Volume 47 No 6 November/December 2021

ACOUSTICS BULLETIN

Institute of Acoustics

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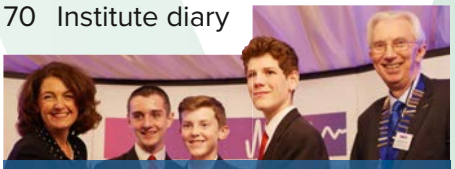
Technical articles review procedure
All technical contributions are reviewed by an expert identified by the IOA Publications Committee. This review picks up key points that may need clarifying before publication, and is not an in-depth peer review.



Cover image: Secondary schools' soundscape competition 2021 winning team at Noise Abatement Society's John Connell awards.

The Institute of Acoustics is 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, governmental 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 Member

Acoustics 2021

I am writing this letter the day after Acoustics 2021 – our unique hybrid annual conference. What a terrific event! We had over 100 members attending the conference at the 10 hubs located around the country and we had a similar number enjoying it from their own homes or offices. Our delegates were not confined to the UK, either. Amongst the early questions were one from New Zealand and one from Dubai. And one of our speakers joined the conference from Tbilisi.

The technology worked very well, although there were the inevitable occasional glitches. This included a previously unknown feature of the IOA HQ guest Wi-Fi that doesn't believe you would want to be logged on to it for more than eight hours. Consequently, in the middle of the first afternoon, the computers in Milton Keynes dropped out in the order in which they had connected in the morning. That was a lesson learned!

It has been estimated that nearly 200 delegates saw Professor Michael Vorländer awarded with the Rayleigh Medal and hear his lecture. It was a delight to be able to show Michael views of several of the hubs so that even though he couldn't really hear the well-earned applause at the end of his presentation – he could see it.

Outstanding support

The conference would not have happened without the hard work of our annual conference organiser Martin Lester to whom we owe a huge debt of gratitude. He spent many hours pulling the conference together and liaising closely with Linda Canty (see below). Our thanks also go to our Meetings Committee including its Chair, Chris Turner, and particularly the technical input from Chris Barlow and Robin Woodward. Chris Barlow effectively was the Broadcast Director for the event – spotlighting session chairs, speakers and questioners as required. We must also thank the speakers who prepared videos of their presentations, David Trew and Matt Torjussen who pressed 'play' at the right moment to run those videos and the various session chairs and hub chairs. Behind the scenes there was also a large WhatsApp group that enabled messages to be exchanged between the hubs to help with the smooth running of the event.

Thank you also to our sponsors – those who produced the videos that ran during the breaks and those who, for the first time in a while, exhibited their products at some of the hubs.

And, of course, as indicated above, working quietly and efficiently as always behind the scenes was Linda Canty – liaising with speakers, liaising with the venues, liaising with the venue managers, drafting the instructions about each hub, helping with registrations... the list goes on. Thank you very much, Linda.

Although it is starting to feel that we are returning to normal conference life again, in fact, we are entering a new normal. The challenge for the Institute now is to find the right balance between fully attended meetings, and hybrid and online meetings which seem naturally to have a greater reach and are more accessible for many members.

Inter-noise 2022

After you have read these next couple of sentences, you must pause and put the dates of Inter-noise 2022 in your diary. They are the 21-24 August 2022, with the conference being held in Glasgow; only the third time in the Institute's history that we have hosted Inter-noise. This is a wonderful opportunity for UK acousticians to witness first hand a conference with more than 1,000 delegates and many parallel sessions covering the whole gamut of acoustics. Furthermore, now is the time to think about presenting a paper at Inter-noise. Your CV will be greatly enhanced when you can say 'Paper given at Inter-noise 2022'.

There is an item on page 20 in this issue from Professor Barry Gibbs, our former president, who is leading the conference organising committee. The intention is that Internoise 2022 will be a fully attended event with delegates from around the world. As you might imagine, there is some nervousness that COVID might disrupt our plans, but at the moment we are being very positive.

Reproduced Sound November 2021

This is going to be primarily an attended event in Bristol held on the 16-18 November 2021 organised by our Electro-Acoustics Group. Even if this subject is not the main focus of your day job, any acoustician will find the papers interesting, and the event is always very enjoyable. Think about enhancing your CPD training by immersing yourself in a different field of acoustics and joining us at this conference.

In the meantime, stay safe

Secondary schools' soundscape competition 2021 winning entry

The International Year of Sound (IYS) highlights the importance of sound in all aspects of life on earth, and it generates a greater understanding of sound-related issues at the national and international level.

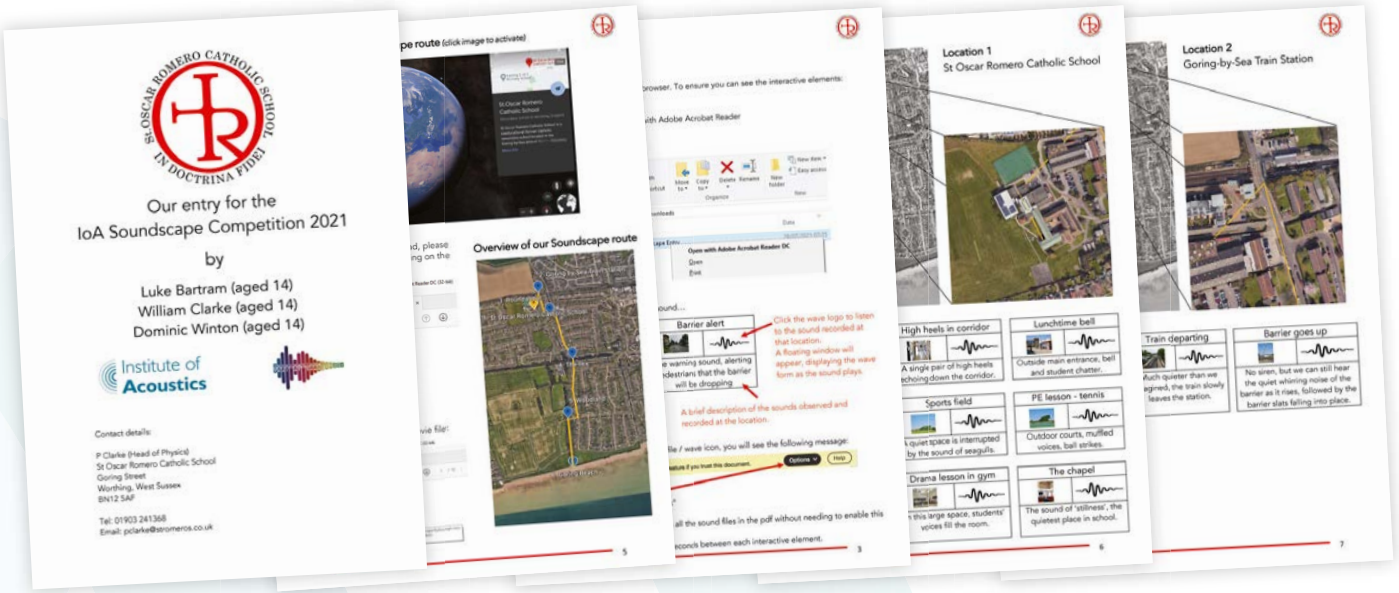
To go alongside our extensive STEM activities, the IOA supported the current IYS with a schools' competition designed to encourage pupils to listen more carefully to the sound environment. We asked small teams of secondary school pupils to produce a map of their local area, indicating the different sounds that can be heard at different places.

This competition provided a fantastic introduction to soundscapes and entries were received from all around the country. After careful consideration by the judges, Year 9 pupils from the St Oscar Romero Catholic School, Goring by Sea, Worthing, Sussex, Luke Bartram, William Clarke and Dominic Winton were awarded the prize for best submission.

Interactive entry

Their interactive entry was innovative, yet simple to follow, with great descriptions of the sounds the pupils encountered. They created a well-thought-out route starting at their school and then moving through their locality and included many different sources of sound. The pupils seemed to be clearly inspired by the competition, demonstrating the emotion involved

Below: (L-R) Under-Secretary of State for the Environment, Jo Churchill with William Clarke, Luke Bartram, Dominic Winton and IOA President, Stephen Turner



with soundscapes and not just the sound levels heard.

The winning entry received a prize of £500 plus a trophy, which was awarded to them by the Stephen Turner, IOA President, at the annual Noise Abatement Society's John Connell awards held at the Palace of Westminster on 20 October 2021.

Peter Clarke, physics teacher at the school said that the competition really captivated the pupils, he said: "Dominic, Luke and William came up with some great ideas about which sounds they wanted to record, culminating in a soundscape walk with a huge variety of natural and artificial sounds, presented in an interactive format. It has changed the way they view, or rather, hear, their surroundings."

Headteacher, Peter Byrne said: "We are so proud of our pupils who took up the challenge of this fascinating STEM competition. They dedicated a lot of time to making sure their entry conveyed the variety of sounds around them. It was also a wonderful opportunity to reflect on our natural world and the sounds within it."

Below: (Back row L-R) Peter Clarke, Head of Physics at St Oscar Romero Catholic School, IOA President, Stephen Turner, Sir Peter Bottomley, MP for Worthing West, Father of the House of Commons, Angela Lamacraft, IOA Council Member and Peter Byrne, Headteacher at St Oscar Romero Catholic School. (Seated L-R) William Clarke, Dominic Winton and Luke Bartram

Pupil, Luke Bartram, really enjoyed taking part in the competition, he said:" It was really interesting to think about all the sounds that we normally take for granted."

Team mate, Dominic Winton said: "Making a soundscape walk was great fun, and we learned a lot about the sounds in our local environment. It was an amazing experience to go to the Palace of Westminster to receive the award."

William Clarke felt that the IOA competition really made the boys think about acoustics, saying: "We wanted to make our entry interactive, so our soundscape walk included sound recordings at each location along the 2km route. We really enjoyed making the recordings and listening to them. We were so pleased to find out we'd won!"

See the winning entry here: **https://www.ioa.org.uk/secondary-schools-soundscape-competition-2021-winner**

Engineering Division

The IOA Engineering Division will support you through the process to help you become one of almost 240,000 registrants that hold international professional recognition.

By Blane Judd BEng FCGI CEng FIET FCIBSE, Engineering Manager

Although there is an indication that things could be returning to normal there is still no move to re-commence face-to-face interviews for professional registration. Based on the success of the online interviews we have done in the past we held more in the middle of October 2021 and the outcome of those will be published in the next edition of Acoustics Bulletin (January/ February 2022). I have held a few more lunchtime sessions on gaining professional registration and hopefully busted a few more myths regarding what is required and how to go about completing the professional review report.

We are still getting some reports which lack the technical content necessary for someone to show they have the competencies in the A and B sections of UKSPEC, (which can be accessed online at **https://www.engc.org.uk/media/3417/uk-spec-fourth-edition.pdf**). Candidates are encouraged to include technical detail relating to the projects they submit in their report.

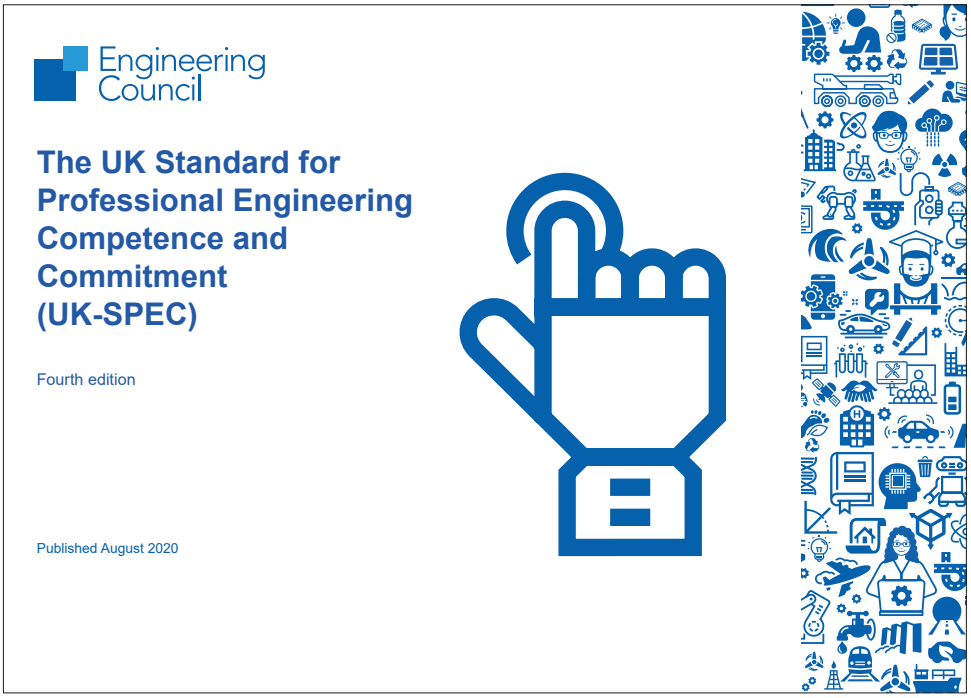
It is useful to consider the 'STAR' approach when explaining your role in projects.

S: what was the situation you were dealing with;

T: what tasks you undertook, or what instruction you gave to deal with the situation;

A: what were your specific actions (remember the panel will be looking for your contribution not the team's); and

R: what were the outcomes?



Did they meet expectations or exceed them, what might you have done differently, how can others learn from this?

Our next set of interviews will take place early in the new year and are most probably going to be virtual. Our thanks go to Emma Lilliman, who has been doing a great job keeping the process going despite the challenges of having to work remotely from the committee, candidates and me.

We remain dedicated to providing the necessary levels of support to assist members like you through the process. Neil Ferguson, who assists with the academic equivalence support, has also been a great help in checking and advising on how candidates should proceed. Through his help and guidance, we are continuing to support a wide range of applicants who do not have recognised qualifications as laid down by the Engineering Council.

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

There are two routes:

1. Recognised qualification route: For applicants who have achieved the required learning outcomes through recognised qualifications.

Qualifications which provide the required level of knowledge and understanding are: P10

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- EngTech: Level 3 qualification as part of an approved apprenticeship scheme;
- IEng: an accredited Bachelor's degree; or
- CEng: an accredited integrated Master's degree or a combination of accredited Bachelor's and Master's degrees.

2. Individual assessment route: Applicants who do not have the recognised qualifications will instead have an individual assessment of their qualifications and any other relevant learning such as:

- formal academic programmes;
- in-employment training;
- experiential learning; or
- self-directed learning.

Applicants may be also asked to write a technical report or attend a technical interview.

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 recognised qualifications for the purposes of EC registration, without the need for further assessment.

It is also possible to provide evidence from the knowledge you have acquired in the workplace.

Above: As they work so well, online interviews for professional registration are likely to continue for now

IOA Diploma

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.

The Institute recognises the IOA Diploma course (with a minimum of three merit passes in the modules) and the several Master's 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.

Revision of the UK-SPEC

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 Engineering Council published their revision of the UK-SPEC at the end of August and the IOA is planning when to implement the new standard. While the changes in UK-SPEC V4 are not significant there are some differences. If you have already started to put your paperwork together it would be wise to get it into us before we implement the new standard.

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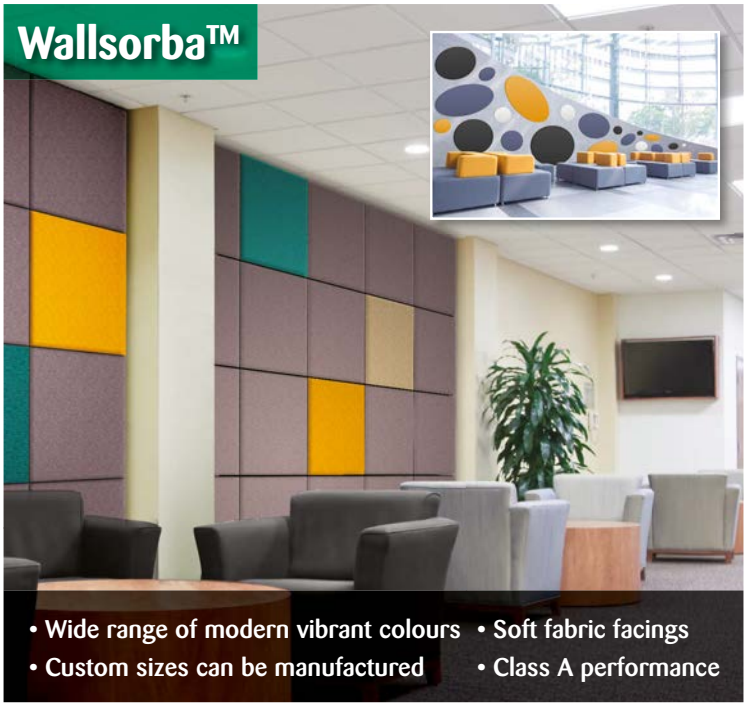

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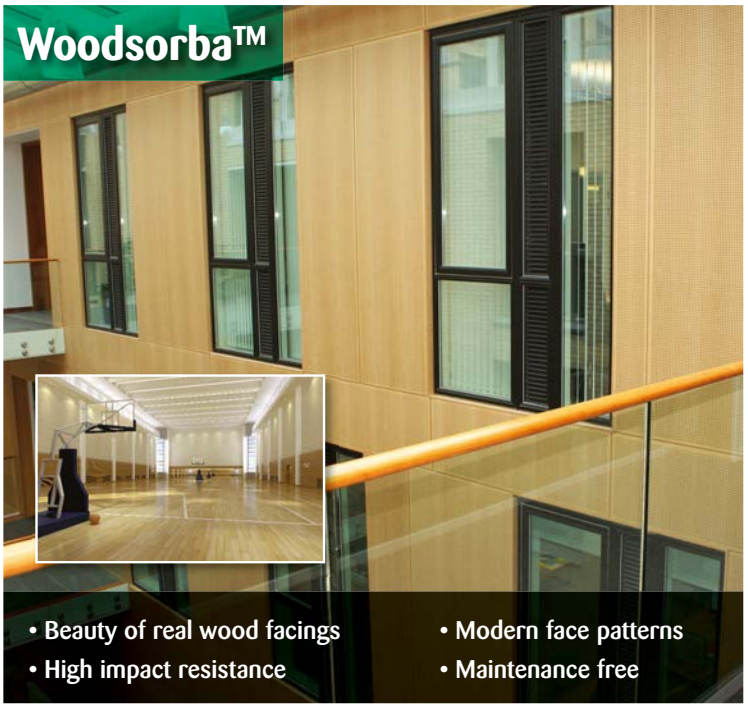

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IOA Events for 2021/22

Understandably, the 2021/22 conference programme is likely to be affected by the COVID-19 virus.

2021

REPRODUCED SOUND 2021
16-18 November 2021
You're on Mute – the importance of Audio
The Bristol Hotel, Bristol
Attend in-person or by Zoom
Book online at
https://tinyurl.com/txmnh3jc

2022

30 March 2022
Hear for Tomorrow
Royal Academy of Music, London
Organised by IOA and Hearing Conservation Association
Royal Academy of Music, London

20-24 JUNE 2022
ICUA 2022
Organised by the Underwater Acoustics Group
Grand Harbour Hotel, Southampton

20-24 AUGUST 2022
INTER-NOISE 2022
SECC, Glasgow
The 51st International Congress and Exposition on Noise Control Engineering (INTER-NOISE 2022) will be held in Glasgow at the Scottish Event Campus (SEC). The SEC is located just outside Glasgow city centre in the west-end and the campus is accessible by numerous transport options.
For details:
+44 (0) 131 336 4203
internoise2022@in-conference.org.uk
https://internoise2022.org/

Acoustics 2021 – recordings only
If you missed the Annual Conference this year you can still view all the presentations by registering on the IOA website to receive the link.
https://www.ioa.org.uk/civicrm/event/info?reset=1&id=569

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- Building and ground vibration

The making of the IOA Video Bulletin episode 2

The IOA continues its ambitious plans to broaden its reach for members, the wider acoustics and acoustics-related communities and the public. As part of this plan, we created a video version of Acoustics Bulletin last year. Linzy Attenborough, writer, director and producer at Thought Juice Films Ltd, has now produced an update to it and describes how this version was produced.

