in mechanical vibrations. So while I was studying for the IOA diploma, I found myself wanting to take over when we came to vibration theory, but I managed to restrain myself (not, I must add, because I had any problems with the lecturers, but just old habits started to kick in)."

Once a thirst for knowledge develops, it seems it never ends. The IOA offers a range of professionally recognised courses for those interested working in any aspect of acoustics. They cover general principles and specific applications including building acoustics and the management, regulation and control of noise and vibration in the workplace and environment.
https://www.ioa.org.uk/education-and-training

Looking for members to join the IOA Publications Committee

The IOA Publications Committee is currently on the lookout for a couple of new members to join us to help shape and steer the future communications of the Institute for its members and various stakeholders. We're active in developing and improving the IOA's website presence; enhancing our social media; overseeing bimonthly issues of our very popular Members' Bulletin; shaping monthly newsletters; varied promotional material; and so much more. We welcome your contributions as the role of communications becomes even more vital to the Institute's affairs. We're already on our way towards becoming a lot more digital, and have plans to evolve our communications offering both in the UK and internationally. If you already have some working knowledge of various communications areas, that's even better, but, if not, don't let this put you off - as you can still join us, and help to participate across these exciting and varied publication activities. You can support us in shaping the ways we engage as the IOA internally to members and externally; all we need is your enthusiasm and willingness to be part of it. Please only put yourself forward if you're able to attend at least two of three meetings held at the IOA's head office, and can spare a little of your time to get involved.

The Noisy Guts Project

Irritable Bowel Syndrome (IBS) is a perplexing problem that affects 11% of the world's population, but the current diagnostic process is time-consuming, costly and elusive. Patients are typically referred to a specialist to undergo a colonoscopy to exclude all other gut disorders.

Professor Barry Marshall of the University of Western Australia is head of 'The Noisy Guts Project', his solution is an acoustic belt that listens, records and analyses gut noises using existing and proven acoustic sensing technology initially designed to pick up the sounds of termites.

Research shows a strong correlation between gut noises and gut disorders. This new acoustic belt is supported by a smartphone app that records symptoms, working in a similar way in which an ECG monitors heart rate. The end result is a safe, non-invasive screening, monitoring and diagnostic tool.

Research shows a strong correlation between gut noises and gut disorders

Diploma awarded to Kim Coleman

In the January/February 2019 issue of Acoustics Bulletin, we published a list of those candidates who had recently completed IOA Diplomas (page 20).

Amongst the list of candidates who had studied at the London South Bank University, we neglected to include Kim's name that should have appeared as 'Coleman JK'.

Ford creates a quiet space for dogs

Ford Motor Company's European division has developed what it calls a 'noise-cancelling' kennel, giving dogs a quiet place to go when thunder crashes or fireworks go off.

Ford says the kennel uses technology that's already found in cars and headphones. Microphones listen to outside sounds and built-in speakers emit opposing frequencies to eliminate the noises. They also use high-density cork for extra soundproofing.

Nearly half of UK dogs show signs of fear during fireworks, according to Ford, noting that the distress spreads to their owners and families too. It says the kennel is a prototype now, but they say it's a first step in using its ideas to solve everyday problems.

Nearly half of UK dogs show signs of fear during fireworks

Simple explanation for the Cuban 'sonic attack' noises

For more than two years, a mysterious and possibly harmful noise, recorded at the US embassy in Cuba, has baffled authorities.

After hearing the high-pitched and persistent noise, more than 20 American diplomats fell ill, experiencing symptoms including headaches, ear pain, vertigo, nausea and hearing loss.

Investigators into the event, which has been called a 'sonic attack', suspect it may have come from some sort of ultrasonic weapon, sound waves or microwaves.

However, fresh analysis now suggests that the noises may be nothing more than the chirping of crickets. According to Alexander Stubbs of the University of California, Berkeley, and Fernando Montealegre-Z of the University of Lincoln, the noises actually belong to the Indies short-tailed cricket (Anurogryllus celerinictus).

When the recordings made at the embassy were compared to this cricket's calls, the two sounds matched "in nuanced detail", sharing the same rate of pulse and frequencies.