After quite a year of frantic productions trying to work around the pandemic, it was wonderful to be reunited with the crew and cast that made the last episode of the IOA Video Bulletin in the same green screen studio in Barnet, north London.

Video content

This year's Video Bulletin covers interesting topics including women in acoustics, the environmental impacts of noise, and sustainability. I also visited to the Winchester Science Centre where children are being inspired to learn all about noise and gathered material to make a fascinating episode. I ended up with so much content to consider, in fact I was almost overwhelmed by the enthusiasm of the acoustics community. I struggled to schedule all the experts that came forward for an interview.

Production

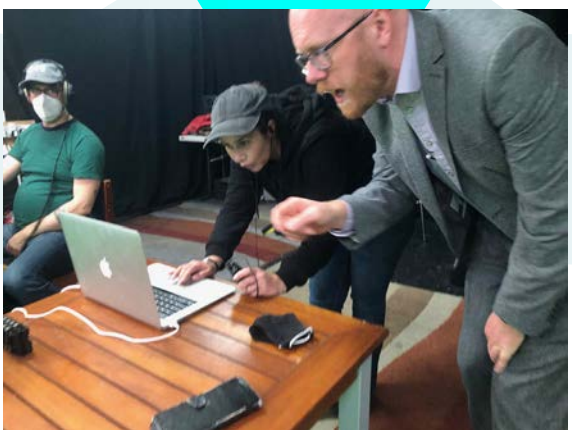
For four years I produced a television programme that was broadcast on TV and am very aware of the many things that can go wrong in the recording of a live show. I used some of these issues to create a spoof live TV show during which much goes wrong. I wanted to use humour but didn't want to 'laugh' at acoustics or acousticians and so chose to make the subject of my comedy the production itself.

So, as we did in the 2020 episode, we also recorded a comedy version of the latest Video Bulletin, in which the crew appeared to be 'less than competent'. However, joking aside, it is difficult to operate the teleprompter and direct actor, Rich Keeble (a former acoustician) at the same time. The challenge is to get it at the right reading speed. Each member of my small team was having to do many jobs on green screen shoot day.

Fillipo Mazzarino operated two cameras. Daniel Hawkes, the location sound mixer, had to mix sound and operate the boom at the same time so I shouldn't complain about having to multitask myself. Luckily, Alex Shaida, IOA Marketing Head visited us on set, so I recruited him to act as clapper loader. Our attempts to multitask were the source of some amusement and provided inspiration for the next comedy version, in which we are planning to have a 'sleepy' camera operator.

New audiences

Although making these episodes comes with many challenges; they are introducing the world of acoustics and the acoustics community to new audiences. They give us the opportunity to discuss the latest research in the industry and I am happy and proud to be part of the team that creates the IOA Video Bulletin.



Top: Linzy, "Not sure about those socks."
Middle: Rich, "I think there's a typo."
Bottom: Linzy, "Yes, I can hear and see!"

Sound Masking

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Open plan offices benefit from Sound Masking

Cellular offices achieve better speech privacy with Sound Masking

Sound Masking is a cost effective solution to the problem of improving speech privacy in today's modern office environment. Best installed during office fit out but often installed as retrofit, Sound Masking from AET has improved the office environment for many international companies throughout Europe over the last 20 years.

In today's office speech privacy becomes a key aim and open plan offices can suffer from two speech problems:

- Other people's conversations can be an irritating distraction
- Confidential conversations can be almost impossible to conduct

Similar problems also exist in cellular offices. Apart from noise breakthrough via partitions, flanking over, under and around them, other problem areas include light fixtures, air conditioning systems and services trunking. Sound masking compensates for these problems.

An investment in increasing privacy of speech is certainly cost effective, with Sound Masking one of the easiest ways of achieving this aim. Sound Masking systems along with acoustic panels and acoustic door seals are increasingly used to achieve the desired level of privacy by a number of our major clients including:

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- BP

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Sound Masking is also known as sound conditioning or white noise systems

Government policies

Over the past few months we have been actively monitoring developing government policy across England, Ireland, Scotland and Wales. Mary Stevens, IOA Policy Support, reports.

We are working to raise the profile of issues relevant to acoustics commenting on policy proposals as appropriate. A new page will be added to the Members' section of the website where we will be adding copies of consultation responses.

Here is a brief summary of consultation responses submitted.

Sale and use of fireworks in Scotland

The Scottish Government sought views on potential new measures for tackling noise, nuisance and anti-social behaviour problems associated with fireworks. In their response, the IOA Scottish Branch considered that local authorities were best placed to administer any licensing scheme; that restriction of sale to limited dates will reduce issues relating to noise from fireworks and supported a proposal for banning fireworks from some areas - for example, areas with livestock or populations with particular sensitivity to noise. Local authority noise teams are considered the agency best suited to enforcing any such areas. In addition, the branch requested clarity on the proposed noise level limit of 120 dB for fireworks when they are set off, advising a distance and relevant acoustic metric and weighting should be used.

https://consult.gov.scot/justice/use-and-sale-of-fireworks-in-scotland/

Jet zero – strategy for net zero aviation

The IOA responded to the government consultation on measures for UK domestic aviation to reach net zero emissions by 2050. While not in a position to comment authoritatively on many questions asked, we made the point that effective management of noise from aviation must not be affected by policies designed to reduce CO_2 emissions. The acknowledgement that aircraft noise is an issue in the document was welcomed. However, disappointment was expressed that the summary of 'Non CO_2 Impacts' does not mention noise. The main thread of our response was that in seeking CO_2 emission reduction, it is essential that the consequential impact on effective noise management is fully considered, given adverse health effects of noise are well documented and cannot be ignored.

Jet zero: our strategy for net zero aviation - GOV.UK (**www.gov.uk**)

Review of onshore wind farm noise assessment guidance: Stakeholder engagement survey

The Department for Business, Energy and Industrial Strategy consulted the IOA as part of a stakeholder engagement seeking views on onshore windfarm noise assessment guidance. A detailed response was submitted, reflecting members' views on aspects including the fundamental approach of the guidance, baseline determination, measurements, noise impact assessment – including cumulative impacts, and noise controls, compliance and enforcement. Some members consider further guidance is required on low frequency noise and vibration, and that if the policy position is that these aspects are not required to be considered, policy guidance stating this would assist all involved in the planning process. The full response is on the wind turbine noise page on the website at **https://www.ioa.org.uk/publications/wind-turbine-noise**

About the author:
Mary Stevens supports the IOA to bring acoustics to the attention of policy makers.

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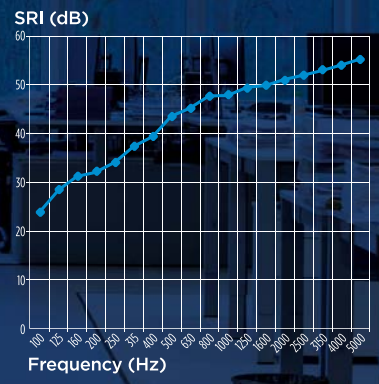

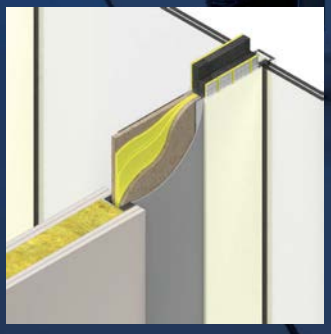

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Noise nuisance

In this article, Dani Fiumicelli looks at the case of *Coventry v Lawrence [2014]* where the Supreme Court said that a defendant may be able to successfully argue that, by changing the use of their own land, the claimants have created a noise nuisance for themselves.

If this is the case, it may well be wrong to hold that a defendant's pre-existing activity has given rise to a nuisance in these circumstances.

We now have the High Court decision where this has turned out to be a decisive factor – *Jones v Ministry of Defence [2021] EWHC 2276 (QB)*. The case concerned noise nuisance from RAF aircraft flying over a house and commercial buildings in Anglesey. The judge had no doubt that the noise of aircraft flying close to, and occasionally over, the land was very loud and interfered with its current use and enjoyment. But he was satisfied that the claimant had not established that the defendant had committed an actionable nuisance. The main reason was that, whilst the locality was largely agricultural, this aircraft noise had been part of this environment for generations. But he also went on to consider the point that the Joneses had changed the use of their land and introduced residential and commercial activities that were sensitive to the aircraft noise.

Previously, this noise had not created a nuisance to the Welsh Water depot use; to which the land had been put before the Joneses moved in. The judgement does still turn on the specific findings of fact that were made, as you would expect, and on the MoD also showing that the RAF were using their land in a reasonable manner and that this use had not increased in intensity.

The claimant has to respect the character of the locality

This is a different argument to saying that the claimant 'came to a nuisance', which still is no defence to a claim in nuisance. But the case has confirmed that the claimant has to respect the character of the locality. Looking at the matter in the round, as the judge in Jones said: "If an occupier of land has conducted an activity in a reasonable manner for many years, I do not consider it fair that a new neighbour who wishes to start doing something that is sensitive to the occupier's activity can complain that the activity in question will disrupt the sensitive use of his land that the neighbour wishes to introduce."

There may be an appeal.

The full judgment can be seen at **https://tinyurl.com/jskfwsvz**

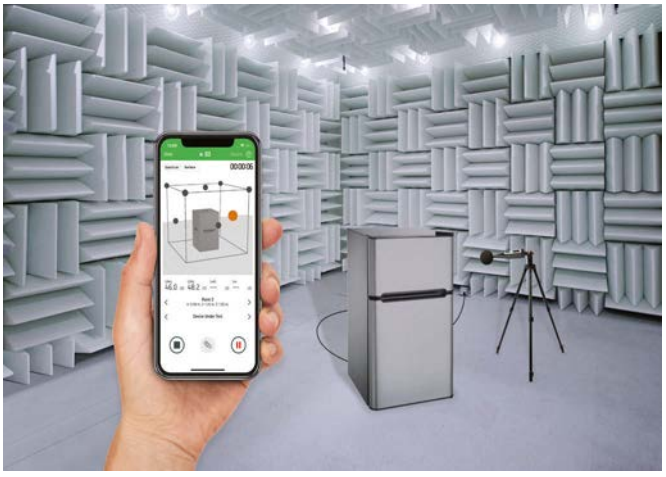
Power and intensity

HBK's Hand-Held family offers a comprehensive range of functionality for product noise assessment.

The new 2245 Product Noise app provides a simple cost-effective system for:

- Easy acquisition and reporting of sound power levels in accordance to ISO 3744 & 3746
- Determination of noise emissions for machinery and equipment
- Measurement of sound pressure levels for workstations and toys
- Declaring product compliance with noise specifications for legislation or commendation
- Comparing noise emissions of machinery and equipment for benchmarking

B&K 2245 sound level meter



Hand-held 2270 Sound Intensity system makes it easy for one person to:

- Perform intensity based Noise mapping for noise source identification
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Email: **ukinfo@bksv.com**

Glasgow calling

The IOA has been selected to organise Inter-noise 2022, which is to be held at the Scottish Event Campus (SEC) in Glasgow on **21-24 August 2022**. Barry Marshall Gibbs, Congress President, and Alistair Somerville, Technical Programme Chair explain more.

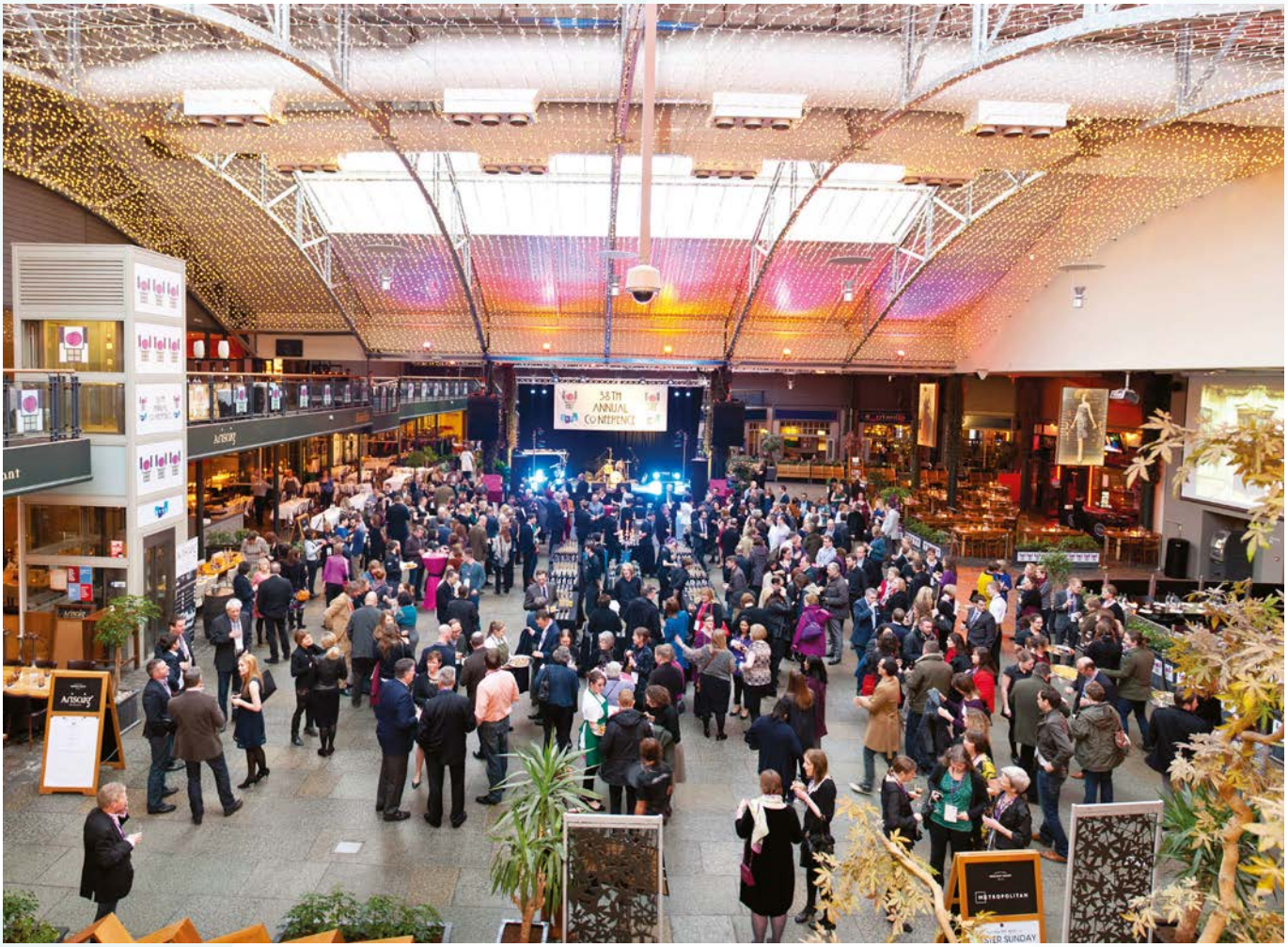
The IOA is working in partnership with the UK Acoustics Network (UKAN) and the International Institute of Noise Control Engineering (I-INCE) to organise the event, which will be the first Inter-noise congress in the UK since the one held in Liverpool in 1996. Older members may have fond memories of that and wish to repeat the experience in Glasgow. So, put the date in your diary.

Inter-noise is the major international conference on noise control engineering and attracts scientists, engineers and consultants from around the world; it may be the first opportunity since Covid for members of IOA to attend a conference in person, present a paper to an international audience or even organise a session containing presentations on a similar topic to their own.

SEC was the venue of COP 26, the UN conference on climate change, held in November this year, and is an ideal location for such a large-scale meeting.

This will be an on-site congress and people attending can look forward to an exciting technical programme, forward-looking keynote presentations, and supported by social events in the city and surrounding country. Why not combine it with a holiday in some of most beautiful landscapes in the world?

Below:
The Scottish Event Campus



Inter-noise theme

The congress theme is 'Noise Control in a more Sustainable Future' and the programme will also cover all aspects of noise control engineering, acoustics and vibration. In addition, there will be special sessions on profession, training and outreach, which will be attractive to early career professionals.

The main topics in the technical programme include:

1. Physical acoustics
2. Advanced measurement methods
3. Modelling and simulation
4. Flow-induced noise and vibration
5. Vibro-acoustics and structure-borne noise
6. Signal processing, reproduction and diagnostics
7. Thermo- and aero-acoustics
8. Aircraft noise
9. Environmental noise
10. Industrial noise
11. Building acoustics
12. Transportation noise and vibration
13. Underwater, ship and offshore acoustics
14. Active control
15. Materials
16. Community noise and planning
17. Human Response
18. Soundscapes and acoustic quality
19. Profession, training and outreach
20. Theme-related: noise control in a more sustainable future

You can express your interest in attending the conference by visiting **https://internoise2022.org/** where you can also volunteer to organise a technical session.

The important dates for your diary:

- Call for abstracts, 1 December 2021
- Registrations, 1 December 2021
- Abstract submission deadline, 4 February 2022
- Paper submission deadline, 4 March 2022
- Final paper submission deadline, 29 April 2022
- Early-bird registration deadline for authors, 29 April 2022
- Non-authors early bird registration regular registration, 8 July 2022
- Conference begins, 21 August 2022

This is a unique opportunity for members working in the field of noise control, acoustics and vibration to come together and exchange ideas about their work in an environment conducive to paper presentations and discussions, and informal networking and with many exhibitors in attendance. More than 100 technical sessions are planned, covering a wide range of issues facing the industry, the research community and the community at large.

We look forward to meeting you there.

Above: Reception at Glasgow's Merchant Square

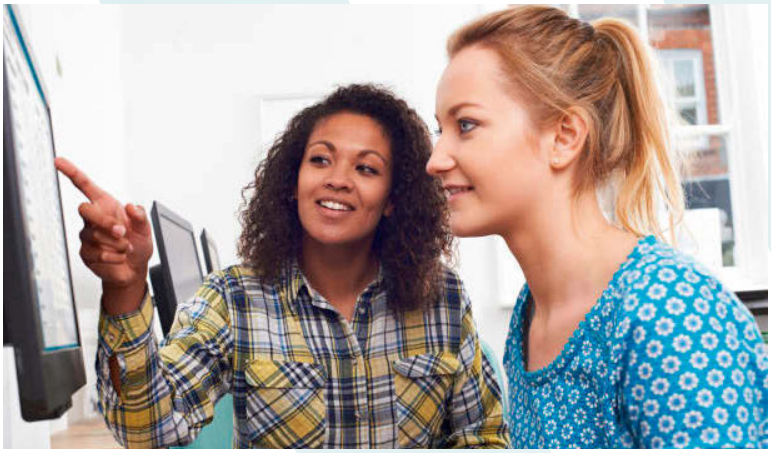
For further information email:
internoise2022@in-conference.org.uk

Register here: **https://tinyurl.com/22jhe64**

Twitter : **@internoise2022**

Work experience

In this issue, IOA STEM committee members, Matthew Muirhead and Vicky Stewart report on initiatives to engage with EngineeringUK and curate a virtual work experience package.



Over the past months, the IOA has worked with two external organisations to help promote its outreach. Firstly, we are glad to say that we are now on EngineeringUK's radar with respect to their initiatives and, in particular, the 2022 Big Bang at school event. Secondly, we are pleased to say that IOA Council has given approval for us to look closely into creating an acoustic-focused virtual work experience package in conjunction with SpringPod. Here we discuss what working with these organisations means for the IOA in the near future, and what help we need from members.

EngineeringUK

EngineeringUK is a high-profile, not-for-profit organisation helping to increase the size and diversity of the engineering talent pool of tomorrow. Getting involved in their initiatives, provides us with a great platform for acoustics as a subject to reach a wider audience and an opportunity to gather more feedback from teachers and students on how to improve our offerings in the future. However, in order to make the most of this chance, we need great quality content, primarily in terms of exciting activities for secondary school students showcasing acoustics at its most interesting, highlighting pathways into the profession and helping guide GCSE and A Level choices.

These activities will then be showcased as part of the next tranche of the Big Bang at School events, starting in March next year (**www.thebigbang.org.uk/big-bang-at-school**). EngineeringUK will work with us to produce the final material but they need existing videos, lessons, activities, ideas, and information from us first. So, if you know of a well-received STEM activity, or a really interesting video that would enthuse students about acoustics, please let us know at **STEM@ioa.org.uk** .

EngineeringUK also have a platform for activities and events that can be offered to schools called Neon: (**https://neonfutures.org.uk/**). This would need ongoing active support from us but could be another excellent platform for existing lessons such as Your Band: (**https://www.youtube.com/watch?v=4iTLSz0u6P8**). Again, if you have any other ideas for what should sit on here to best represent acoustics, please let us know.

Work experience

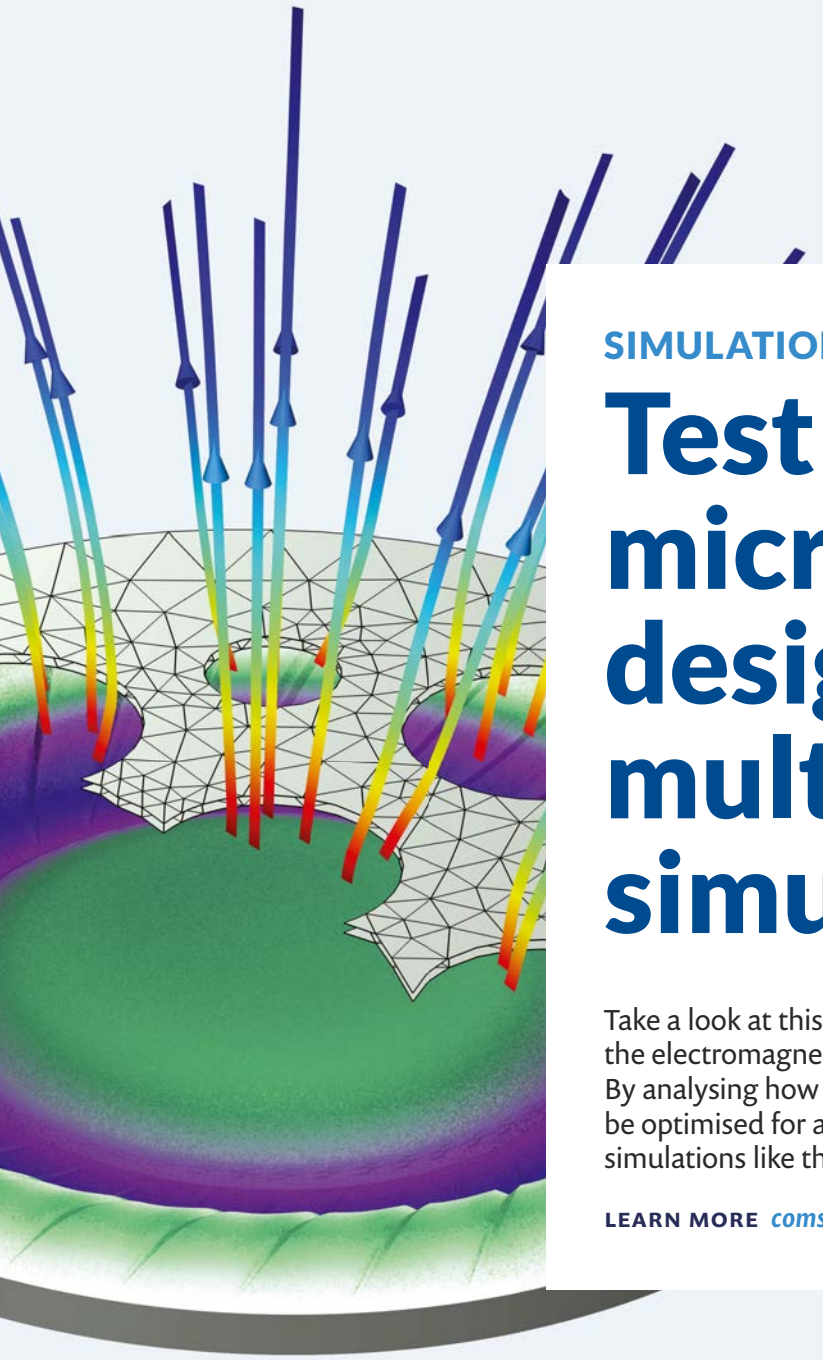
Another form of outreach that the IOA is looking into involves the curation of a repeatable virtual work experience event. This could be an excellent way in which we could both enthuse students about the subject and direct them to the numerous avenues into the industry, such as appropriate university courses, apprenticeships and diplomas etc. This requires content for a similar age group, but the emphasis is slightly different. Here we need material that can be delivered effectively online and/or support the student in carrying out an activity by themselves.

Ideally, we would have a raft of different approaches – careers examples, self-study, videos, quizzes, puzzles, live webinars etc. – covering the extraordinary breadth of topics acoustics reaches. We want to show the full range of careers in acoustics from researchers to policy makers, and from underwater acoustics to speaker design to vibration specialists, as well as consultants. We also want students to see that there are many ways into the industry too, including degrees, the diploma and the Acoustic Technician apprenticeship. We would also want the students to 'meet' acoustic professionals at different stages of their careers.

The work experience will be designed to take up to 10 hours to complete. We will need to find quality content for five different modules, where the coverage of each module will be dependent upon the information that we are able to collect.

See **https://www.springpod.com/virtual-work-experience** for examples of what can be done and please let us know if you would be willing to help bring this together. We are keen to get as much help as possible, but if what you do is a more niche element of acoustics, we would especially like to hear from you.

Timescales for this one are tight and (although finished content can come in due course) we are looking to have a plan and a commitment from the IOA in the next six weeks, so get your thinking caps on!



SIMULATION CASE STUDY

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IOA Early Careers Group

Welcome to the Early Careers Group (ECG). As always, we have been busy with various projects.

By Tom Galikowski, Group Chair

At the recent Acoustics 2021 conference, the IOA ECG and UKAN+ Early Careers Significant Interest Group hosted a session on effective collaboration between industry and academia.

We invited the following researchers, engineers and consultants who presented their experiences of effective collaboration between industry and academia:

- **Professor Barry M Gibbs**, Honorary Professor in the Acoustics Research Unit, University of Liverpool and Immediate Past President of the IOA. Barry started the session by outlining his experience of more than 25 years of research collaboration and industrial grants. He provided his personal views in three examples focusing on consultancy developing into an ESPRC grant, work for Standards Working Group maturing into a grant and a collaborative project with a major aircraft manufacturer and finally, a consultancy for an SME. Barry highlighted importance of trust, time and perseverance in developing fruitful collaborations. It is crucial to network and respond to even the smallest of enquiries – these can mature into large projects in the future. Being pragmatic and listening carefully to what industrial partners say were other important points made in the presentation.
- **Nick Sheppard**, Technical Director at Thales UK, responsible for airborne and underwater acoustics in the maritime side of the business. He gave the insider track on what works well in the industry and academic engagement. Nick stressed the importance of 'shouting loudly' when communicating your research and technology and its relevance, to the industry. Industrial partners can help with accessing specialists or resources not available to universities. There are also PhD opportunities available for relevant research. Academic research is also a route of building a relationship with individuals.
- **Dr Antonio Torija Martinez**, lecturer in acoustic engineering at the University of Salford and the UKAN+ Early Careers Champion for the topics of manufacturing and transport. He gave a perspective of an early career academic on the collaboration between industry and academia. Antonio discussed three main funding programmes focusing on interactions between research and industry: Knowledge Transfer Partnerships (KTPs), Innovate UK and the Higher Education Innovation Fund (HEIF). Antonio discussed case studies for each one, drawing from his personal experience ranging from intelligent sound level meter, propulsion unit for electric aircraft and acoustic vehicle alerting system (AVAS) for e-scooters.
- **Andrew Mitchell**, doctoral researcher at UCL. He outlined his take on effective industry-research collaboration work. Andrew himself progressed from architectural and environmental acoustic consultancy work to a becoming a PhD student at UCL and working on a number of projects such as the Soundscape Indices (SSID) project, which focused on developing soundscape metric for policy. Andrew made an interesting point of using frustration to propel innovation and making sure research had practical, real-life use. He gave examples of his dissatisfaction with the inadequacy and impracticalities of both the consultancy approach (i.e. using national standards) and research (lack of guidance on bringing soundscapes into real-world practice) with neither making any difference to residents or office users. Both of these experiences helped him to focus his research.

The presentations were followed by a Q&A session and a more informal panel discussion on the theme of collaboration and future research in acoustics. The latter part of the session was introduced by Professor Kirill Horoshenkov of the University of Sheffield and one of the UKAN+ Project Leads, who presented the UKAN+ Acoustic Research Priorities, available here **https://acoustics.ac.uk/acoustics-research-priorities** . Currently, 20 higher order priorities are listed and have been developed to guide applications for future research and funding proposals.

The resulting discussion went well over the allocated time and finished with calls to continue a conversation between research industry and academia.

A recording of the webinar and the presentation are available on the IOA website.

The session was organized jointly by the UKAN+ Early Careers SIG comprising Dr Simone Graetzer, and Dr Nikhil Banda, and the IOA Early Careers team comprising Tom Galikowski and Ashley Leiper. We would like to extend enormous thanks to the speakers for their time before and during the event. As always, the event would not have been possible without the help of the IOA team – Linda Canty and Alex Shaida. Thank you all!

Future Early Careers webinars

The Early Careers webinars group is keen to hear from all members on possible content for future events. A feedback form has been sent to all Early Careers Group members. We will appreciate just three minutes of your time to complete the form as this will help us to organise events that will be of greatest interest to our members.

Early career of Graeme Littleford (HS2 Ltd)

In this column, we highlight a wide range of skills, sectors and regions where Early Career professionals work. In this issue, Graeme Littleford of HS2 (High Speed Two) Ltd and ECG Representative at the IOA Electroacoustics Committee, gives an insight into his career so far and how he ended up working on the largest engineering project in the UK.

"I first heard of acoustics when I was finishing my BSc in music technology, worrying how I was ever going to find a job in a recording studio (particularly with my lack of talent in music production!) My lecturer mentioned that acoustic consultancy was, in fact, a 'real job', which would link my interests in music/audio, maths and physics.

"I joined WSP in 2014 and quickly got stuck into a wide range of projects across most acoustic disciplines. Key for me at the time was getting exposure to as much as possible so I could really work out what I enjoyed. Early on I spent lots of time on-site across the UK, building up experience to start taking the lead on smaller residential and building services assessment. I then started to get involved in modelling PA/VA systems for a few of the Crossrail Stations and I was part of the design team for the early design of HS2 Euston Station. I realised from there that my real interest was in architectural acoustics and, specifically, designing PA/VA systems, it always felt like the most tangible link back to my bachelor's degree, which included audio and hardware.

"In 2016, I also started a master's in environmental and architectural acoustics at LSBU, studying one day a week fitted around work. This course covered some of the acoustic principles that were lacking in my bachelor's and furthered my knowledge on PA/VA systems through research.

"Part of the way through my studies at LSBU, I joined Atkins to continue developing experience in designing and commissioning PA/VA systems. At Atkins I was also exposed to a wide range of projects, primarily architectural and building acoustics across commercial developments and in the rail sector. I worked on some fantastic projects ranging from the design of some Metro stations in UAE, the design of Atkins office, the design many PA/VA systems in rail stations in the UK and supporting HS2 in reviewing designs from their contractors and developing prediction methods.

Right:
Graeme Littleford of HS2 (High Speed Two) Ltd

Below:
HS2 is the largest engineering project in the UK

"Most recently, in June, I joined HS2's system integration and capabilities team, which is responsible for ensuring that HS2 delivers capabilities related to noise and I'm leading work on the acoustic design of stations/depots. Working on the client-side means approaching things from a new perspective, which is another refreshing challenge.

"The best thing about working in acoustics for me is the wide variety of interesting projects, from small independent projects to working on one of the largest infrastructure projects in Europe, every project has had something enjoyable about it whether that be a particular technical challenge, or some great people to work with."

ECG new members

The ECG is open to all members of the IOA (both corporate and non-corporate) who shall normally be under 35 years of age or within first five years of their career. The group is always keen to hear from members and non-members alike. To join the Early Careers Group, to find out more information or to voice your concerns, visit **https://www.ioa.org.uk/early-careers-group**

There are ECG vacancies at Central Branch, North West, Research Committee and Physical Acoustics Group – if you are interested, please get in touch with the ECG or the relevant groups directly.

The ECG is always on the lookout for CPD ideas – please email us on **earlycareers@ioa.org.uk** if there are any technical, career and education-related topics you would like to be discussed.

Approved Membership Applications

The Membership Committee reviewed 75 application forms on 12 August 2021 by the online system. 39 applications have recently been approved by the Council following the recommendations of the Membership Committee. The committee saw 29 new candidates joining the IOA, this is including a new sponsor. The remaining being members upgrading or being re-instated.

FIOA

Ben Cox	Sarah Haynes

MIOA

Dominic Attwell	Alejo Garcigoy	Mike Pau
Antonella Bevilacque	James Hipperson	Ben Reed
Christy Carr	Charlie House	Mhairi Riddet
Liu Cheung	Piotr Kowalczuk	Jamie Ross
Joanne Corey	Elisabeth Laughland	Thomas Shemeld
Thomas Dalton	Samuel Lawrence	Edgar Svazas
Steffan Davies	Martyn Ludlow	Michael Symmonds
Mae'r Davis	Matthew Malone	Stephanie Teow
Stefan DeVito	Jim Nelligan	Terry Vincent
Benjamin Dixon	Andrew Nesbitt	Jake Woolley
Peter Dunlop	Dilan Neumann	Phillip Wright
Kyle Edwards	Martyn Parker	Yanko Yankov
Andrew Evans	David Pauliuc	Mandy Yeo

AMIOA

Rita Campos	Tanisha Mascarehas	Craig Savory
Max Colverson	Alexandra Mills-Bell	Jonathan Seiffert
Frederick Davies	Ronny Ospina Orozco	Yanjie Shan
James Evans	Diogo Pereira	William Sterlini
Matthew Griffin	Michael Raven	Daniele Toma
Sam Logan	Jonathan Rigg	Samar Verma

TechIOA

Krzysztof Pniewczuk	Thomas Veale	Will Rowe

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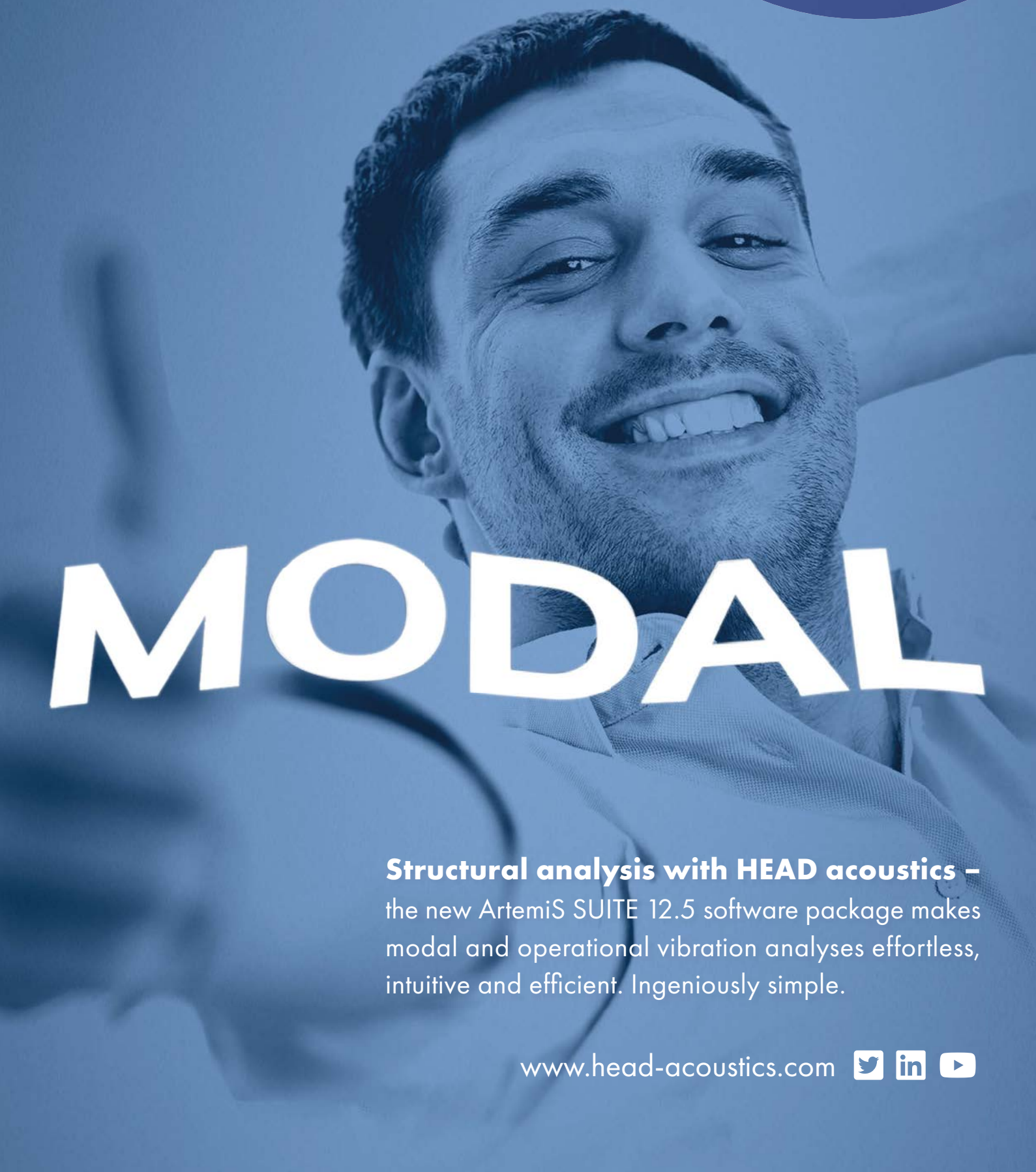

MODAL

Structural analysis with HEAD acoustics – the new ArtemiS SUITE 12.5 software package makes modal and operational vibration analyses effortless, intuitive and efficient. Ingeniously simple.

www.head-acoustics.com

Measurement and Instrumentation Group

By Simon Bull

'Question Time' for acousticians

The Measurement and Instrumentation (M&I) Group of the IOA held an 'ask the expert' panel session in June (via the wonderful medium of Zoom) offering direct access to measurement specialists and leading experts from many of the sound and vibration equipment manufacturers.