The US embassy in Cuba

Heathrow may add 25,000 flights a year before third runway

An extra 25,000 flights a year could come through Heathrow before the third runway is built

An extra 25,000 flights a year could come through Heathrow before the third runway is built, according to plans revealed by the airport as it launched a new consultation over its airspace and operations.

To help maximise its capacity ahead of expansion, Heathrow has proposed that aircraft could land on both existing runways at the same time during busy periods.

The plans would involve lifting the current cap to more than 500,000 flights a year and new areas of London would be brought under Heathrow flight paths for the first time.

In a separate consultation last year, most respondents rejected the idea of concentrating more planes over the same area and asked the airport to vary flight paths, which is likely to affect thousands more homes. However, some areas under flight paths, such as parts of south-east London, could get some respite.

John Stewart, of the Heathrow noise reduction campaigning group, Hacan, said: "Although a third runway will clearly bring many losers, one long-lasting impact of these proposed changes is that a break from aircraft noise would be guaranteed to many more people than those who currently enjoy it, as Heathrow would make the biggest changes to its flight paths since opening in 1946."

Imaging techniques help to rescue sound from the Nuremberg trials

During the course of Nuremberg trials, which were held from November 1945 to October 1946, newspaper accounts detailed the events. Only 50 hours of the proceedings were filmed, and the court also published written transcripts of the trials, which run for thousands of pages.

At the same time, audio technicians recorded 1,942 black gramophone records, which offer a complete sound record of the trials. After the trials concluded, they were shipped to the International Court of Justice in The Hague.

In 2006, Ottar Johnsen, a professor of signal processing at the University of Fribourg, heard that the Nuremberg recordings had been pulled out of the archives, and the International Court of Justice was looking for ways to digitise them. But officials were concerned that the recordings were too old and fragile to play with a standard record needle.

Johnsen had been researching a solution inspired by Stefano Cavaglieri, a colleague at the Swiss National Sound Archives. "It was a strange idea about taking a picture of a record, looking at the sound and extracting the sound," Johnsen said.

After only a month, Johnsen and student, Sylvain Stotzer succeeded in reading their first record. The process relied on a film photograph of the record's surface taken in a darkroom. The physical grooves in records contain the sound, so a picture that reveals microscopic detail is crucial. The negative is placed in a high-resolution scanner and the scanned image is put on a computer where an algorithm reads the sound from the image.

The International Court of Justice thought that Johnsen's technology could extract the sound from the antique Nuremberg records without damaging them, so in 2006, an ICJ archivist brought 10 records to Switzerland to do a test. Johnsen, Stotzer and the archivist listened to the first recording, which was very clear, but Johnsen's technology was never used.

In his tests, Johnsen revealed that actually, the records weren't too fragile to be digitised. Instead, they are now being converted by a French audio company using sensitive phonograph needles to read them. About one-third of the collection is now complete.

Noise-cancelling system for quieter nights

Noise levels around 35 dBs are sufficient to disrupt a person's quality of sleep – a level easily exceeded by moderate snoring that occurs in the 50 to 60 dB range.

But a new noise-cancelling system, embedded within the non-snoring partner's pillow, relies on an adaptive algorithm that adjusts to each snorer's unique breathing patterns. A study describing the design was published in January in IEEE/CAA Journal of Automatica Sinica.

To cancel out a sound wave, a second sound wave of equal amplitude but opposite phase must be interposed with it. Therefore noise-cancelling systems must detect the initial sound, account for residual noise (errors), and then produce sound waves that cancel out the original ones. While such systems already exist for snoring, most were designed to mount on the headboard of beds.

Lichuan Liu's team at Northern Illinois University designed a system that's embedded in the partner's pillow. It involves an adaptive filter that receives two input signals — snoring signals, which are detected by a reference microphone, and residual noise (errors), which are detected by two error microphones. Based on these inputs, the adaptive filter then generates the appropriate antinoise signal, which is emitted by two speakers within the partner's pillow.

In this project, Liu and her colleagues used an adaptive LMS algorithm. "Since each snorer's snore signals have their unique time-frequency characteristics, it is essential to design an adaptive LMS algorithm for the best cancellation performance for different snore signals," said Liu. Thanks to the adaptive LMS, the filter in this system can adjust to the length of an individual's unique snore, and respond to subtle changes in its acoustic characteristics.