The panel comprised:

- Simon Bull (M&I committee member and session Chair), MD of Castle Group Ltd;
- John Shelton (M&I Group Chair), MD of AcSoft Ltd;
- Mark Dowie (M&I committee member), Brüel & Kjær;
- Tony Higgins (M&I committee member), Enviroconsult Ltd; and
- Martin Armstrong (M&I committee member), retired from Brüel & Kjær.

The event started in true 'Question Time' style with a brief biography of each of the panel followed by an introduction by M&I Group Chair, John Shelton. The session then moved straight on to questions starting with a cracker asking whether we will ever see calibratable class 1 MEMS microphones. In essence, they are already with us although it was pointed out that in making cheap MEMS chips perform to class 1 specification involves so much modification and packaging, that they end up costing not much less, although there are still benefits in terms of ruggedness and redundancy where multiple MEMS chips are used.

Standardisation

Questions followed about short duration statistical measurements, determining the noise floor of sound meters, when you might see a higher L_{Aeq} than L_{Amax}, whether geophones are better than accelerometers, what quality of sound recordings should you make and a few other equally diverse questions. The answers to these questions were very detailed and delved into the rights and wrongs of having a standard fast response for all 1/3 octave bands, as well as a technical description of how sound meters calculate Ln values and how there is a lack of standardisation across the industry for it.

This was the first time the M&I group had run a session like this, and it covered a huge range of topics to a significant degree of detail, with a mixture of pre-submitted questions and some presented on the day, the panel members were certainly put to the test bringing out some very interesting technical insights in areas that normally get very little coverage.

If you missed the event, then you can listen to the recording by visiting **https://vimeo.com/569769761/2864f14cb6**

Panel members

Simon Bull

Simon is MD and proprietor of Castle Group Ltd and has worked there for the past 29 years. He joined Castle after completing a degree in business studies at Leeds Met and bought the business in 2014. Simon's main area of expertise in the acoustics world is with the development of noise and vibration measurement equipment. He is a member of the IOA and sits on the M&I Group.

John Shelton

John Shelton is an experienced acoustician specialising in instrumentation. He is the MD of AcSoft having set up the business in 1994 following experience working developing loudspeakers at Goodmans, and later working with Brüel & Kjær UK as an area sales engineer. John has specialisms in the measurement of sound intensity and source location techniques, as well as managing technical sales of instrumentation across the UK. He is an active member of the IOA and sits on several national committees and working groups on measurement and instrumentation. He chairs the IOA M&I Group.

Mark Dowie BSc (Hons) MIOA

Mark has worked for Brüel & Kjær since 2004 and is currently an application specialist. This role includes understanding customers' current and future needs across all aspects of noise and vibration and working with the development team to ensure that Brüel & Kjær products are suitable for real-life applications. He also provides application training for customers, particularly in environmental noise. In 2010, Mark became a member of the IOA and joined the M&I Group in 2014.

Tony Higgins

Tony Higgins has more than 30 years of regulatory and consultancy experience dealing with noise and nuisance issues. He worked as an Environmental Health Manager for Telford & Wrekin Council for over 20 years, and as a consultant specialising in environmental pollution (including noise and nuisance) for the past 15 years. Tony is a member of the IOA and an elected member of the IOA M&I Group.

Martin Armstrong

Martin has been involved with measurement and instrumentation since 1954. Firstly, at NGTE Ptestock, then Derritron, followed by LDS and finally Brüel & Kjær. He retired from B&K in 2001 but was retained as a consultant on vibration for a further 15 years. Martin is a mechanical engineer and an electronic engineer and has been on BSI and ISO committees on mechanical vibration for over 30 years covering calibration and human response to vibration.

Meet the EDI Working Group!

We'd like to introduce you to the IOA Equality, Diversity and Inclusion (EDI) Working Group; a few of our members have prepared a profile so you can get to know them better. Please do come and speak to us if you see us out and about, or email **diversity@ioa.org.uk** if there is something you would like to discuss.

Angela Lamacraft, EDI Working Group Chair

I'm a Principal Acoustic Consultant at a small environmental consultancy based just outside Reading. During my career I have also worked for a large international company and a medium-sized, multi disciplinary engineering consultancy, which has given me an insight into the different challenges faced by acoustic consultants, especially those in larger companies where acoustics may not be prioritised.

I had my first child in 2015. The company I was with at the time was very accommodating and following maternity leave I was allowed to reduce my working week from five days to three. My current employer has been similarly agreeable to a reduced working week. However, from speaking to other parents who want to look after young children for more than just two days at the weekend, I am aware that there are many employers who do not believe that a role could possibly be done by a part-time worker. This is particularly true for employers who need to fill a vacancy, hence many parents, and particularly women, find that they have no option but to stay at their existing company, even if they would prefer to move elsewhere.

Since becoming the IOA's Diversity Champion and setting up the Equality, Diversity and Inclusion Working Group, my eyes have been opened to many more challenges faced by our membership. What has struck me most is that there are many people within the Institute who do not work most effectively with the traditional 9:00 to 17:30, open plan office style, and that do not thrive in an industry dominated by assertive, white, middle-aged men.

I am certain that if areas of society are unintentionally excluded from Institute activities, or the acoustics industry generally, the Institute and the acoustics profession miss out on their experiences and viewpoints, which then affects the delivery of services to the Institute's membership and to our business clients. It is therefore essential to acknowledge that people are individuals who may work most effectively in a different way, and that we explore how we can support all colleagues within the Institute and within our workplaces. P32

Simon Chandler-Wilde

I've worked throughout my career at UK universities, in engineering and maths departments, and since 2003, I have been Professor of Applied Mathematics at the University of Reading, where my teaching and research interests span computational and mathematical acoustics. I've been a member of the IOA since my early 20s, and have previously been part of the IOA's Research Coordination Committee. I was really keen to join the IOA's new EDI Working Group as a continuation of long-standing activities in diversity and inclusion, which culminated in appointment, in a job share, as Reading University's first Dean for Diversity and Inclusion, in a five-year appointment that started in 2015. In that role I co-chaired Reading's work on gender and LGBT+ equality, which led to a first Athena SWAN Silver award for Reading in March 2020, and to Stonewall Top 100 Employer status in 2019 and 2020. Since April 2021, I have been part of the management team for the UK Acoustics Network, leading on diversity and inclusion.

Daniel Goodhand

I am chair of the Publications Committee and a member of the IOA Council. I became Diversity Champion during my first term on council in 2017 and Angela Lamacraft took over as Diversity Champion after me. I stepped up to join the Equalities, Diversity and Inclusion working group in 2021.

During my time as Diversity Champion, I drafted the IOA's Equality, Diversity and Inclusion Policy and worked with the Royal Academy of Engineering to fulfil the IOA's obligations under our concordat with them.

I encouraged committees and groups to appoint diversity champions and to place diversity and inclusion on their agendas, I also took other steps to help move the IOA along the Diversity and Inclusion Progression Framework.

I am a father of two wonderful children who are both mixed-race. To the best of my knowledge my children haven't experienced any direct discrimination, but I want to make sure they get to grow up in a fair society where their success is dependent only on their ambitions and abilities. That has motivated me to sit on the Equalities, Diversity and Inclusion Working Group to make sure everyone has an equal opportunity to succeed and to encourage individuals from all walks of life to become involved with the Institute of Acoustics at all levels.

Adam Lawrence

I have worked in acoustics consultancy at Atkins since I graduated from Salford back in 1996, mostly dealing with transportation and environmental noise. I have inherited a rare neurological condition called Hereditary Spastic Paraplegia (HSP) which slowly degrades the nerves in my spine, affecting my mobility. HSP is an umbrella term, with more than 90 types identified so far, symptoms can start at any age and progress at a range of speeds. Many people also have other symptoms including pain, fatigue, bladder problems and depression, and there is a large range of other symptoms which people can also have. There are no cures for HSP and all treatments are to do with symptom relief. As this is a rare condition; it is not known about by many healthcare professionals, which makes getting a diagnosis challenging for many people.

I am Chair of the HSP Support Group (**www.hspgroup.org**), a small charity providing support to those with HSP in the UK. We aim to provide a friendly community, share how people have dealt with the challenges HSP presents, hold meetings allowing people to feel less isolated and meet up, and award grants to help members purchase equipment to improve their quality of life. We also fund research into HSP to help find new information about treatment options and help the understanding of HSP. I also liaise with similar support groups in Europe, the Americas and Australia.

At Atkins I am Co-Chair of our staff network for people with disabilities, hidden conditions and long-term health issues. We have been raising awareness about disabilities, encouraging open conversations and making sure that colleagues are supported. We recently provided input into Atkins' reasonable adjustments policy, as the company worked to become a Disability Confident Employer.

I joined the IOA EDI Working Group with a disability hat on, to ensure that discussions around under-represented groups consider issues and challenges faced by people with disabilities on a daily basis.

The IOA is a signatory to the Engineering Diversity Concordat: **https://www.raeng.org.uk/diversity-in-engineering/professional-engineering-institutions/engineering-diversity-concordat**

Bridget Shield

I've been working in acoustics since 1973, always within a university engineering department, involved in teaching and research. Throughout, I have been aware of the very low numbers of women working in the field. In my early career there were very, very few women at acoustics meetings and conferences; on several occasions I was the only one! The IOA Code of Conduct was, until the late 1980s, expressed purely in terms of 'he' and, until relatively recently, there were few women on IOA Committees or in executive roles. Furthermore, within engineering departments in my university, there was blatant sex discrimination with women being very unfairly treated in terms of workloads, promotion and so on, compared with male colleagues.

Hence, during my career I've been involved in initiatives to encourage girls and women to consider a career in science or engineering. I was a Joint Chair of the Women in Engineering Centre at London South Bank University, which organised conferences and school visits to raise awareness of engineering as a potential career. We also set up the national Women in Engineering Centre at the university to provide advice and support to women studying and working in all branches of engineering.

Things are definitely changing for the better in engineering in general, and in acoustics in particular, in terms of the role of women in the industry. In recent years it has been a real pleasure to me to see the number of women IOA members increasing, and to note how visible women members are, taking leading roles on Committees and Council, organising conferences and so on. This is despite the fact that the number of women members remains relatively small – around 12% of the corporate membership – so there is still a long way to go.

An area that I think needs addressing is to encourage people to return to acoustics after a career break. Many, especially women, with a parenting or caring role, find it difficult to return. In my own case, after a 10 year break, I found it very challenging as so many things had changed during that time – terminology, technology, units of measurement and so on.

As an academic I was lucky in having a certain amount of flexibility in my working hours, but I know that in consultancy, particularly in today's frantic world, that may not be possible. I would like to help the IOA to develop support for people wishing to return to work, for example, in the form of mentoring and refresher courses, and to encourage employers to consider ways in which they could help their younger staff who are juggling personal and professional responsibilities.

Since being President of the IOA I have also been aware of the lack of diversity of our membership in many other areas. I hope the Equality, Diversity and Inclusion Working Group will help to address this issue by raising awareness of it, and encouraging strategies and initiatives designed to overcome it. P34

Susan Witterick

I am Director of dBx Acoustics Ltd based in Manchester.

I joined the EDI committee as I have diagnosis of autism and ADD, as well as suffering from depression. It's really important to me to encourage people to be open about their 'difference', particularly around neurodiversity and mental health. The more we can talk about these issues, the less stigma I hope there will be around them.

Neurodiverse people's brains have a different operating system, but that doesn't mean it's a bad one – we can look at things from a different perspective and come up with ideas which nobody else may have thought of. The accommodations we need to help us be effective in our jobs are simple to make, the hard part is understanding as an individual what would help you, and then feeling able to ask for it.

Similarly, I believe that talking openly about our mental health is an important part both of processing what is happening to us, and allowing others around us to provide support. As an employer, I'd much rather that someone took a duvet day to help get themselves to a better place, than keep on struggling in silence and make themselves feel worse. I lead by example in this area!

I'm looking forward to working on the Working Group to continue my crusade of normalising difference, and really hope that other acousticians with similar conditions to my own will feel more able to be who they are, instead of always pretending to be who they think other people want them to be.

Ismail Alli-Balogun

I am Director at Carterhatch Architectural Acoustics. I graduated from the University of Salford with a degree in acoustics and have worked at a few consultancy practices in and around London since then. I participate in the activities of the IOA (I've been a member of the Education Committee since 2017) and the ANC (I'm currently on the Working Group tasked with developing new guidance for assessing sport and leisure noise).

I joined the EDI Working Group to help the IOA achieve its aims regarding equality, diversity and inclusion and I am keen to ensure that activities that the Working Group get involved in are aligned to objectives that are measurable, achievable and likely to result in lasting improvements to inclusion and equality.

I think it's important to work with the IOA's existing committees and specialist groups to integrate EDI into the core functions and activities of the Institute. I believe this will help to increase the understanding of what equality and inclusion means for IOA members, which may lead to greater representation (of underrepresented groups) across the entire Institute.

If you want to discuss the work of the IOA Equality, Diversity and Inclusion Group email us at: **diversity@ioa.org.uk** .

Mechanical vibration, guidance, instrumentation, calibration and measurement

In this instrumentation corner article, Martin Armstrong, a founder member of the IOA M&I Committee, discusses mechanical vibration and the human response to it in respect of health, safety and comfort.

By Martin Armstrong

For the past 12 years, the members of the Measurement and Instrumentation (M&I) Group have provided articles for Acoustics Bulletin that looked into interesting corners of many aspects of measurements and instrumentation, and the metrics used in evaluating human exposure to sound and vibration.

From the IOA members page: *The mission of the M&I Group committee is to advance the science of measurement of both sound and vibration and to explain the instrumentation required to achieve this goal, not only to the IOA membership but the wider public as well.*

As shown in the title, this article addresses the subject of vibration, specifically, **mechanical vibration**, not necessarily in the order listed. A short reminder; the international committee for vibration is the ISO Technical Committee No 108, Mechanical vibration, shock and condition monitoring. Here in the UK the BSI committee is GME/21, Mechanical vibration and shock and condition monitoring. There is also CEN, the European Committee for Standardization, which is an association that brings together the national standardisation bodies of 34 European countries, with an agreement on technical cooperation between ISO and CEN (Vienna agreement).

With the current Covid 19 pandemic situation, no face-to-face meetings are taking place, and the latest information issued October from ISO was that virtual only meetings are extended to 31 January 2022. For the past two years, the loss of the normal interaction at working groups has hindered the pace of progress. The formation of new working groups covering transducer calibration and human response to vibration instrumentation has left a gap in the wider considerations of mechanical vibration.

In this article, the emphasis is to consider human response to vibration, both for health and safety and comfort. Mechanical vibration measurements, a_h, a_k, a_d and a_b are the time-averaged weighted acceleration values in ms^{-2}. The frequency ranges are 8 Hz to 1000 Hz for HA and 0.5 Hz to 80 Hz for WB. The three orthogonal directions are nowadays measured concurrently, this was not always the case in the past. Values are in general linearly time averaged with the eight hour average, daily working time, used to evaluate compliance with the Health and Safety at Work Directive, see SI 1093:2005. Intermittent or transient vibrations encountered are sources of complaint and of adverse comment, and being non stationary require dose or peak value measurements.

Calibration

Starting at the beginning of the measurement trail, devices for measuring shock and vibration have been described in many ways in documents, e.g. pickups, sensors and probes. In 1996, a resolution was passed in TC 108 that, in future, the term 'transducer' should be used in describing shock and vibration measuring devices. Unfortunately, some companies still use the term 'sensor' in their literature.

At that time, transducer calibration was covered by the ISO 5347 *Calibration of vibration and shock pick-ups series*. A complete rethink took place with a new ISO 16063 series and over time the earlier series has been replaced though work is still ongoing.

Such standards are periodically under review, which is the case with BS EN ISO 16063-21:2016: *Methods for the calibration of vibration and shock transducers. Part 21: Vibration calibration by comparison to a reference transducer* which incorporated amendment 1.

An amendment 2 was expected to be published in 2021. The total frequency range now extended from 0.1 Hz to 20k Hz, more informative text and revised figures showing different configurations. Standard back-to-back, fixture using a transfer transducer and an exciter with built-in transducer.

All 15 P member[1] countries voted positive in November 2020 to this amendment 2. However, there were so many comments, many beyond the amendment, that the final text has been delayed. As it is now out of allocated time it could be cancelled and need to be restarted.

It is important in measurements to be able to make *in situ* checks to verify that the instrumentation is performing correctly. There is BS ISO 16063-44:2018 *Methods* P36

for the calibration of vibration and shock transducers. Part 44: Calibration of field vibration calibrators. This is an important standard to provide traceability of a specified reference vibration value at the reference frequency at the measurement point. This document specifies the instrumentation and procedures to be used in performing the calibration of field vibration calibrators (FVCs). This calibration document states: *'It is not applicable to FVCs used for the calibration of transducers. These are covered by ISO 16063 21.'*

Related standards in the 16063 series to be aware of are Part 31:2009: *Testing of transverse vibration sensitivity* and Part 34:2019: *Testing of sensitivity at fixed temperature.* Such transducer data provided by the supplier of the instrumentation is important in evaluating uncertainty budgets in any measurement.

Human response to vibration

Here there are two strands:

1. standardising the parameter to be measured; and as required,
2. standardising the values to be specified and the instrumentation to perform such measurements.

The frequency ranges are listed above as in ISO 5349-1 for hand-arm and in ISO 2631-1 for whole body. There is nothing changed on that front and the instrument standard BS EN ISO 8041-1:2017 *Human response to vibration – Measuring instrumentation, Part 1: General purpose vibration meters* specifies the requirements for pattern evaluation, or validation, periodic verification and *in situ* checks, and the specification of vibration calibrators for *in situ* checks. Prior to, and following a measurement or series of measurements *in situ*, checks act to verify the instrument's basic calibration and functionality. This should not be omitted.

As mentioned, the changes in the structure of the ISO TC 108 subcommittee from 2017 with new Working Groups for calibration and human response to vibration, with the inevitable overlap of time scales, has given rise to anomalies that will need correcting or understanding.

When a complete revision of ISO 8041, to supersede ENV 28041:1993 was undertaken, it was of concern that there was no specification for a field calibrator, unlike in acoustics. When ISO 8041 was published in 2005, it had a normative Annex A, 'Specification for vibration field calibrator'. In this annex calibration within the scope of ISO 16063-21 is the method, at the reference vibration values and frequencies for the relevant application. Now there is a calibration standard, ISO 16063-44:2018 for the FVC. However, it was published after the latest issue of ISO 8041-1:2017 where there is no change to Annex A.

In May, a first edition of ISO 8041 2: *Human response to vibration - Measuring instrumentation - Part 2: Personal vibration exposure meters (PVEM)* was published. This fits in well with the health and safety hierarchy to give the true working day exposure values. Personal vibration exposure meters as a logging measuring instrument measure over a long period of time (e.g. a whole working shift) and are used unattended, without measurement personnel present, so that the measurements can include artifacts, measurement errors and also periods without vibration.

It specifies two parts allowing for fixed, temporary wired or wireless interface between the vibration input and the display of the measurement. The logging, signal processing and operator detection systems can be split between the two parts. Note: PD CEN ISO/TR 19644:2018 gives guidance on the assessment of daily vibration exposure at the workplace, of different methods employed, according to the requirements of health and safety where the PVEM has a prominent role.

ISO 8041-2:2021 relies on the pattern evaluation, validation and periodic verification tests, as well as the *in situ* checks, specified in ISO 8041-1:2017. Unfortunately, there is no reference to using ISO 16063-44 which was published in 2018 to calibrate the FVC. BSI has not published it as BS EN ISO 8041-2 as the importance of traceable calibration checks in the field needs to be clarified. A national foreword is to be added to address this situation.

Guidance on measurements

Guidance documents, whether as standards, from the Health and Safety Executive or trade institutions are a mixed bag. Care needs to be taken to ensure measurements being used meet a measurement standard.

In what I call 'the first division' are those directly associated with a measurement Standard. An example is BS EN ISO 5349-2: *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Part 2: Practical guidance for measurement at the workplace*. This part of ISO 5349 provides practical guidelines to perform P38

References

[1] Participating members are called P members, as opposed to observing members, who are called O members. Each technical committee has different numbers of countries participating and it is against that number that those voting in favour are equated. For a project to be approved there must be more than 66.66% P members in favour.

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measurements correctly and to develop an effective strategy for measurement of hand-transmitted vibration at the workplace.

Another standard, this time covering whole-body comfort assessment, is BS 6472-1:2008 *Guide to evaluation of human exposure to vibrations in buildings – Vibration sources other than blasting.* The measurements are according to ISO 2631-1 and ISO 2631-4 with the instrument standard ISO 8041. The parameters are weighted acceleration Wb and Wd and the vibration dose value (VDV). An earlier standard BS 6841:1987 is broadly the same. Therefore, any assessment from a measurement has standardisation of the measuring equipment as well as traceability to an accurate calibration at the reference vibration values and frequencies using an FVC.

The next tier could be to use data obtained with instrumentation complying with a Standard, plus other parameters. PR CEN/TR 15350, *Mechanical vibration – Guideline for the assessment of exposure to hand-transmitted vibration* using available information including that provided by manufacturers of machinery is one example. It is based on the requirements and guidance given in EN ISO 5349 1 and EN ISO 5349 2 but instead of measuring the vibration magnitudes at the specific workplaces, the methods in this document use existing vibration values from, for instance, the ISO 28927 series on hand-held portable power tools.

To assist in providing advice on safety at work, identifying vibration magnitudes and exposure times using different procedures, the PD CEN ISO/TR 19644:2018 *Human response to vibration. Guidance and terminology for instrumentation and equipment for assessment of daily exposure at the workplace according to the requirements of health and safety* covers different methods employed. The PVEM is an important tool in this regard.

Where a guidance document has a problem is where a parameter to be measured is not fully specified, or more than one objective is being addressed. BS 6472-2:2008: *Guide to evaluation of human exposure to vibration in buildings – Blast-induced vibration* is a case in point. The two normative documents listed are BS 6841 and ISO 8041, which are specific to human response to vibration from 0.5 Hz to 80 Hz. The standard specifies peak particle velocity measurements (PPV), not r.m.s or VDV, but over a frequency range from from 4.5 Hz to 250 Hz. So basically, the origins here of the vibration in buildings is a legacy document from BS 7385-2: *Evaluation and measurement for vibration in buildings Part 2. Guide to damage levels from ground borne vibration* and not human response to vibration. BS 7385 gives the lowest frequencies expected as 1 Hz and the highest 1000 Hz with a more limited range of 4 Hz to 250 Hz being usually encountered.

Further to this it is generally the use of velocity transducers, or geophones, which are typically used for building damage. They operate above their resonance frequency, which is where the 4.5 Hz comes from as the lowest frequency. In fact, as this is the 3dB damping point accurate measurements commence around an octave above this frequency.

In fact, in many instances, this guidance document is often taken as a measurement document and referred to by equipment manufacturers. Though BS 6472-2 is for blast-induced vibration it is used to cover many transient vibrations such as pile-driving. It is a guidance document and while it refers to BS 6841 and ISO 8041 for human response to vibration it needs better guidance on human exposure to vibration in buildings to ensure it is the response of humans to vibrations between 0.5 Hz and 80 Hz being evaluated.

A revised PPV model

Do any of the human response to vibration weightings in ISO 2631 provide the means of converting the acceleration to a velocity? In BS 6472-2 it is stated that the typical range of vibration frequencies for blast-induced vibrations is from 5 Hz to 40 Hz.

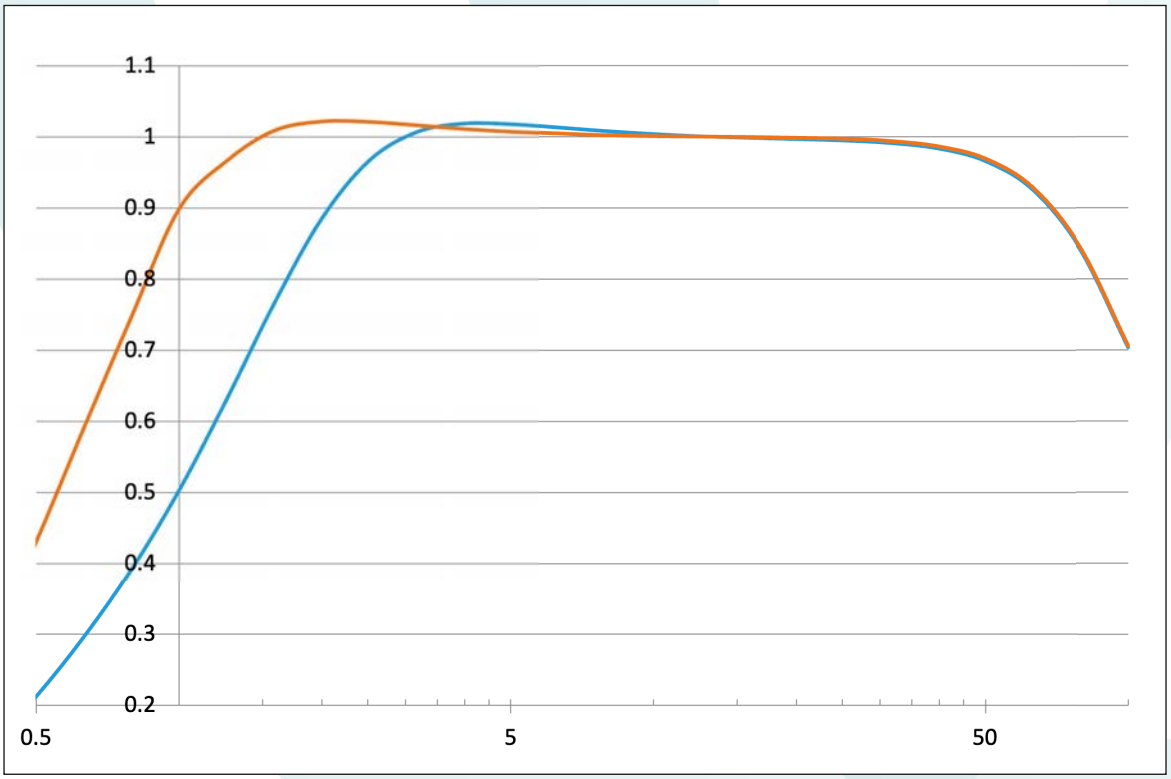
In reality it is possible to measure the human response to vibration with PPV by using an instrument meeting the BS EN ISO 8041-1 standard, selecting the W_d or W_e weightings (see Tables B.3 and B.4) on all three channels, and selecting the term frequency-weighted values 3.1.5.8 – peak vibration value, would measure particle velocity. The resultant displayed value will be in m/s^2 acceleration but velocity weighted.

So where does weighting Wd meet the requirement of integrating the acceleration to velocity? The a-v transition is at 2 Hz, ideal to both meet the requirements of human vibration and velocity in the range for particle velocity. In fact, W_e has an a-v transition at 1 Hz and, therefore, could be more suitable but not all instruments incorporate this weighting.

All that is needed is to apply a conversion from the weighted acceleration value instrument display to a velocity value in mm/s. The whole-body vibration at the reference vibration value is 1 m/s^2 at the reference frequency of 100 rad/s (15.915 Hz) which is a velocity of 10 mm/s.

The weighted acceleration factor for W_d, at the reference frequency is 0.1262 and such that a conversion

Table 5 from BS EN ISO 8041-1: velocity response for W_d and W_e weightings for an input vibration



factor of 79.24 results in an error of less than 0.1% when recording the vibration value in mm/s.

In calibrating such an instrument with weighting W_d, according to the Periodic procedure 12.1 in BS EN ISO 8041-1, as required in Table 5 at the 1/3 Octave frequency of 12.5 Hz and 1 m/s^2 (12.64 mm/s) the calculated value would be 12.65.

The weighted acceleration factor for W_e, at the reference frequency is 0.06288, such that a conversion factor of 159.0 results in an error of less than 0.1% when recording the vibration value in mm/s.

In calibrating such an instrument with weighting W_e, according to the Periodic procedure 12.1 in BS EN ISO 8041-1, as required in Table 5, at the 1/3 Octave frequency of 12.5 Hz and 1 m/s^2 (12.64 mm/s) the calculated value would be 12.65.

Is it a way forward? Only time will tell though the relevant BSI committee GME/21/6/4 has not yet put forward a proposal to revise BS 6472-2, though there is a proposal to revise BS 6472-1.

Conclusions

A new issue of the transducer calibration standard ISO 16063-21 is unlikely to be published shortly. The problem is that the comments from the committee exceeded the original objective of the Amendment 2. If the work is expanded to the entire document then additional support for a revised project will be required as it is currently flagged as in a critical phase as being out of time.

A national foreword will be incorporated in the publication of BS EN ISO 8041-2. It has been agreed and the BSI publications team should complete this process shortly.

At present, the ISO committee WG33, covering human response to vibration instrumentation, has no project to follow on from ISO 8041-2 and could disband.

About the author:
Martin Armstrong is a founder member of the M&I Committee, been a member of BSI and ISO committees for 30 years and having been retired for 20 years is now retiring a second time.

IOA 2021 Rayleigh Medal

The Institute of Acoustics is delighted to award Professor Vorländer its most prestigious award, the 2021 Rayleigh Medal, in recognition of his outstanding work.

The Rayleigh Medal is the IOA's most prestigious award. It is awarded without regard to age to persons of undoubted renown for outstanding contributions to acoustics. It is normally presented to a UK acoustician in even-numbered years and an overseas acoustician in odd-numbered years.

left: Professor Michael Vorländer

Citation for the award:

Professor Michael Vorländer is a full professor in the Faculty of Electrical Engineering and Information Technology at the Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen University – a top technical university in Germany.

Before joining Aachen University in 1996 he was a Research Officer at the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig (an equivalent to the National Physical Laboratory in the UK).

Interdisciplinarity and a broad interest in acoustics were always specific to Professor Vorländer's work. Since joining RWTH he has been driving research and education in acoustics with significant contributions in acoustic measurement techniques, room acoustic simulation, binaural technology, and Acoustics Virtual Reality – an emerging field in which he was one of the founders from the beginning. This new field required an extension of interdisciplinarity towards digital audio technology and 3D sound.

More specifically, Professor Vorländer's contribution to acoustics has been outstanding in the following three areas:

(i) The development of new science;
(ii) providing high quality education; and
(iii) community building and professional support.

Professor Vorländer leads the Institute of Technical Acoustics in Aachen which is a world-class organisation founded in 1963. The Institute carries out high quality research into acoustic measurement and simulation technology. Professor Vorländer is a world-leading figure in these areas of research publishing his work prolifically in top acoustical journals and in the proceedings of international conferences.

Professor Vorländer's impact in terms of providing acoustics

related education has been huge. Since becoming a full professor at Aachen University he has lectured acoustics to and graduated almost 4,000 MSc and undergraduate students. He has led 38 PhD students to successful completion. Many of these PhD students have become academics at top universities worldwide or set up their own businesses related to acoustics.

In terms of acoustics community building and professional support he has a high profile. His CV presents a long list of various roles and commitments he has undertaken during his active career. Professor Vorländer has dedicated a considerable proportion of his life to work within professional societies, organising conferences and supporting editorial boards of top international journals in acoustics.

He has been an active member of the German Acoustical Society, the European Acoustical Association, the Acoustical Society of America and the International Commission on Acoustics. His level of participation in these societies and professional bodies was instrumental in developing a clear vision and strategy for the future of the acoustics research community and beyond. His contribution to the organisation of the International Year of Sound 2020/2021 has been immense. He has played a highly active role in organising every important international conference including the tri-annual International Congress on Acoustics, the Forum Acusticum, meetings of the Acoustical Society of America and several other international events. Over the years, these meetings have attracted tens of thousands of participants and enabled the acoustics community to exchange knowledge, identify challenges in acoustics and develop collaborative research to address those challenges.

Professor Vorländer has also worked closely with the UK Institute of Acoustics and UK Acoustics Network. This work has facilitated the establishment of close international collaboration between Early Career Research groups. This work is ongoing and is developing rapidly and is essential to the sustainability and competitiveness of acoustics related research, particularly in Europe. He has also contributed significantly to the Acoustical Society of America's Committee on International Research and Education which aims to support early career researchers from developing countries.

In summary, Professor Vorländer's contribution to acoustics has been outstanding in terms of its reach and significance. The impact of his research, teaching and professional support in general has been greatly valued by the acoustics community worldwide. Professor Vorländer is a highly intellectual but yet a modest and approachable person. His communication skills are excellent and he has used them wisely to promote acoustics as a key discipline globally.

Bringing acoustic metamaterials to hospitals

At the end of 2020, we wrote an article for Acoustics Bulletin summarising some of the research at Sussex on acoustic metamaterials [1]. One of the applications mentioned was the design of metamaterial panels for noise management in intensive care units. In a context where metamaterials are usually perceived as 'single tone' objects, we wanted to test them in a real scenario, where they could be designed to work over larger bandwidths. This article summarises what happened next.

By Gianluca Memoli[1,2], Letizia Chisari[2], Lorenzo Bonoldi[1] and Abdelhalim Azbaid El Ouahabi[1] ([1]AURORA Project, School of Engineering and Informatics, University of Sussex, Brighton. [2] Metasonixx Ltd, London)

How noisy are hospitals?

Hospital wards are noisy places. They were already noisy in 1859, when Florence Nightingale denounced noise as the "most cruel abuse of care" for patients and staff. The presence of unwanted sounds ('noise') has been increasing in hospitals ever since [2]. In a recent review [3], de Lima Andrade *et al*. summarise the findings of 33 different studies in the period 2015–2020, reporting measured values of the equivalent sound pressure level L_{eq} ranging from 37 dB (A) to 88.6 dB (A) during the day and night-time values of 38.7 dB(A) to 68.8 dB (A). This huge variation is partly due to hospital environments being very different from one another, with rooms full of sound-reflecting but easy-to-sanitise surfaces, to the wide range of sources, but it is also partially due to measurements not always being taken by properly trained acousticians [4].

Within hospitals, intensive care units (ICUs) are particularly noisy. Even when particular care was taken in following the measurement standards, as in a 2014 collaboration between a London hospital and the National Physical Laboratory [5] or by a 2019 team comprising clinicians from Oxford and acousticians from Southampton University [6], hourly sound pressure levels in the range 60 dB(A) – 65 dB(A) were recorded, at the level of patients' heads, constantly through the day.

Existing soundscapes are therefore starkly in contrast with what was prescribed by World Health Organization in its Guidelines for Community Noise [7]: a 1999 document recommending sound pressure levels of $L_{Aeq,16h} \leq 30$ dB (A) in hospital wards[1] and a maximum value of $L_{A,max}=40$ dB(A) for sound events during the night. Meanwhile, higher noise levels in clinical environments have been linked to negative impacts both on patients (e.g. sleep disturbance, increased blood pressure, delayed recovery) and staff (e.g. stress and increased chance of burnout) [4] [8].

Dawson and Johansson (2020) explain why maintaining such levels is challenging, and particularly in intensive care units [9]. According to their questionnaire-based study, the first source of noise perceived by patients and staff is 'conversation'. Staff voices, however, are difficult to mitigate in intensive care units, where sudden and effective communication between staff members often underpins the success of care. They suggest therefore to act on the sounds made by medical equipment and related alarms. This is the second source in terms of perception and is often the closest to the patients' heads.

To quantify this source, at the start of our project we visited a local hospital and measured in-situ the acoustic emission from two key pieces of medical equipment: a ventilator and a cPAP machine. Both are essential to aid respiration in patients, and since they have been used more frequently and in larger numbers during the ongoing pandemic, the source 'machinery noise' has become particularly impactful during 2020–2021. Wards were quickly and suddenly transformed into places that could accommodate (and treat) COVID-19 patients [10]. In the UK, this meant ventilators/cPAP machines in each ward, one near each bed.

The two instruments were found to be different in terms of their sound emission. We found that the cPAP machine could easily reach sound pressure levels around P44

Reference

[1] According to [7], the recommended sound pressure level in areas where patients are "being treated or observed" should not exceed 35 dB(A). In a more recent guidance [21], published in 2013, the UK Department of Health suggests higher sound level limits for external sources – e.g. for multi-bed wardsL_(Aeq,1h)≤45 dB(A) during daytime,L_(Aeq,1h)≤35 dB(A) at night-time andL_Amax≤45 dB(A) during sleep – but does not prescribe any recommended total sound levels including medical equipment operation, which is to be considered on a case-by-case basis.

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70 dB(A) during operation (at maximum flow), with most of the sound coming from air flow (i.e. below 1 kHz) and an alarm whose main tonal component was at 2,500 Hz. The ventilator, conversely, was perceivably quieter in terms of its background emission due to airflow, but its tonal alarm easily reached 25 dB (A) above the background (see Figure 1a). The tonal alarm of the ventilators we observed during this hospital visit had a first peak at 1000 Hz and the two main harmonics at 2,000 Hz and 3,000 Hz. Two additional peaks could be observed at 1,800 and 2,300 Hz.

Taking on board user requirements

Given the measured levels, it is apparent that classical solutions may solve the issue and, in fact, traditional acoustic panels have been proposed by Luetz *et al*. [11] to create corridors behind patients' beds in ICUs: a fixed separation between the medical instrumentation and the patient.

The staff we interviewed, however, were adamant that the solution proposed by Luetz *et al*. was not easily applicable to retrofit existing ICUs. In most of the ICUs, they said, there is very little space to manoeuvre around the patient's bed (see Figure 1b), while staff may need access both to the instrument and to the patient from all sides, at short notice. They therefore liked the idea of a barrier but added that any panel between the instrument (i.e. the source) and the patient (i.e. the receiver) should be easily removable and ideally mounted on wheels, like the rest of the near-bed equipment. Another key requirement was that barriers needed to be easily washable with a wet wipe, like the rest of the equipment.

Our first idea was to mount a panel on wheels like those used for conference posters. Standard considerations on indoor acoustic barriers [12] indicated that we would need a panel 1.7 m tall (i.e. twice the height of the main sound source in the ventilator) and as wide as possible, but an analysis of the space between the bed and the existing equipment revealed a maximum available space for the base of 40×70 cm and a maximum width for the panel of 4 cm. The need to guarantee the safety of patient and equipment from a panel falling accidentally (when moved) thus translated into a requirement to minimise the overall weight of the panels.