In experiments, when a noise-sensing dummy was placed in a bed and exposed to recorded snoring, the system designed by Liu and her colleagues achieved noise reductions of 31 dB and 30 dB, in the dummy's right and left ear respectively; in contrast, placement of the system on the headboard only achieved noise reductions of 22 dB and 21 dB.

A new noise-cancelling system relies on an adaptive algorithm that adjusts to each snorer's unique breathing patterns

For 'Bohemian Rhapsody,' sound artists blended Rami Malek's performance with Freddie Mercury's vocals

The biopic about Queen and Freddie Mercury is propelled largely by a soundtrack of the band's hits of the '70s and '80s, and audiences could take the sonic craftsmanship for granted.

The scene of the band recording the title track at Rockfield farm "was very complicated in terms of all the sound elements in the recording area," says the film's re-recording mixer/music mixer, Paul Massey. "There was headphone leakage, the guitar amp humming, listening to the track through the control room speakers.

"It took a long time to get the sounds real, in the right perspective."

One scene features a 37-second montage of Mercury (Rami Malek) coaxing a perfectly pitched recitation of "Galileo! Figaro!" from drummer Roger Taylor (Ben Hardy). The band's sound engineers ransacked the archives for useful material, including original stems of Queen recordings.

"The 'Galileos' and 'Figaros' are actor, Ben Hardy, mixed in with original takes of Roger Taylor," says supervising sound editor, John Warhurst. "And when you hear Rami singing 'Bohemian Rhapsody' in the studio, it's a 1975 take of Freddie that was never used."

Massey says that "99.9%" of the singing in the film is Mercury. The rest is a blend of Malek's voice with Mercury sound-alike, Marc Martel.

"We only did that for vocals that didn't exist, like the audition scene in the parking lot, 'Happy Birthday' over lunch and writing 'Love of My Life' at the farmhouse," Warhurst says.

For the rest, "We went to great lengths to get Rami's performance in synch with Freddie's performance and make it as tight as we possibly could," Massey says.

Armstrong Ceilings' wood solutions are enhanced, naturally

Searches for 'statement ceilings' are up by 310% according to Pinterest, and creating a signature piece out of what is often referred to as the 'fifth wall' became one of the hottest interior design trends of 2018.

One material with multiple benefits for ceiling use is wood. Not only is it beautiful and timeless, it is a natural, sustainable product with inherent insulating qualities whose durability makes it ideal for statement ceilings that nevertheless still have to be maintained.

With this in mind, Armstrong Ceiling Solutions has refreshed its portfolio of wood solutions, presenting simplified and clear-cut configurable options that make even the most bespoke and intricate wood ceilings easy to specify and install, always considering acoustic performance, matching grains, layouts, configurability with other materials and site conditions.

The Armstrong range of wood solutions offers architects plenty of design options with seven organic natural veneers (Ash, Maple, Oak, American Cherry, American Walnut, Natural Bamboo and Caramel Bamboo), three edge details (MicroLook, Vector and SL2) and accompanying grid systems available in an extensive palette of colours. The introduction of a new 2400mm x 192mm channelled plank option also adds an extra dimension to the range.

For complete acoustic control (the range performs up to 0.80aw), the lay-in square and rectangular tiles are offered with a choice of six perforation patterns and the channelled planks with three groove patterns. A black acoustic fleece is supplied with the perforated options.

All Armstrong's hand-crafted and finished wood solutions are from renewable sources and are 100% recyclable, and for applications where natural wood cannot be used, wood effects on metal panels, baffles and canopies are available.

For more details call **0800 371849** or email **sales-support@armstrong.com**

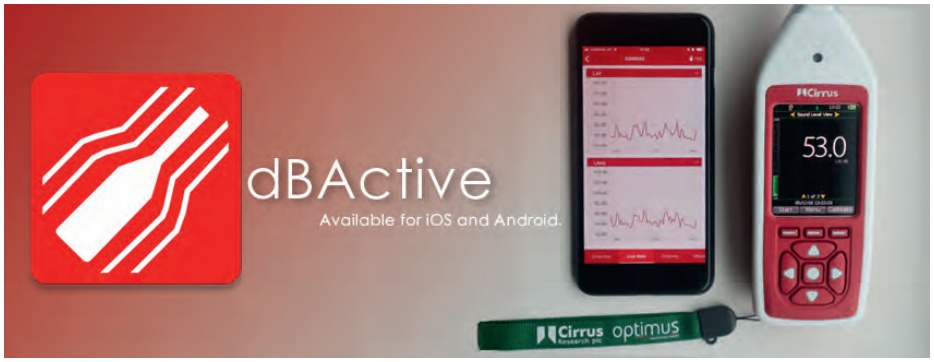
Cirrus makes life easier for noise monitoring specialists with its dBActive smartphone app