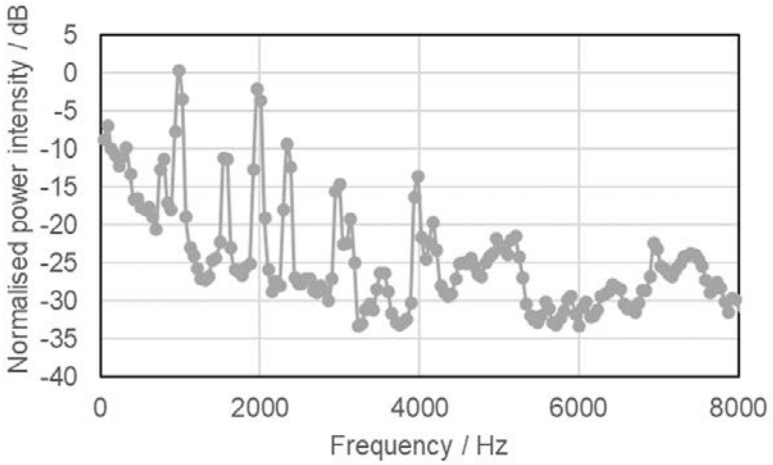
Using metamaterials

As already mentioned in the November/December 2020 Acoustics Bulletin article [1], reducing weight is one of the key winning points of acoustic metamaterials. Given a panel of wood or metal or plastic, inserted between the source and the receiver, the traditional approach to increase sound reduction is based on adding mass (e.g. another panel or an absorber), while the same panel can be 'transformed' into an acoustic metamaterial by carving out mass. It could therefore be argued that the term 'acoustic metamaterials' indicates a toolbox of design methods that complements existing ones used by consultants every day, more than new material chemistry. Acoustic metamaterials 'work' by acting directly on the wavefront, shaping it as it bounces or passes through them. This is true for acoustic holograms [13] and seismic waves [14], with some of these design techniques building on the early works on phononic crystals [15] or acoustic diffusers [16].

The key limitation traditionally associated to acoustic metamaterials, however, is their bandwidth: most geometries rely on local resonances. Nonetheless, recent studies have shown that larger bandwidths can be achieved by combining resonators of different sizes ('rainbow absorbers' [17]) while maintaining a small thickness (λ/10, where λ is the larger wavelength affected). P46

Below:
Figure 1: Insights from our first visit: (a) the typical spectrum of a ventilator and (b) staff working in a critical care unit (*source: iStock photo*)

(a)



(b)

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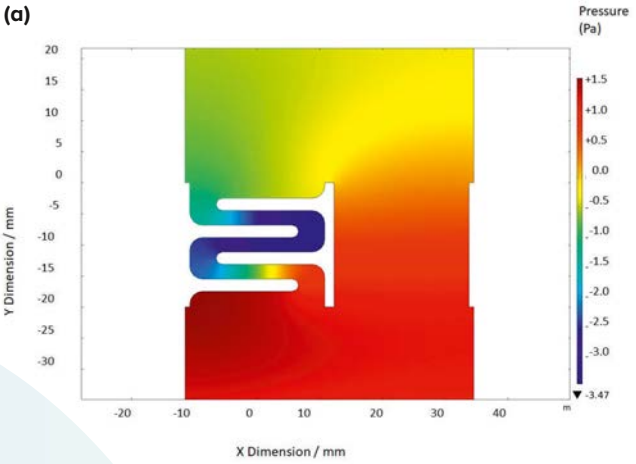


For this project, we based our panel on a basic structure ('unit cell') made of two metamaterial 'bricks' [1]: one empty and one of labyrinthine nature. In particular, we used a labyrinthine structure capable of inducing a phase difference of 180 degrees on the sound passing through, over a relatively large bandwidth. As observed in Figure 2a, 2D finite-element simulations (COMSOL Multiphysics, with a plane wave coming from the bottom) show that, with bricks as thick as 20 mm (in the direction of propagation), sound cancellation can be obtained with this type of unit cell even at wavelengths much larger than the dimension of the bricks (λ=150 mm in Figure 2a). In particular, when the panels are left open for air to pass as in Figure 2a, field insertion losses of about 11 dB have been achieved over three octaves with these type of structures (i.e. measured according to ISO 16283-3:2016, between 300 Hz and 5,000 Hz [18]).

Given the difference between the measurements and the recommended levels, we decided this performance was not sufficient, so we improved the insertion loss by using closed bricks (Figure 2b), with overall thickness of 25 mm and wall thickness of 1mm. Panels containing different types of these cells were designed and simulated (in 3D) at Metasonixx Ltd, before a final experimental test at Sussex University.

Above:
Figure 2: The metamaterial used in this work: COMSOL simulation for a unit cell that allows air passage (a) and the unit cell used in this work (b), which does not let air through. It is worth noting that λ=150 mm in (a)

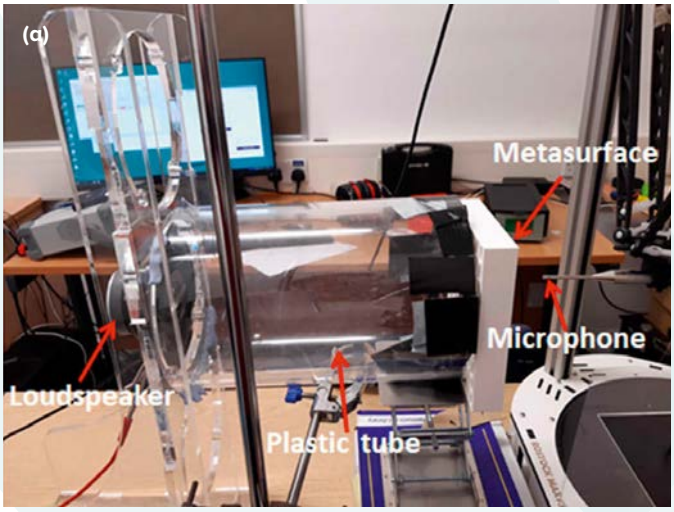
Below:
Figure 3: Measurements taken at the University of Sussex to verify the performance of the panels: (a) experimental set-up and (b) results of three different microphone scans. Data relative to 1 mm hardboard have been obtained using the mass law [19]. Each point in the scans is the average over four successive measurements and is affected by an uncertainty of about 1 dB (not represented)

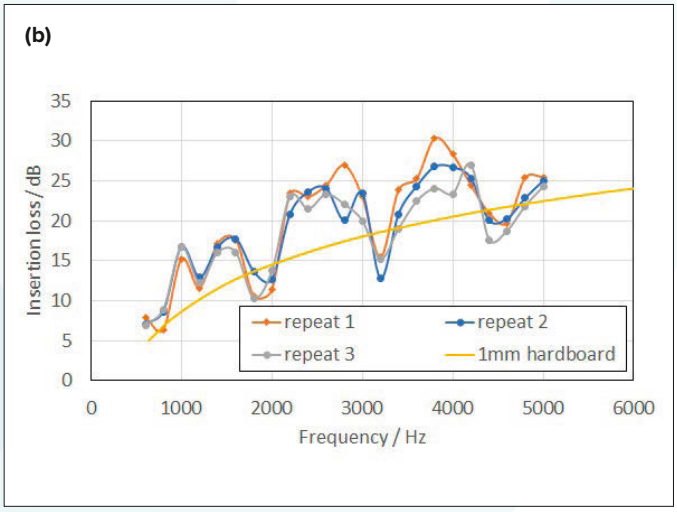
Experiments were conducted using as source a commercial loudspeaker (JVC CS-J520X) driven by the amplified signal of an arbitrary waveform generator. The speaker was mounted at one end of a waveguide (Figure 3a) and the frequency response of the whole system was found (outdoor) to be flat in the range 500 Hz – 5,000 Hz. The metamaterial panels were 3D-printed in PLA and mounted at the other end of the waveguide during testing. Measurements were taken after the panels using a 1/8'' microphone (B&K 4138), whose signal was amplified (B&K Nexus 2691) and then collected using a digital scope (Picoscope) using custom-designed software. As shown in Figure3a, the microphone could be moved relative to the metamaterial panel using a 3D positioning system.

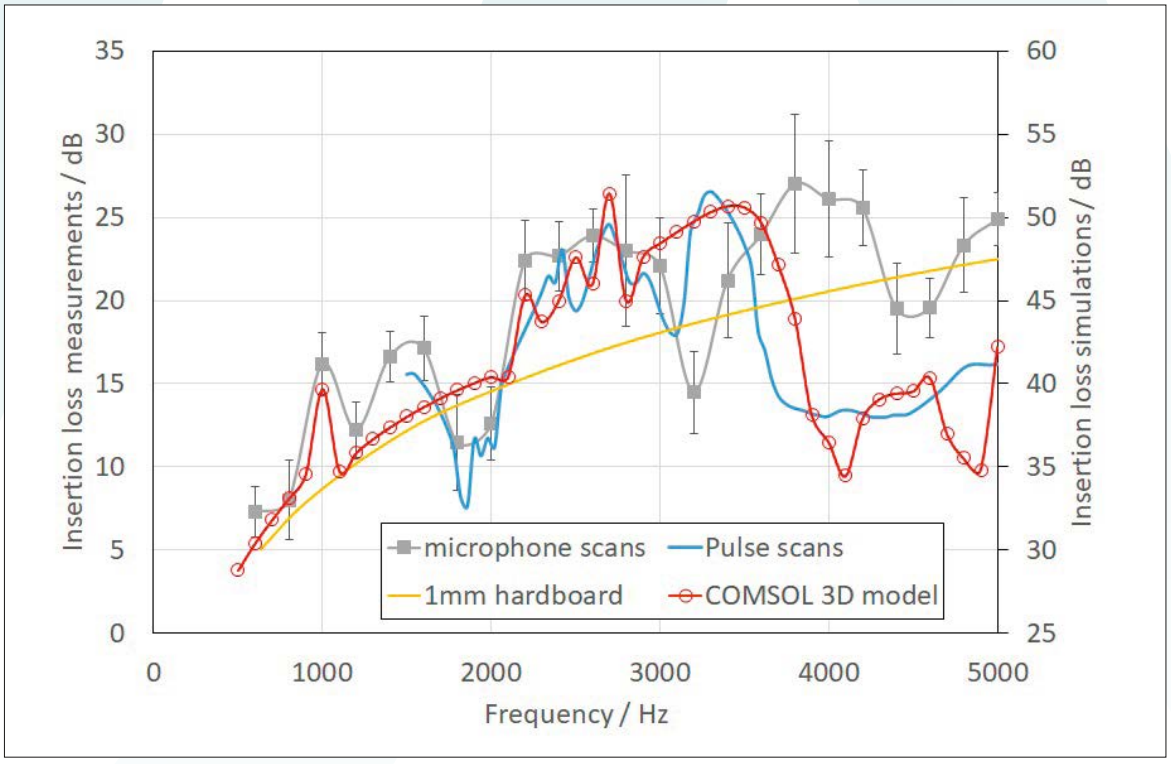
Initially, we used microphone scans in the frequency domain to characterise the panels, taken with and without the metamaterial. We defined the pressure after the waveguide as the average value measured in the range 125-285 mm from the end of the waveguide. The ratio of the averaged values with and without the metamaterial panel were used to calculate its insertion loss, using as source tonal signals in the range 500-5,000 Hz. The results of these measurements are reported in Figure 3b, which also reports the theoretical insertion loss for a 1 mm-thick hardboard plate, calculated using the mass law [19] and a density of 1,040 kg/m^3. Figure 3b highlights the effect of the metamaterial structure behind the 1 mm wall, which gives a superior insertion loss at 1 kHz and between 800 Hz and 1.6 kHz and between 2.2 kHz and 4.4 kHz[2] P50

Reference

[2] We decided to use hardwood as reference because the data in the literature show an excellent agreement between measurements and the values predicted by the mass law, for this material.







Above:
Figure 4 Comparison between the two measurement systems used in this study, the COMSOL simulations and the mass law for a hardwood panel (1 mm thick). Error bars represent the standard deviation from **Figure 3b**

Finally, we repeated the panel characterisation in the time domain, with a method inspired by the technique used by Fusaro *et al*. to characterise the acoustic performance of metamaterial window [20]. We used 12 µs square pulses as source and recorded the response of the system (with and without metamaterial panel) at 100 mm from the metasurface for 2.9 ms and with 0.7 µs resolution. As shown in Figure 4, the results with this latter method led to a trend like that obtained from the microphone scans, especially in relation to the 1 mm hardwood curve. In particular, this method confirms the features between 2,000 and 3,000 Hz and the peak around 1,500 Hz. There are, however, important differences, e.g. the insertion loss obtained in the time domain has a peak at 3,300 Hz, followed by a loss in performance (compared to the 1 mm thick wall) above 4 kHz.

As a partial explanation for these differences, Figure 4 also reports the results of the COMSOL simulations (obtained using the structure in Figure 2b to build a 3D model and simulating transmission through the 1 mm thick wall) at 100 mm from the metamaterial panel. Even if the effect is clearly shifted too high in the dB range, the simulations capture the trend observed by both measurement methods: the metamaterial geometry impacts the insertion loss mostly at 1 kHz and between 2,000 Hz and 3,500 Hz. The loss in performance above 4 kHz may therefore be connected to the position where the time-domain measurements and the COMSOL simulations were taken, highlighting the need for a standard method to characterise metamaterial-based structures. P52

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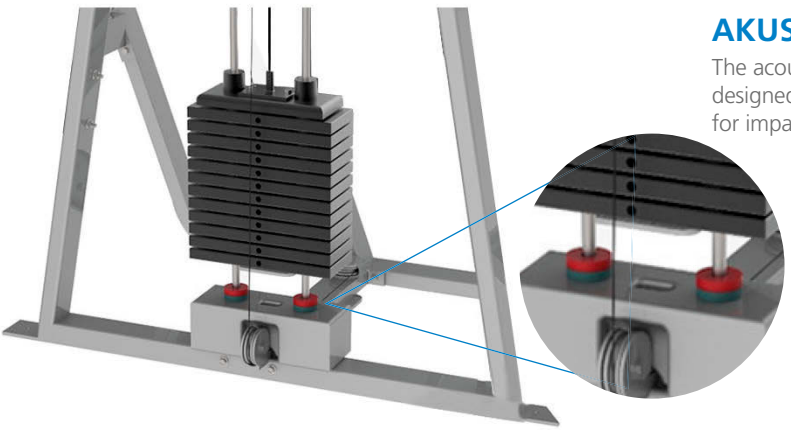

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Testing in situ

As mentioned earlier, we targeted a 1,700 x 700 x 40 mm movable barrier. We used standard aluminium struts (RS PRO, 40×40 mm) to build a basic rack, in which we inserted different 3D-printed panels optimised to be joined together. In order for the external surface to be cleanable, as requested by the clinical staff, we covered both sides of the panels in Figure 2b with washable fabric (see Figure 5a). The final prototype can be found in Figure 5b.

We brought the barrier to one of the COVID wards at Princess Royal Hospital in Haywards Heath. The staff brought us to an empty room and, after cleaning the movable barrier with a wipe, we positioned it between the equipment and the bed (Figure 6a). The clinical staff brought a cPAP machine and a ventilator. Insertion loss was measured using a portable class 2 sound level meter (Figure 6b) positioned over the bed, set to capture the average sound pressure level over one minute ($L_{Aeq,1\ min}$) and the maximum value over one minute (L_{max}). Without any equipment in the room, we measured $L_{Aeq,1\ min}$=36.6 dB(A) and L_{max}=44.1 dB(A), in accordance with recommended values [21].

We acquired measurements in three conditions:

1. with no barrier;
2. with the barrier close to the bed (Figure 6a); and
3. with the barrier closer to the instrument.

Results can be found in Table 1. As can be expected, the maximum effect was registered when the barrier was closer to the source.

The barrier had little effect on the sound produced by the cPAP machine, whose emission is dominated by frequencies below 1,000 Hz: the effect on $L_{Aeq,1\ min}$ was not bigger than 2 dB(A). The low frequencies mask the effect on the alarm, which was only slightly more pronounced; i.e. 3.1 dB(A) reduction. This result was in part due to the small room where the testing occurred, with reflections reaching the sound level meter both from the back wall and the ceiling. P54

Right & below: Figure 5: Incorporating the metamaterial panels into a movable barrier: (a) the procedure to cover half of the panels with fabric and (b) the final movable barrier, waiting to be delivered to a hospital

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Above and right: Figure 6: Testing in situ: (a) the movable barrier positioned between the bed and the equipment, in the position labelled as 'close to the bed' and (b) the measurement equipment (on page 55)

P56

	No barrier / dB(A)		Barrier close to bed / dB(A)		Barrier close to equipment / dB(A)	
	$L_{Aeq,\ 1m}$	$L_{A,\ max}$	$L_{Aeq,\ 1m}$	$L_{A,\ max}$	$L_{Aeq,\ 1m}$	$L_{A,\ max}$
cPAP	67.2	69.5	65.6	68.2	65.2	66.2
Ventilator	69.6	73.1	67.8	71.9	57.3	68.7

Above:
Table 1: Results of the hospital tests in October 2021, using the movable barrier in Figure 5b

For the ventilator, instead, we measured a sound level of 69.6 dB(A) without the barrier, which reduced to 67.8 dB(A) – when the barrier was close to the bed – and to 57.3 dB(A) when the barrier was closer to the instrument. The maximum reduction measured – 12.3 dB(A) – is very close to the value of insertion loss measured at Sussex for 2,000 Hz (see Figure 4), suggesting that the sound after the barrier is dominated by the peaks at 1,800 and 2,000 Hz (see Figure 1a), which are not altered by the inserted panel. This conclusion seems to be confirmed by the value of L_{max}, which went down by 4.4 dB(A) when the movable barrier was close to the instrument.

If the reduction on the cPAP machine is barely perceivable, even the reduction on the ventilator needs to be improved by at least 4 dB(A) for patients and staff to perceive a net positive impact[3]. One of the potential ways to achieve a better effect is to redesign the bricks to move to lower frequencies the region where sound cancellation is most effective. Another is to use diffractive terminations to both reduce diffraction from the barrier's edges and reflections from the ceiling [22], but this is challenging in terms of the available space for staff to manoeuvre. Both methods are being explored for the next testing round.

Conclusions

In this article, we have presented some results relative to our first generation of metamaterial-based barriers for noise management in hospitals. We described the type of panels we used (for the first generation) and highlighted the need for a standardised method to characterise metamaterials that cannot be inserted in an impedance tube. We also presented two potential characterisation methods and compared measurements taken in the laboratory with FEM simulations. Finally, we described how the panels fit into a standard rack and reported on their effect in-situ. In future studies, barriers of improved performance will be mass-produced, to allow testing in a larger number of hospitals.

[3] Differences of 5 to 6 dB between successive sounds may be needed for people to even tell there is a difference. Differences above 10 dB(A) should be targeted to achieve an effect perceived by most listeners. Similar results have been found by the Heathrow Respite Research study [24] for aircraft sounds.

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Remembering

Lilianne Lauder, BSc (Hons), Ch.EHO MREHIS, MIOA

Lilianne Lauder, wife of Vincent McBride and mother to Gerry and Marco, passed away peacefully in the early hours of Friday 13 August with Vincent, Gerry and Marco at her bedside. Alistair Somerville, IOA President Elect and REHIS Past President, looks back on her short, but remarkable and well-lived life.

It is always a time of great sadness when family, friends and colleagues pass away. It is a particular shock when that person is as young and full of life, as Lilianne was. This news will have come as a complete surprise to many, as most were not even aware she had been ill. Lilianne did not want her condition known and, with the best of intentions, did not want to put people in the position of having to ask her how she was. This being the case, I think it is now appropriate to let you know about Lilianne over the past few years.

Lilianne's illness was diagnosed in August 2017. There followed a course of treatment and surgery. Other than her time in hospital and whilst recovering from surgery, Lilianne continued to work as an environmental health officer at Midlothian Council, rarely missing a day. She was always a positive person and this, together with her cheerfulness and bravery, helped her and her family to cope. When Lilianne was recuperating in hospital from major surgery, the ward sister, doing her nightly rounds, came to Lilianne and said: "I can usually tell how my patients are doing just by looking at them. But I can't do that with you because you are always smiling."

Following a period in remission, she required further regular treatments in 2019, with some limited periods of success. In August 2020 she was admitted to hospital and significant cancerous activity was detected again. She hoped treatment would allow her to return to work but the condition and treatments meant she felt too ill to do so.

Earlier this year she started on a European-wide trial of a new drug but her general health was too poor for this to continue. Lilianne's condition deteriorated rapidly and she moved home where she continued to receive treatment and palliative care.

Her early life

Lilianne was born in Whitburn on 21 October 1966, a daughter to Robert and Annette Lauder and sister to Ian and Gordon. She was a bit of a 'Tomboy' and evidently liked to prove her strength by carrying bricks around the garden. (She would later continue to demonstrate this by carrying heavy sound insulation test equipment when a much larger, male colleague complained of his bad back! She enjoyed a happy home and many family holidays but sadly lost her father when she was just 14. To help her deal with the situation, Lilianne threw herself into her studies and did well at school and at university.

Lilianne started the BSc course in Environmental Health at Strathclyde University in 1984 and began her career as an EHO after graduating and gaining her REHIS Diploma in October 1988. It was while working as an EHO in Edinburgh that she met Vincent, who she later married in 1995. In 1996 Gerry was born and Marco, 18 months later. When Gerry and Marco were in their early years at primary school, Lilianne worked for a while as a learning assistant at St Ninians Primary School. This was a post she really enjoyed and in her short time there, was a popular member of staff. The two boys are now all grown up and a real credit to them both. Lilianne always encouraged Gerry and Marco in all they did and was extremely proud of all their achievements, be they academic, in sport and at work.

Lilianne loved singing and playing music and at various stages took up playing the recorder, the piano, the guitar and the violin. Her love of music and singing continued and a few years ago she joined the Portobello Community Choir, thoroughly enjoying the singing and friendliness of the group. Holidays at home and abroad, picnics on the allotment, outings and evenings in, all with her family and friends. These were what she enjoyed most of all.

During lockdown, Lilianne completed a distance learning course at Aberdeen University in Nutrition and Health. As well as her long-standing interest in this subject, Lilianne hoped to gain an insight into how she might be able to improve her own health. Typical of Lilianne, she said wanted to develop her knowledge even further with a view to helping others improve their health and lifestyle choices through education and advice.

Lilianne's career

Lilianne's career in environmental health and acoustics included working for Edinburgh, Scottish Borders and Midlothian Councils. She was recognised as an expert in many aspects of her profession and served on various national committees/working groups and as an examiner, for both REHIS and the IOA. She became a Chartered EHO in 2005.

Lilianne's main area of interest was in acoustics and noise control. After moving to the specialist Noise and Planning Section in Edinburgh, she quickly became extremely knowledgeable in environmental noise, noise nuisance, event noise control, vibration monitoring and sound insulation testing. Whilst in this section, she assisted in organising the REHIS 'Noise Update Conferences' and achieved an MSc in Acoustics at Heriot Watt University (1993). As well as putting this knowledge to use for the benefit of her employers, Lilianne also ran our IOA accredited courses in environmental noise measurement. She was regularly thanked by students for her patience and commitment as a tutor.

Since 2004 Lilianne worked for Midlothian Council, latterly as a Principal Officer with managerial responsibilities for the full Public Health remit. She was well respected by her staff and colleagues for her knowledge, experience and supportive manner. Latterly, Lilianne also worked for a few years as a part-time lecturer on the Environmental Health BSc course at the University of West of Scotland. Although undergoing chemotherapy treatment, she continued with the lecturing responsibilities and the travel to Paisley as, having given the commitment to that job, she didn't want to let anyone down.

I have been an EHO colleague, line-manager, fellow tutor and friend of Lilianne's for many years. Throughout I have been witness to her being a public servant in its truest sense, as a professional practitioner, tutor, manager and being the proudest of mothers. She always went the extra mile to assist colleagues, students and members of the public alike and to look out for her 'boys'. Lilianne loved her job as an EHO, particularly the acoustics element, but loved her family more!

Tributes

Lilianne was a great supporter of the IOA and REHIS (the Royal Environmental Health Institute of Scotland) and below are some professional colleagues' quotes! Thank you to all who contributed.

"It was always a relief when Lilianne attended the meetings because I knew there would be solid advice and experience to draw on."

"When the profession was looking for guidance, it was Lilianne who volunteered and through her dedication and diplomacy managed to get a disagreeing group of consultees to agree a guidance document, which is still very much in use, some 10 years later."

"At meetings, her knowledge and expertise in acoustics were readily sought and willingly given for many years."

"Lilianne was an immense contributor to REHIS. She was also Chair of the South East Pollution Liaison Group from 2013 until she became ill. All of us attending that group learned a lot from Lilianne, particularly in relation to noise but also air quality and contaminated land."

"Lilianne was someone who excelled in all aspects of her professional life, dedicated to a fault and always went the extra mile to help her colleagues and students."

"Thankfully, there was a friendly face at the back of the room that I recognised, Lilianne."

"Lilianne was always patient, diplomatic and tenacious."

"Lilianne has been a tremendous support to me over the years."

"I can't overstate Lilianne's knowledge and commitment and I have been lucky to have learned from an extraordinary talent."

"She always had a cheery smile!" (A universal quote from all who knew her).

The 2021 A B Wood Medal

The Institute of Acoustics is delighted to award Dr Louise Roberts the A B Wood Medal, in recognition of the importance of her behavioural response experiments carried out under appropriate acoustical conditions, and, in particular, monitoring the particle motion, despite the difficulties in doing so. Her work has broad implications for the understanding of sound and vibration detection by animals in the sea and on land.

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 whose work is associated with the sea.

Citation for the award:

Dr Louise Roberts is currently a postdoctoral research associate in the College of Agriculture and Life Sciences at Cornell University, Ithaca, New York.

Louise has been carrying out very original research on the effects of sound and vibration, including substrate vibration, on fish and invertebrates. Louise has fully demonstrated her ability to work both in the laboratory and the field on this topic and is extremely good at writing up her research and publishing important papers in the peer-reviewed literature.

She is excellent at experimental design and, in particular, has carried out experiments on the responses of free-living animals in the sea itself, using both sonar and stereo TV cameras, as well as in entirely controlled laboratory environments. Experience like that is rare, as most scientists working on bioacoustics have mainly carried out their work only in laboratory tanks.

Louise works well as part of a team, and she played a major part in the successful Soundwaves project for UK Government's Department for Environment, Food and Rural Affairs (DEFRA). She participated in the preparation of a review, as part of that project,

Above:
Cornell University, Ithaca, New York

entitled: *Understanding the Scale and Impacts of Anthropogenic Noise in the Marine Environment.*

Published in 2012, Louise contributed substantially to this review which covered the following topics:

1. Effects of underwater noise on fish and invertebrates;
2. Introduction to underwater sound;
3. The importance of sound in fish and crustaceans;
4. Quantities for the measurement of sound;
5. Derived sound metrics;
6. The effects of noise on fish and invertebrates;
7. Population level and ecological effects;
8. Mitigation; and
9. Observing fish and invertebrates in the wild.

Louise Roberts is a very innovative young scientist. She also gets on very well with other workers and is willing to shoulder responsibility for undertaking work in the field.

She is very interested in anthropogenic noise and in marine soundscapes. However, she also has a wider interest in animal behaviour. She has served as a project mentor to 10 undergraduate students, and has taught marine biology to university students.

Louise's work has broad implications for understanding sound and vibration detection. She is a very practical researcher, and is especially capable of carrying out studies in the sea on the responses of marine animals to underwater sounds. She is one of the few scientists that has taken full account of the sensitivity of fish and invertebrates to particle motion rather than sound pressure, and has carried out exceptionally innovative work on the sensitivity of invertebrates.

Louise has tremendous experience of making underwater sound measurements, including the measurement of particle motion (which is often neglected, although it is particle motion that most fish and invertebrates can detect, rather than sound pressure).

She has extensive experience in using underwater television, sidescan sonar systems and echo-sounders to observe fish behaviour. She has strong experience of data acquisition, data analysis and post processing, especially for field experiments. She has used hydroacoustics to monitor fish movements and is an experienced boat handler.

Louise's ability to design and carry out high quality experiments at sea, and to work with others as part of an operational team, made her a prime candidate for the A B Wood Medal. She has spent a lot of time at sea in small boats, observing fish and shellfish behaviour.

She is an exceptionally innovative young researcher, with considerable practical skills. She also has an exceptionally good record for publishing her work, with more than 14 publications since 2014.

Much of her early work was carried out in the UK and Ireland, but since 2017 she has worked in the USA. She has taken part in a large number of conferences and invited seminars, and has also written scientific articles for newspapers.

She was recently a member of the Advisory Board for the 5th International conference of the Effects of Noise on Aquatic Life, that took place in Den Haag, The Netherlands. She has acted as a reviewer for a number of scientific journals, including: Proceedings of the Royal Society of London – B (Biological Sciences); Marine Pollution Bulletin; Acta Ethologica; and Estuarine Coastal and Shelf Science.

She is well aware of the importance of carrying out acoustic experiments on animals under natural conditions in the sea, rather than in aquarium tanks, where the acoustic fields can be rather poor. Carrying out work in the sea itself can be rather difficult, but Louise has the practical skills that enable her to perform such experiments. She has encouraged other scientists to join her in working within the sea.

BRANCH NEWS

Midlands Branch

IOA Midlands Branch evening meeting 29 September 2021

Each year at Derby University the IOA Midlands Branch and Derby acoustics students gather to listen to presentations from the previous year's projects from the IOA Diploma and the MSc in Applied Acoustics.

This year we welcomed three recent IOA Diploma students on a very well attended Zoom meeting.

The speakers and topics were:

- **Conor Chambers:** 'The effectiveness of variable acoustics in multipurpose halls';
- **Jonathon Howell:** 'Is the rating of impact sound insulation for separating floors in Building Regulations Document E fit for purpose?' and
- **Matt Hunt:** 'Tranquility and low frequency noise in Shipley Country Park, Derbyshire'.

All three presentations were very high quality, and the speakers clearly demonstrated their enthusiasm for their topics, showing the new intake of students on this year's diploma course what can be achieved.

Thank you to all three participants for their excellent presentations and the interesting discussion afterwards.

As is traditional the evening was sponsored by ANV Measurement Systems, for which the Midlands Branch thank Mike Breslin and Matt Torjussen, a token of appreciation will be winging its way to Conor, Jonathon and Matt.

Particular thanks to John Pritchard of Derby University for arranging and hosting the presentation and to Rob Bungay and Linda Canty for managing the Zoom meeting.

SPECIALIST GROUP

Building Acoustics Group

James Healey appointed as Chairman of the Building Acoustics Group (BAG)

James Healey has recently been appointed as the Chairman of the Building Acoustics Group (BAG). He is Acoustics Director at specialist consultancy, engineering and advisory firm, AESG, where he is responsible for developing the UK acoustics team and overseeing technical delivery across other global offices, including Dubai and Singapore.

James succeeds Roger Kelly who held the position as Chairman of the BAG for more than 11 years. Not only has Roger been a significant driving force in every annual conference for the last decade (and the talisman of entertainment for most conferences), he also brought a fair, light-hearted and punctual approach to every committee meeting. The committee would like to thank Roger for his significant contribution over the years.

Commenting on his appointment as the newly-elected Chairman, James said: "I look forward to building on the achievements of the BAG, and thank Roger for his excellent leadership. I remain committed to working alongside the team in elevating BAG's influential position in the sector so that we continue to be at the forefront in overseeing guidance and standards and bringing new research to the UK building acoustics industry."

IOA Groups and Branches – A new Group and a revised Group!

As a result of the growing interest in the topics of sound and health effects and soundscapes, the IOA tasked the Vice President (Groups & Branches) to consider whether new groups should be formed, so, accordingly, a survey of IOA members was carried out in late 2020/early 2021 in order to seek the members' views on this matter.

By Graham Parry, Vice President, Groups & Branches.

A Survey Monkey ***'Potential new IOA groups'*** **questionnaire went out to all members and 489 IOA members responded to it. The survey results were considered carefully and the following describes the headline points for the two potential new groups:**

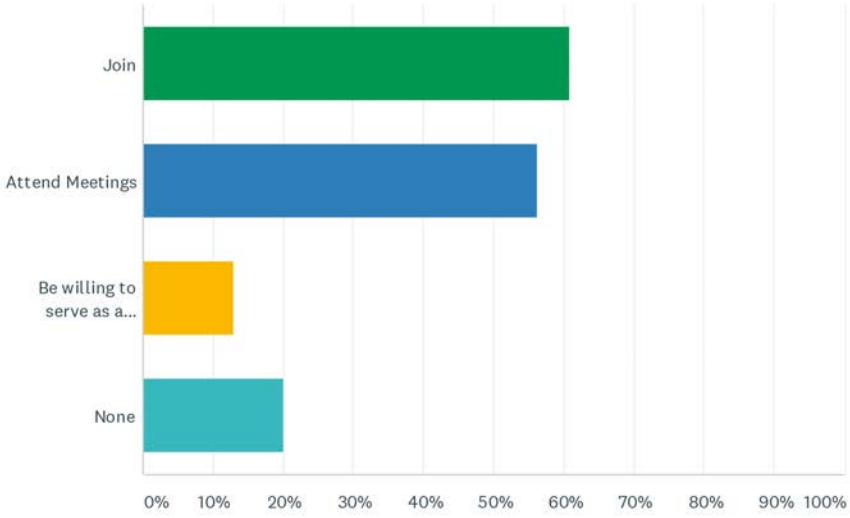
1. Sound & Health Group

The results of the survey were often somewhat anomalous in that the responses to different questions did not always reflect other responses elsewhere in the survey. By way of example; 76% (374) of respondents supported the idea of a new 'Noise and Health' group (N&H Group), vs 24% (115) who disagreed, whilst 53% (241) of respondents did not agree that noise and health should continue to be covered by the Environmental Noise Group (ENG), vs 47% (218) who did. If a new N&H Group was set up, 275 respondents said they would attend meetings. Importantly, a massive 63 members P64

Potential new IOA Groups SurveyMonkey

Q4 If a specific Noise & Health Group was created within the IOA would you:

Answered: 489 Skipped: 0



ANSWER CHOICES	RESPONSES	
Join	60.94%	298
Attend meetings	56.24%	275
Be willing to serve as a committee member	12.88%	63
None	20.04%	98
Total Respondents: 489		

would be willing to serve on the committee which is an almost unprecedented level of interest!

In respect of the areas a N&H Group should cover, 97% of respondents (473) wanted a new N&H Group to cover human effects; 47% (229) to cover land ecology and 19% (93) to cover marine species.

In free text comments, the most common response was that health was seen as important enough to warrant a standalone group. A clear delineation was seen from the Environmental Noise Group (ENG):

- Health requires multi-disciplinary expertise beyond acoustics, such as non-acoustic factors, epidemiology, social and behavioural science, physiology, HIA, interactions with wider determinants of health (e.g. air quality), etc.
- Health effects are not limited to the external environment/ environmental noise.
- Some members considered that the existing ENG's remit focused predominantly on exposure and assessment, whereas a new N&HG would focus on evidence and effects. Other members considered ENG's current scope as being too wide.

The most common concern raised was the potential overlap with the existing scope/remit of the ENG and the Building Acoustics Group (BAG). Others questioned the interface with occupational health/effects of hearing.

2. Soundscapes Group

In respect of soundscapes, 60% of respondents (284) supported the idea of a new standalone Soundscapes Group (SG), vs. 40% (191) who didn't. 56% of respondents (255) would prefer the status quo of soundscapes to continue to fall within the scope of the ENG and BAG, vs 44% (198) who did not. In this respect, there were very mixed messages coming from the membership as to a preferred way forward which in itself provided a stimulating debate as to how best to take the subject forward.

If a SG was formed, 96% of respondents (395) would like it to cover soundscapes in respect to human population outdoors, 70% (285) would like it to cover indoor soundscapes within buildings.

229 respondents said they would attend meetings, 54 said they would be willing to serve as a committee member.

Following on from the survey of members, an IOA Council working group met on 5 August 2021 to discuss the survey results in detail. The working group comprised Graham Parry (Vice President – Groups & Branches, Ben Fenech, Peter Rogers and Steve Mitchell (Chair of ENG) who, following a thorough review of the survey results and an in-depth discussion, agreed that the following recommendations should be submitted to Council.

Recommendations to Council

A new 'Sound and Health' group is formed to focus specifically on the health effects of sound on human health. The scope would include sound in external and internal environments, and the influence of non-acoustic factors. The group would be chaired by Ben Fenech, and committee membership would include at least one representative

Below:
This example page from the survey shows the complexity of the responses

Potential new IOA Groups — SurveyMonkey

#	RESPONSES	DATE
1	I think that there is a strong possibility that the same people who are currently part of the Env Noise Group would end up being part of this new group as well, and the time spent in meetings etc would just double.	3/8/2021 8:36 AM
2	I think noise and health is fundamental but already covered in a holistic way by ENG and other Groups. It would be fundemanetl to a Sounsdcape Group too. If formed must be outward-looking.	3/2/2021 7:51 PM
3	Will splitting health from enviromental make it better? Not sure but it may isolate health issues from those carrying out the predictions.	2/26/2021 1:32 PM
4	Buildings: standards for HMO and adaptations, new builds, retrospective alterations. This affects phys, psy and social health. Of ultimate significance the need to integrate with architects and their training (schools, Uni, ARIBA &c) so that noise is a prime consideration of design at the outset. So standards must be set and met. Esp if home/flat is where the office is increasingly located	2/25/2021 6:52 PM
5	Unless there is unwillingness amongst the existing group, it would seem better to rebadge the group as Soundscape, Environmental Noise and Health Group rather than subdividing areas which seem naturally part of the same remit	2/25/2021 8:16 AM
6	Would we interface with occupational health professionals but not duplicate their good work?	2/23/2021 3:40 PM
7	The scope vs the Environmental group would need to be clear including shared areas. For instance when does an environmental noise move from annoyance, nuisance and into prejudicial to wider health? That is if I am understanding nthe new groups remit.	2/22/2021 12:23 PM
8	My field of acoustics is not in Noise & Health and so my response to questions 1 & 2 and 6 & 7 may be misleading. "No Preference" responses would have been more appropriate if they had been available.	2/22/2021 12:18 PM
9	It would be interesting to branch into how noise affects ecology and if this is something new we can help mitigate against.	2/20/2021 8:17 PM
10	It is suggested that the scope of this group (and perhaps the name) should be expanded to include quality of life, to better align with current planning policy. Understanding and assessing the evidence for or against the effects of noise on health and quality of life requires an understanding of medical terminology, certain medical conditions, sleep stages, statistics and the design of medical studies (e.g. cross-sectional studies, cohort studies, systematic reviews). I agree that this is a specialist area which warrants a new group and which would benefit greatly from close collaboration with healthcare professionals and researchers who may not be members of the Institute.	2/18/2021 10:42 PM
11	The group might be useful for raising the importance of PHOF indicators B14a,b,c with Local Authority Health and Wellbeing Boards and the need to allocate sufficient resources to ensure the PHOF targets are achieved (by identifying local issues via the JSNA).	2/18/2021 6:52 PM
12	I would be more interested in joining this group if it included topics such as soundscapes and psychoacoustics	2/18/2021 4:04 PM
13	It is a valuable group where the IOA should take more of a lead	2/18/2021 11:34 AM
14	Keen to particularly understand aircraft noise and health	2/18/2021 10:56 AM
15	Of particular help would be to focus on getting health linked IoA noise criteria / guidance out (for the various commercial sectors not currently covered by for e.g.BS4142 (like pub ent's / bars and clubs etc.). Working group outcomes / drafts never really saw the 'light of day' leaving a bit of a public health vacuum for regulation and control. This would be a good opportunity to review such matters and issues. Recent noise related Covid advice / restrictions for these sectors proved the chasm of need and understanding in both technical and practical related matters.	2/18/2021 9:42 AM
16	I would like to see some sort of funding to be made available via application for IOA members to undertake research in these areas. Collectively, IOA members have a vast amount of knowledge, a diverse skill base and ever growing personal and professional networks within the field, which would make for some really promising, insightful and potentially surprising research.	2/17/2021 3:42 PM
17	I agree that protecting people's health is important enough to have a separate group focusing on this issue	2/17/2021 2:14 PM
18	Environmental Noise, Amenity, Health and Wellbeing for humans and fauna are closely interrelated.	2/17/2021 1:29 PM

each from central government, government agencies, local government, acoustic consultancy and academia. A draft Terms of Reference (ToR) is being prepared for the new Group.