Cirrus Research has launched its new dBActive smartphone app to enhance its Optimus+ sound level meter range.

Available for both iOS and Android devices, it adds a range of new connectivity and functionality to the Optimus+ thanks to the latest Bluetooth technology.

Now, measurements can be started, paused and stopped remotely, so the instrument can be used from up to 10 meters away – ideal for potentially dangerous or inaccessible areas.

The live measurement data can be viewed for all parameters, as well as the live octave band information. The connectivity will also allow previous measurement data from the connected instrument to be viewed and instrument settings to be seen and changed.



The Optimus+ sound level meter has a new ergonomic keypad with easier navigational tools, a new screen and enhanced audio quality. It features a range of in-built functions that can be adapted for specialist use, such as vehicle noise.

"The new dBActive smartphone app for the Optimus+ will undoubtedly help make life a lot easier and safer for anyone who works in the noise monitoring sector," said Tony Towle, Cirrus' Marketing Manager. "The new addition of Bluetooth technology will give our customers a smoother user experience and connectivity assurance – a must when you are working in remote or external locations."

The dBActive App is now available from both Google Play and the App Store.

For more details visit:
https://now.cirrusresearch.com/optimus/
or **www.cirrusresearch.co.uk**

What a drag!

Sisters, Morgan and Caitlin Wilson have made a name for themselves nationally and internationally in junior dragsters, where they reach speeds of up to 85mph in under eight seconds.

However, racing comes at a price with health and safety paramount both on and around the track. Noise pollution has become much more of an issue over recent years with standards being scrutinised and tightened.

Rachel Wilson, the girls' mother, said: "As with all forms of motorsport, noise is becoming an increasing factor and all of the sportsman classes in our sport are governed by noise limits, but this year is the first that the governing body is taking these more seriously and insisting that silencers be used if cars are above the limit for the class.

"Our junior cars have methanol engines so they are noisy and we have to be within a 113 decibel limit in a static test, and that's why we have asked Cirrus Research to help us out."

Cirrus is working with the Wilson family to get the most accurate noise measurements on the girls' dragsters to see if they fall under the noise limits laid down by their governing body. Anything over the 113 dB limit and the family will have to look at ways to limit the noise output from the dragsters, such as using silencers or other noise limiting devices, which can reduce the horsepower of the single cylinder engine.

As drag races can be won or lost by 0.001 seconds, accuracy is absolutely vital and it's essential to ensure that the harmony between the engine and the clutch is maintained. Any drop in horsepower could result in a narrow defeat.

Cirrus used its Optimus+ Green, ideal for this type of outdoor environmental challenge, providing everything to measure occupational and environmental noise with a range of features and functionality that allow simultaneous measurements of multiple parameters.

Built to UK, EU and international standards, the Optimus+ is compatible with the Cirrus range of outdoor measuring kits.

The tests were carried out by Cirrus expert, Jonathan Phillips. The initial test on the unmodified exhaust/engine came in at 126.2 dB(A). Further tests with an improvised noise suppression device attached to the exhaust at maximum revs, brought the noise levels down to 120.9 dB(A), but this was still several decibels over the 113 dB limit the Wilsons were trying to meet.

Despite the fact that the dragster was still over the prescribed noise limit with the improvised noise-reduction device fitted, the test highlighted the issue so that now, the family can begin work on finding a new solution to the problem.

Marking Tinnitus Week

Speaking just ahead of Tinnitus Week (4th – 10th February 2019), Peter Wilson, founder of Echo Barrier, said that noise reduction strategies should be implemented into our everyday lives to prevent a range of illnesses.