The existing 'Environmental Noise Group' is relaunched as the 'Environmental Sound Group', and soundscapes is added to its remit. Its committee membership would include two seats for soundscape experts. The ENG ToRs would be revisited to this effect. Effects of sound on 'on-land' ecology would remain within the scope of ESG.

Auditory health effects would continue to be covered by the Speech and Hearing Group.

Effects on marine life would continue to be covered by the Underwater Acoustics Group.

Council met on 22 September 2021 to discuss the proposals and voted unanimously to endorse the recommendations.

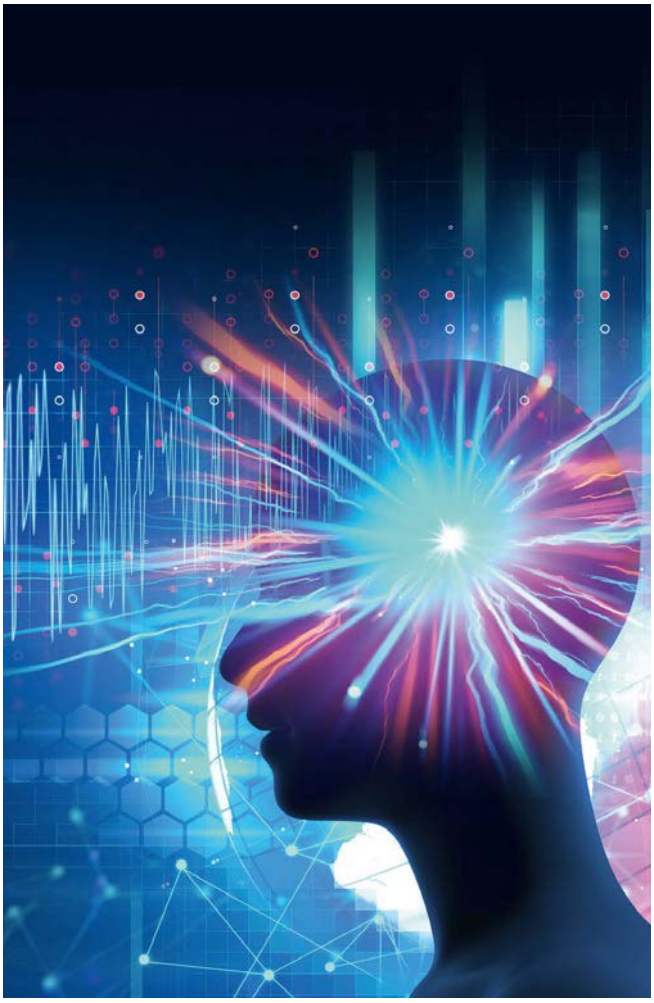
The way forward

The new Sound & Health Group (SHG) will initially convene with Ben Fenech as Chair and he invites those who would like to be on the committee to get in touch with him. Once a tentative committee is in place notification of an EGM will go out to the membership and the EGM will formally get the specialist group up and running.

The Environmental Noise Group is renamed as the Environmental Sound Group (ESG) and revised ToRs will be provided by the committee of the renamed Group and the AGM will be held at the usual time.

Acknowledgements

I am indebted to the work that Ben Fenech, Peter Rogers and Steve Mitchell put into considering the various options available to the IOA and how best to move things forward. Without their insight into the options available and the willingness to reach compromises on behalf of our membership we would not now be celebrating our twelfth Group and a repurposed and renamed Environmental Sound Group.



NEWS

Rattlesnake rattles can deceive the human ear

Rattlesnakes increase their rattling rate as potential threats approach, and this abrupt switch to a high-frequency mode makes listeners, including humans, think they're closer than they actually are, researchers report in the August 2021 issue of 'Current Biology'.

"Our data show that the acoustic display of rattlesnakes, which has been interpreted for decades as a simple acoustic warning signal about the presence of the snake, is in fact a far more intricate interspecies communication signal," says senior author, Boris Chagnaud at Karl-Franzens-University, Graz. "The sudden switch to the high-frequency mode acts as a smart signal fooling the listener about its actual distance to the sound source. The misinterpretation of distance by the listener thereby creates a distance safety margin."

Additional results showed that rattlesnakes adapt their rattling rate in response to the approach velocity of an object rather than its size. "Snakes do not just rattle to advertise their presence, but they evolved an innovative solution: a sonic distance warning," Chagnaud says. "The snake rattling co-evolved with mammalian auditory perception by trial and error, leaving those snakes that were best able to avoid being stepped on."

Stolen equipment

Some environmental noise monitoring equipment was stolen from a site in Pontefract, West Yorkshire, sometime between 13:00 on Monday 13 September and 11:00 on Friday 17 September 2021:

- Rion NL-52 sound lever meter, serial number 00242747 – including environmental case, windshield etc.

If any member is offered this equipment for sale, or they come across it in any way, please get in touch with Hepworth Acoustics at: **enquiries@hepworth-acoustics.co.uk or 0161 242 7900.**

Worcestershire theft

Monitoring equipment has been stolen during an unattended noise survey in Stoulton, Worcestershire. The equipment was found to be missing on 23 August and included:

- Rion NL-52 sound level meter, serial number 01265463
- UC-59 microphone, serial number 10691
- Weather kit, including peli case, batteries, chain and padlock.

If any member is offered this equipment for sale, or they come across it in any way, please get in touch with inacoustic on: **0117 325 3949.**

First sessions announced for virtual Radio TechCon 2021

Attracting new talent to broadcast technology, a delve into the BBC's free creative technology tools and a visit to South Africa are all on the agenda for this year's Radio TechCon conference.

Radio TechCon, the UK radio and audio industry's technology and engineering event – takes place on Monday, 29 November 2021. Due to the ongoing uncertainties of the pandemic, the conference will be in a live, interactive virtual format once more.

Delegates will be able to enjoy sessions which celebrate the achievements of the radio and technology community.

Radio TechCon (Image courtesy of Vincent Lo)

Topics include:

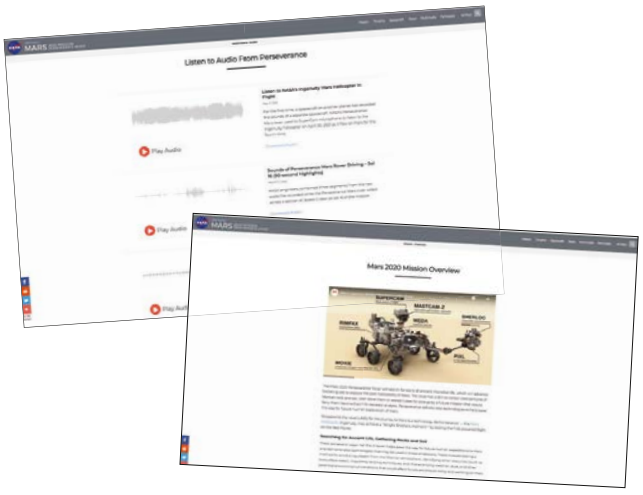
- Attracting new talent to technology: how can radio and audio companies compete for new recruits and how do we retain the technology talent we already have?
- South Africa's digital plans: with the UK and much of Europe focused on DAB and DAB+, why is South Africa choosing DRM as part of its digital future?
- BBC Maker Box: did you know the BBC R&D team has free tools for creative technologists and producers to explore? Find out how you can get on the inside track and join in at home with some live demos of the latest technology.
- All delegates will receive eight hours of CPD credits, accredited by the IET.

Tickets to Radio TechCon 2021 are £99 + VAT and are on sale at **radiotechcon.com**

Audio from NASA's Perseverance Rover

NASA has recently unveiled a resource that contains a variety of unique audio clips taken from a pair of microphones affixed to the agency's Perseverance Rover. It includes the whirring sounds of the NASA Ingenuity Helicopter and the unique rumbling of the rover driving on the red planet. https://mars.nasa.gov/mars2020/multimedia/audio/

In a separate resource, (**https://tinyurl.com/3p8b5fwk**) NASA demonstrates the subtle differences between sounds commonly heard on Earth and how that audio would be experienced on Mars.



Mobile measurement technology above the clouds: SQuadriga III from HEAD acoustics now also without battery pack

The new SQuadriga III-V1 variant without an internal battery from HEAD acoustics takes mobile sound and vibration measurement technology for aviation applications to a new level.

With its comprehensive range of functions, user-friendliness and flexibility, the compact SQuadriga III measuring system established itself as a standard for the automotive industry following its first generation (2003). In the battery-free V1 version, SQuadriga III now also meets the requirements for flight testing; for example, eliminating the internal lithium-ion battery makes shipment by air freight possible.

Mobile sound and vibration measuring devices for the aviation industry often have to operate independently of the aircraft's onboard power supply. Within the scope of aviation regulations, certified external rechargeable batteries are used for this purpose. In-flight applications, SQuadriga III-V1 powers itself via an external voltage source (10-30V), and a capacitor supplies the internal real-time clock.

The exact time, position, and speed are available with a satellite receiver for the common navigation systems (GPS, Galileo, GLONASS, BeiDou). The unique feature: recordings from spatially separated devices, for example, in the airplane and on the ground, can be conveniently and quickly synchronised with each other at a later time using accurate time information with sampling precision. GPS speed and position, as well as pulse and analog signals, can be used to start and stop measurements. The large display with capacitive multitouch and the intuitive operation, including gesture control, round off the user-oriented look and feel.

Image © HEAD acoustics GmbH

Six raw recruits join Zentia's new apprenticeship programme

Ceiling systems manufacturer, Zentia, has launched a formal apprenticeship programme at its two factories in the UK.

The company has taken on six recruits in a variety of roles for its ceiling tiles and grid/suspension system factories in Gateshead, Tyne and Wear. They include a laboratory technician, two process operators, a manufacturing engineer, HR administrator and HSE technician, some of whom are combining on-the-job training with a day a week at college, over 18 to 42 months.

Zentia already employs seven former apprentices from as long ago as the 1990s in roles ranging from engineering supervisor, project engineer, process improvement engineer and junior control systems engineer to shift maintenance technician.

Zentia's Head of HR Nicky Gallagher explained that the company had historically had a level of success in recruiting mechanical and electrical apprentices and seeing their careers develop as they moved on into permanent roles. But these opportunities had been on an ad-hoc, sporadic basis rather than in set numbers or annually. She said: "As we look to further grow our business, people development is high on our agenda and apprenticeships form part of this activity. I'm delighted we now have the opportunity to launch the Zentia Apprenticeship Programme, and our plan is to recruit further apprentices each year."

Former and current Zentia apprentices

Sto acoustic system helps restore historic London gallery

The Hayward Gallery at London's Southbank Centre was upgraded using the StoSilent Distance acoustic system to help create a new and dramatically improved acoustic environment.

The two-year refurbishment project for this impressive example of 1960s Brutalist architecture included a total redesign of the existing roof structure. The 66 pyramid-shaped skylights, which originally featured on the building had become damaged over time, while internally, a series of impractical sound-absorbing baffles and a translucent suspended ceiling had been used below them.

The aim was to remove the suspended ceiling, reclaim the original height of the gallery spaces, and allow more natural light to enter. The pyramid roof lights were reconstructed using modern materials, and this meant that reliable acoustic treatment needed to be fitted into the coffer spaces below them in order to create the required acoustic environment.

Parts of the interior spaces retain their original concrete surfaces, and there are other acoustically hard, reflective surfaces present, so improving speech clarity and lessening impact from foot traffic had to be achieved.

The StoSilent Distance solution allows the creation of modern, clean, monolithic and seamless solutions, and can accommodate unusual design features. It was installed in the deep acoustic coffers which sit below each of the pyramid skylights. This lightweight system can be used to achieve, monolithic, seamless aesthetics, inclined planes or curves, or sharp and consistent joints.

The StoSilent Distance system was finished with StoSilent Décor M, which can be tinted to match a wide range of RAL colours and shades from the StoColor system.

The Hayward Gallery at London's Southbank Centre now has a dramatically improved acoustic environment (image courtesy of Morley Von Sternberg)

Pontypridd Riverside Scheme

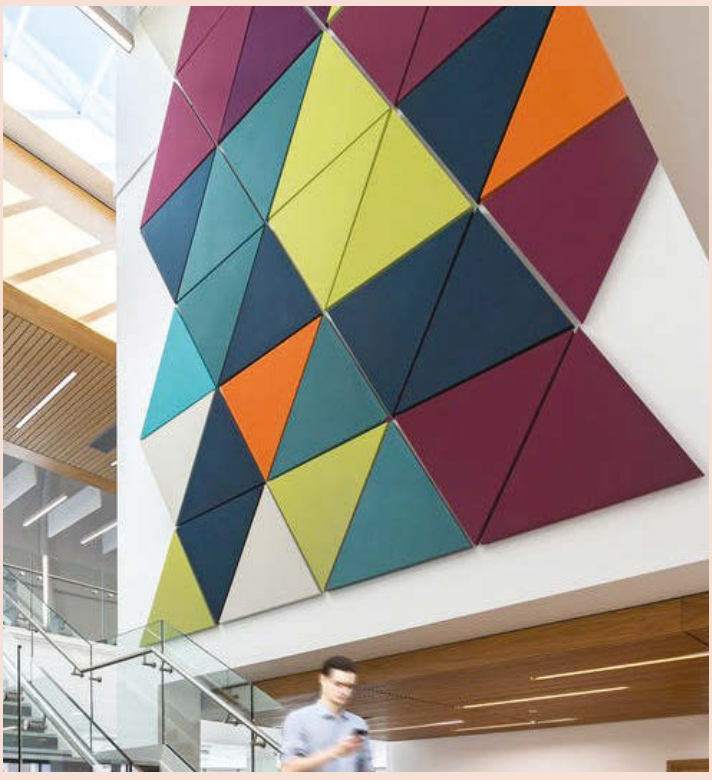
Over 9500m^2 of Rockfon acoustic ceiling and wall systems were installed throughout a flagship project in South Wales.

Forming an important part of a £200m redevelopment, the flagship three building Llys Cadwyn (Chain Court) mixed-use riverside development encompasses office and retail units alongside a state-of-the-art library, café, leisure fitness and community facilities in the heart of Pontypridd.

The facades of two of the buildings are glazed, with those facing the riverside designed with sun-deflecting vertical fins. These buildings required high levels of sound absorption due to the predominantly open-plan office interiors on their upper floors.

In the library, sound control was an obvious specification requirement so Rockfon® Universal™ Baffles were installed. Rockfon Specification, Manager Rowan Green, said: "It was really beneficial to be part of the design specification process for this landmark build from an early stage. A guiding requirement was to achieve the least visible grid, using a selection of Rockfon ranges to create aesthetically pleasing results with high levels of sound absorption. In addition to the Eclipse feature wall, versatile, technologically advanced Rockfon Blanka® was installed throughout the three buildings, with specialised Blanka Bas utilised in meeting rooms to promote speech intelligibility. Rockfon® Koral™ was used exclusively within washrooms and lobbies."

The Rockfon Blanka range offers a wide choice of alternatives for installation and usage. All embody Class A sound absorption (aw 1.00), 87% light reflection and >99% light diffusion and room to room sound Insulation >26dB. Blanka's easy clean, anti-static surface prolongs product life and is non-directional, which speeds up installation, saving time and money.



Rockfon Eclipse® wall panel

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Members are reminded that **ONLY** Sponsor Members are entitled to use the **Sponsor IOA logo** in their publications, whether paper or electronic (including web pages).

Committee meetings 2021/2022

DAY	DATE	TIME	MEETING
Friday	5 November	09.30	CCMOEHAV Examiners and Committee
Monday	8 November	10.30	CCENM Examiners
Monday	8 November	13.30	CCENM Committee
Tuesday	9 November	10.30	CCWNRA Examiners
Tuesday	9 November	13.30	CCWNRA Committee
Wednesday	10 November	09.30	CCBAM Examiners and Committee
Thursday	11 November	10.30	Diploma Tutors and Examiners
Thursday	11 November	13.30	Education
Wednesday	24 November	10.30	Executive
Wednesday	**8 December**	**10.30**	**Council**
Thursday	3 February	11.00	Publications
Thursday	10 February	10.30	Meetings
Thursday	17 February	10.30	Membership
Thursday	24 February	10.30	Diploma Tutors and Examiners
Thursday	24 February	13.30	Education
Tuesday	1 March	10.30	Diploma Examiners (London)
Wednesday	2 March	10.30	Executive
Wednesday	**16 March**	**10.30**	**Council**

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Imitation is the sincerest form of flattery but don't be fooled.

Not all Remote Systems are created equal.

- Real Time (1 minute uploads) Data; Essential for Pro-Active Control
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Rion VM-56 - *Groundborne Vibration Meter*

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- Intuitive User Interface - Just Like Rion NL-52
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- Live to Web Monitoring with LivePPV / LivEnviro
- Third octave and wav file recording options avaliable
- BS 6472:1, ISO 8041, DIN 45669, BS 5228: 2 and BS 7385: 2 compliant

Rion NL-52

Setting the Standard for Environmental Noise Measurement

- Class 1 - PTB Type Tested with and without Outdoor Microphone Protection
- Low Power Consumption - 10 days on a single 12Ah gel-cell battery
- Single 130dB range
- Unrivalled Reliability
- Easy to Use
- CSV data on an SD card
- 10 msec sampling as standard
- Options transferable between meters
  - Audio (WAV) recording
  - Octave/Third Octave
  - FFT
  - Reverberation Time