According to the British Tinnitus Association, the condition affects 10% of the adult population and can be exacerbated or triggered by exposure to loud noise.

Mr Wilson said: "Research is being undertaken that shows the impact that our environment has on our bodies, with noise being a focal point. Tinnitus is only one of many known by-products of excessive noise.

"As an acoustics expert, I have seen first-hand the impact of noise pollution and more needs to be done to implement noise mitigation strategies into our everyday lives.

"Temporary acoustic barriers can help local authorities, construction, rail and live events companies reduce their noise pollution, and in turn, help reduce the impact on their local communities."

Echo Barrier provides temporary noise reduction solutions, to help businesses, contractors and local authorities keep the noise down and improve community relations.

For more details visit: **www.echobarrier.com**

Peter Wilson, founder of Echo Barrier

Armourcoat on the menu for new Centre Point restaurant

Armourcoat has been specified throughout the VIVI restaurant, a new 1960s inspired eatery in the Centre Point Building in London's West End.

VIVI's 290-cover dining room has its interior design inspired by sixties colours and fabrics and the new restaurant, created by rhubarb – the team behind Sky Garden and Verdi Italian Kitchen at the Royal Albert Hall, is part of a wider refurbishment of Richard Seifert's Grade-II listed high-rise tower.

Armourcoat finishes have been used in the entrance lobby, restaurant reception, bar and dining area, with close to 300m² of hand-finished polished plaster applied to the walls. In addition, 240m² of Armourcoat's new acoustic plaster system has been installed in the ceilings in the main dining room.

Designed to optimise the acoustics of interior spaces, the Armourcoat Acoustic plaster system offers a clean and smooth mineral surface that can be applied seamlessly over large expanses to both flat and curved surfaces. Comprising a special mineral wool composite panel that is bonded onto the substrate and finished with a seamless layer, the system presents an elegant, marble-based plaster finish while allowing sound energy to pass through the surface. The system was recently granted the Quiet Mark Award – the international mark of approval from the Noise Abatement Society Charitable Foundation.

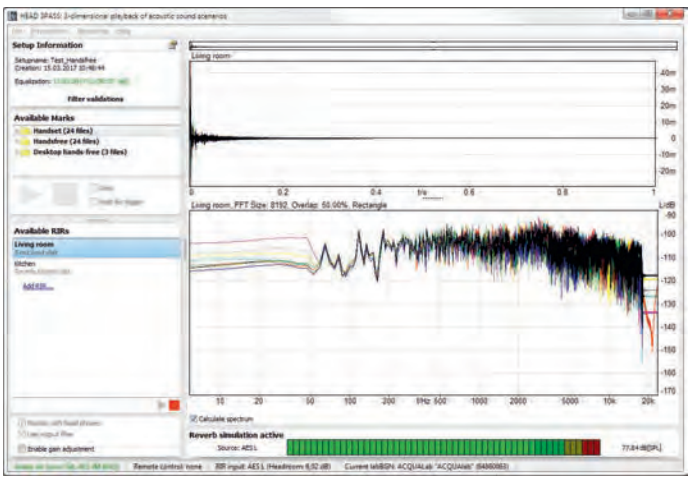
HEAD acoustics launches world´s first acoustic environment for realistic measurements

Users of mobile phones, voice-operated smart home devices or hands-free terminals have to deal with different background noises and room reverberation that impair their user experience. Therefore, realistic performance tests of communication devices do not only need to consider background noise but also reverberation. HEAD acoustics has launched 3PASS reverb for this purpose, a software option for its background noise simulation systems 3PASS lab and 3PASS flex. 3PASS reverb is capable of simulating realistic room reverberation.

Realistic reproduction in the laboratory

With 3PASS reverb, HEAD acoustics have developed a methodology that enables developers and manufacturers to reproduce different room characteristics like realistic reverberation in the laboratory. The software simulates the reverberation of the room by applying the previously recorded impulse responses to any audio signal in real time. While an artificial head measurement system plays back the direct sound signal, the background noise system covers playback of the reverberation components based on the impulse response from the original room. Exemplary impulse responses from various rooms are included as standard in 3PASS reverb.

The methodology invented by HEAD acoustics has been approved as ETSI standard TS 103 557 in December 2018.



Automated testing of voice-controlled smart home devices

With HQS-SmartHome, HEAD acoustics provides a new tool for testing communication and audio quality of voice-controlled smart home devices. The database for the ACQUA analysis system contains efficient test series for analysing and optimising smart speakers, speakerphones and conferencing devices. HQS-SmartHome (HEAD acoustics Quality Standard) offers a wide range of realistic and reproducible measurements and simulations to users. Therefore, the database is ideally suited to ensure high quality of smart home devices from research and development phase to serial production.

Simulate realistic background noise and reverberation

Voice-operated smart home devices are used in various situations and rooms with different acoustic room properties. Settings with one single talker, as well as with multiple talkers, have to be taken into account. HQS-SmartHome consists of test series for two different application scenarios; single talker scenarios and multiple talker scenarios. In addition, the database offers tests for evaluating speech and transmission quality under realistically simulated background noises for various everyday situations. It enables users to determine speech quality in the presence of reverberance, thus, acoustic room properties are correctly simulated in the test laboratory. These measurements require the background noise simulation systems 3PASS lab or 3PASS flex as well as the option 3PASS reverb. Additionally, the database allows users to reliably test the performance during double talk.

Directivity measurements

For simulating the different positions of moving talkers, directivity measurements are implemented in HQS-SmartHome, performed in combination with the high-precision turntable HRT I. Furthermore, HQS-SmartHome provides traditional electroacoustic measurements such as echo, frequency response, delay and distortion. All measurements in the database are conducted fully automated. In HQS-SmartHome, both artificial and real speech signals are used for testing in sending and receiving direction. The analysis software ACQUA plays back and processes the audio signals, the measurement results are quickly analysed and clearly displayed by the software.

For simulating the different positions of moving speakers, directivity measurements are implemented in HQS-SmartHome

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Committee meetings 2019

DAY	DATE	TIME	MEETING
Wednesday	**20 March**	**10.30**	**Council**
Thursday	28 March	11.00	Meetings
Tuesday	9 April	10.30	CCWPNA Examiners
Tuesday	9 April	1.30	CCWPNA Committee
Thursday	25 April	10.30	Membership
Thursday	9 May	11.00	Publications
Thursday	16 May	10.30	CCHAV Examiners
Thursday	16 May	1.30	CCHAV Committee
Wednesday	22 May	10.30	Executive
Wednesday	**12 June**	**10.30**	**Council**
Tuesday	25 June	10.30	ASBA (Edinburgh)
Tuesday	26 June	10.30	Research Co-ordination (London)
Tuesday	2 July	10.30	CCENM Examiners
Tuesday	2 July	1.30	CCENM Committee
Tuesday	2 July	10.30	CCBAM
Wednesday	3 July	10.30	Distance Learning Tutors WG
Wednesday	3 July	1.30	Education
Thursday	4 July	11.30	Meetings
Thursday	1 August	10.30	Diploma Moderators Meeting
Thursday	8 August	10.30	Membership
Wednesday	11 September	10.30	Executive
Thursday	19 September	10.30	Engineering Division
Wednesday	**25 September**	**10.30**	**Council**
Thursday	10 October	10.30	Meetings
Thursday	17 October	11.00	Publications
Thursday	31 October	10.30	Membership
Tuesday	5 November	10.30	Research Co-ordination(London)
Tuesday	19 November	10.30	CCWPNA Examiners
Tuesday	19 November	1.30	CCWPNA Committee
Wednesday	20 November	10.30	Diploma Tutors and Examiners
Wednesday	20 November	1.30	Education
Thursday	21 November	10.30	CCENM Examiners
Thursday	21 November	1.30	CCENM Committee
Thursday	21 November	10.30	CCBAM Examiners
Tuesday	26 November	10.30	ASBA Examiners (Edinburgh)
Tuesday	26 November	1.30	ASBA Committee (Edinburgh)
Wednesday	27 November	10.30	Executive

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.

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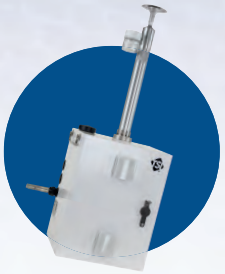

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Not all Remote Systems are created equal.

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  - FFT
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